2 May 2023

Clean Energy Capacity Study Team
Jobs and Skills Australia

Email: CleanEnergyWorkforce@jobsandskills.gov.au

Dear JSA Study Team

Federation University Australia is pleased to make this submission to the Clean Energy Capacity Study. Our history dates back over 150 years to the establishment of the School of Mines in Ballarat and today we have campuses across Victoria from the Wimmera in the west to Gippsland in the east. We are focused on the new industries and the transition that will be involved, including for existing workers from more traditional energy sectors. We have expertise in mine rehabilitation and our Centre for New Energy Transition Research, the establishment of which was funded through a federal government grant, is working to develop solutions focused on the regional workforce. Federation University in association with the Latrobe Valley Authority produced a Gippsland Energy Skills Mapping Report 2022 towards the end of last year (Attachment A) which covers many of the issues JSA's discussion paper is considering.

With state government and industry support we have built a wind turbine heights training tower, part of the Asia Pacific Renewable Energy Training Centre, outside Ballarat which will provide much-needed training in Australia and the region for the wind industry. Extending this to a renewable energy training centre at the Morwell Innovation Centre in Gippsland would deepen research and training capability in a region that will see significant transition in the next few years. The case for such a centre is set out at Attachment B. As the only university in the Gippsland region, we work closely with the Committee for Gippsland, TAFE Gippsland, the Latrobe Valley Authority, Regional Development Victoria and local councils. We have hosted recent visits from federal government delegations and Ministers to discuss the challenges and opportunities the energy transition presents industry and workers.

In addition to wind technology, in which we are developing a national capability, there is a gap in Gippsland to grow capacity in hydrogen and bring in industry partners, with whom we have been engaging. A modernised Hydrogen and Fuel Cell Research Facility at Federation's Churchill campus, working in partnership with others, such as Swinburne University, would help to kick-start hydrogen adaptation and adoption in the Gippsland region, providing future job opportunities and helping industry to transition, as well as providing a more certain base for industry investment. A concept paper is at Attachment C.

[redacted]

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Our recently released ten-year plan to reach net zero underlines our commitment to the new energy transition https://federation.edu.au/strategy/towards-net-zero-2033. Our Campus Vision is aligned to this and seeks to deliver the best utilisation of our legacy assets.

From 2025, all of our students will have a work-based experience as part of their learning, with curriculum co-designed and co-delivered with and by industry. This Co-operative Model of Education at scale will be a first for Australia. I was pleased to have had the opportunity to talk about this vision at last year's Jobs and Skills Summit. Our future is aligned with our students' and local industries' needs and we need to respond to them, not the other way around. This is particularly the case for mature-aged and part-time students who need to fit caring and job responsibilities around training and reskilling. Our hybrid models of learning and development of a greater array of short courses are continuing to meet the market.

Federation University also made a submission last month to the federal government's Australian Universities Accord process where we made suggestions for a more harmonised post-secondary training system and more streamlined skills recognition and accreditation processes. As a dual sector provider, Federation covers the breadth of the Australian Qualifications Framework. The Migration Review, the Employment White Paper process being led by the Treasury and the recent Productivity Commission report are also relevant to this piece of work as acknowledged in the Complementary Policy Settings outlined in the JSA discussion paper. The National Reconstruction Fund also has a role to play in which industry, governments and training institutions need to come together.

Please do not hesitate to contact [redacted]

Yours sincerely,

[redacted]

Gippsland Energy Skills Mapping Report 2022

Federation University Australia

Identifying, supporting, and retraining the current fossil fuel energy workforce to a renewables based energy industry, will lead to significant job growth, and will be critical to the region's future success.

This report was prepared by the Centre for the New Energy Transition Research (CfNETR), Federation University Australia on behalf of the Latrobe Valley Authority and TAFE Gippsland

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LATROBE VALLEY AUTHORITY

VICTORIA State Government

Federation University Australia

Executive Summary

Recent studies have shown the considerable potential for job growth across the renewable energy sector. The Australian Bureau of Statistics (ABS, 2019) concluded that the number of full-time equivalent (FTE) jobs related to renewable energy activity grew by 28 per cent in 2017 and 2018 to a total of 17,740 FTE jobs across Australia. In its 2016 report on renewable energy jobs, the Climate Council argues that moving to a 50 per cent renewable electricity target scenario by 2030 will lead to over 28,000 new jobs, with almost 50 per cent more employment than a business-as-usual scenario. These jobs will be created in the construction, operation, and maintenance of new energy installations and in shifting traditional, fossil-fuel-based power generation to new energy-generating fields.

In its 2020 report, the Clean Energy Council of Australia points to creating 4,000 jobs in Victoria due to major renewable energy projects and investments. A major focus in Victoria is on the Latrobe Valley, which has key infrastructure such as transmission lines, existing and proposed high-voltage direct current (HVDC) links with Tasmania, offshore wind farms, and Energy Australia's repositioning. Moreover, the federal government has identified Latrobe Valley as a hydrogen hub (the Committee for Gippsland initiatives, the NERA cluster for a hydrogen economy, and others).

The renewable energy industry is driving this job growth, underpinned by state government policy targets and support structures. This growth is expected to continue, and the diverse workforce needed to support this industry must be highly skilled. With several large-scale projects coming online across Victoria, specifically Gippsland, there is an urgent need to lay a solid foundation for a Gippsland training base.

The energy sector in Gippsland already has a skilled workforce. Understanding how we can support this workforce to use innovative technologies is the key to increasing the region's economic prosperity. There are gaps in our understanding and reporting procedures of existing skills, required skills, and transferable skills that are necessary for the future workforce in the energy sector in Gippsland.

The specific aims are as follows:

- Identify current renewable energy projects in Gippsland and their projected development
- Identify the existing skills and future skills required
- Identify the skill gap
- Capture training across education and industry
- Identify gaps and opportunities for training and education
- Determine how to reduce the skill gap

Desktop literature reviews, stakeholder engagements, and online surveys are used as vehicles to achieve these objectives. Technicians and trade workers represent 17.8 per cent of Gippsland's population, which is higher than the state average of 13 per cent. Many of these technicians, trade workers, and labourers are already highly skilled and experienced in the conventional energy sector. Gippsland contains a broad workforce with skills and experience that can be used to design and manufacture new energy technologies.

There is overlap between the fossil fuel and renewable energy sectors in broad occupations: technicians, construction and project managers, engineers, electricians, and others. However, there is no direct occupational match for the core mining workforce, which consists of drillers, miners, shot firers, and mechanical trades. This is particularly relevant to the export industry for metallurgical and thermal coal, where the bulk of coal mining jobs are concentrated.

Up to 80 per cent of renewable energy jobs are in design, manufacturing, construction, and installation. However, by 2030, almost 50 per cent of those jobs could be in operations and maintenance (O&M). In addition to the traditional energy workforce, the digitally enabled workforce has been identified as critical for the future energy sector.

Critical occupations and skills within a digitally enabled workforce include:

- Data analytics
- Cyber-physical system specialists
- Software application and programming skills

Furthermore, there would be new occupations and skills required in the energy sector, which include:

- Smart grid engineers
- Hydrogen production professionals
- Occupational health and safety professionals
- Internet of things (IoT) engineers

There are opportunities for operation and maintenance (O&M) jobs to be created in offshore and onshore wind projects. For example, blade technicians – already an in-demand role – and civil construction workers will be required. In addition to these technical skills, cross-cutting skills are also required. There are potential jobs for construction project managers, senior managers, and accountants in the renewable energy sector in Gippsland. However, according to the stakeholder engagement feedback, the energy industry does not completely understand what is being done to train its workforce.

Seven universities in Australia currently offer renewable energy programs. From these, three universities in Victoria provide undergraduate programs specialising in advanced renewable engineering. The undergraduate programs are mostly at basic and intermediate levels, covering aspects of electrical, sustainable, electronics, and communication fields of study. Despite post-secondary education related to clean energy and industry engagement in developing these programs, skill shortages exist and are expected to worsen.

There are over 250 units available in the vocational education and training (VET) sector, covering electrical engineering and renewable energy specialisations across Victoria. However, there are still some new programs and course development opportunities, especially in hydrogen technology, smart grids and battery development.

A key to addressing skills shortages in the sector and unlocking additional gains is to make the industry more accessible and appealing to diverse groups. Women are significantly underrepresented in the energy industry, but opportunity abounds. People from other diverse backgrounds (e.g., people with a disability, indigenous people) are also underrepresented in the energy sector.

Based on the findings mentioned, the following recommendations are made:

01

State-of-the-art infrastructure, equipment, and laboratories are required in Gippsland to deliver new energy training and education:

- Urgently undertake a business case into the establishment of a New Energy Education and Training Centre at the Morwell Education Precinct including costing state-of-the-art hardware and software facilities including power system simulator, hydrogen simulation tools, navigator systems incorporating existing energy management systems, microgrid controllers, human-machine interface communication tools and protection devices.
- Consider in the business case options for a hub and spoke model that would allow for the establishment of a centre in Morwell, but with training nodes across Gippsland including Sale and East Gippsland.

02

New programs need to be developed and offered in Gippsland to meet the requirements of the new energy sector in the next 2-10 years including:

- Certificate III in Renewable Energy-ELV
- Certificate IV in Renewable Energy
- Diploma in Renewable Energy Engineering
- Bachelor of Renewable Energy
- Certificates II, III and IV in hydrogen, storage and fuel cell technologies (with potential to explore undergraduate hydrogen-specific qualifications)
- Most training and education units are currently solar and low-voltage system oriented. Develop modules and units of other renewable energy applications including IoT, smart grid technology and big-data applications in energy systems.
- Other short courses will need to be considered, in close collaboration with the industry including asset management and graduate certificates in power and energy.
- Explore how to best train offshore and onshore wind technicians, with as many local training options as possible.

03

Partner with the industry to ensure education and training programmes meet industry needs:

- Develop a new energy industry advisory group in Gippsland to advise education providers on curriculum development, work placement, research and innovation and other collaborative opportunities.

04

Raise awareness of new energy careers:

- In partnership with primary, and secondary schools, local learning and employment networks, career practitioners, educators, industry and government seek to develop priorities and programmes to promote new energy sector careers for a diverse group of school leave and mature age students.
- Promote clear pathways into new energy-related careers across the secondary school, VET and higher education.

05

Develop clear pathways between secondary, vocational and higher education in clean energy careers:

- Develop clear pathways between certificates, diplomas, advanced diplomas, undergraduate, graduate certificates and postgraduate studies in clean energy.
- Provide multiple exit points based on career preferences.
- Ensure recognition of prior learning.
- Close collaboration between VET and Higher Education required.

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Abbreviations & Definitions

Abbreviation	Description
ABS	Australian Bureau of Statistics
BESS	Battery Energy Storage System
CPD	Continuing Professional Development
DERs	Distributed Energy Resources
DNSP	Distribution Network Service Providers
EV	Electric Vehicle
GW	Gigawatt (a measure of power or load)
GIS	Geographical Information Systems
HE	Higher Education
IoT	Internet of Things
OEM	Original Equipment Manufacturer
OHS	Occupational Health and Safety
O&M	Operations and Maintenance
PV	Photovoltaic (Solar)
SCADA	Supervisory Control and Data Acquisition
VET	Vocational Education and Training

Term	Description
Accreditation	The action or process of officially recognizing someone as having a particular status or being qualified to perform a particular activity. Post-secondary institution or program as meeting the standards established by a nationally recognized accrediting association.
Cross-cutting (transferable) skills*	Skills such as teamwork, critical thinking, and skills related to information and technology enhance the ability to transfer and apply knowledge in a variety of settings. In literature, these skills are referred to as cross-cutting skills. They enhance learning and its application in most disciplines and careers.
Major Course	The primary field of study in a higher education course.
Minor Course	The secondary (or lesser) field of study that complements the major course of study.
Short Course / Micro credentials	A learning programme that provides combined content or specific skills training in a short period of time. Short courses often lean towards the more practical side of things and may have less theory than a technical and further education (TAFE) certificate or higher education degree course; this gives learner a more hands-on experience within the field of interest. Short courses can be accredited or non-accredited. Short courses are often referred to as micro credentials. These are mini qualifications that demonstrate skills, knowledge, and/or experience in a given subject area or capability.

*M. Snow Andrade, 'Cross cutting skills: Strategies for teaching and learning,' Higher Education Pedagogies, vol. 5, 2020.

1— Context

Renewables based energy provides the opportunity for a more diverse, dispersed workforce. A national clean energy workforce of close to 1.8 million people could be created in Australia by 2025 with assured training and ongoing projects.

1— Context

In the Australian context, there have been several preliminary studies exploring the future energy workforce potential and projected growth. Until recently, very few of these had provided a breakdown of the skills and roles required of the future workforce. For some years, governments, industry bodies, and advocacy groups (e.g., State of Victoria, 2016, 2018; Clean Energy Council, 2020a; Beyond Zero Emissions, 2020) have claimed that the future workforce will be 'green'. These reports generally focus on the opportunities for Australia and the specific opportunities for traditional carbon/fossil fuel regions such as the Latrobe Valley. However, apart from a few particular areas of Australia (e.g., Latrobe Valley, Hunter, Bowen Basin), the overlap between coal mining and power generation locations and renewable energy zones is not significant (Briggs et al., 2020a). There is far greater geographical dispersion in renewable energy than in coal mining and power generation, as illustrated in Figure 1 using Victoria as an example. This pattern is replicated across the eastern seaboard of Australia.

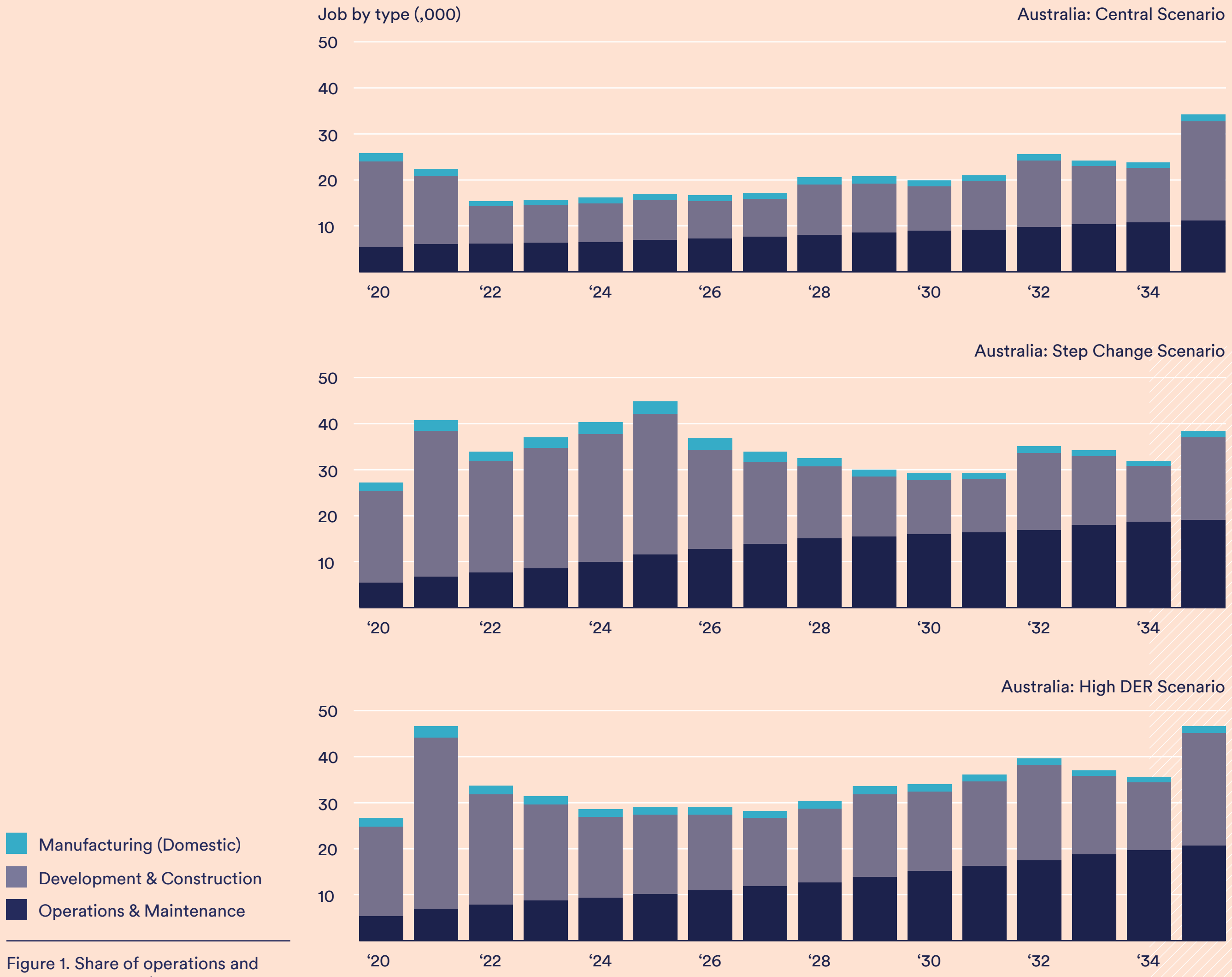


Figure 1. Share of operations and maintenance jobs (Briggs et al., 2020a)

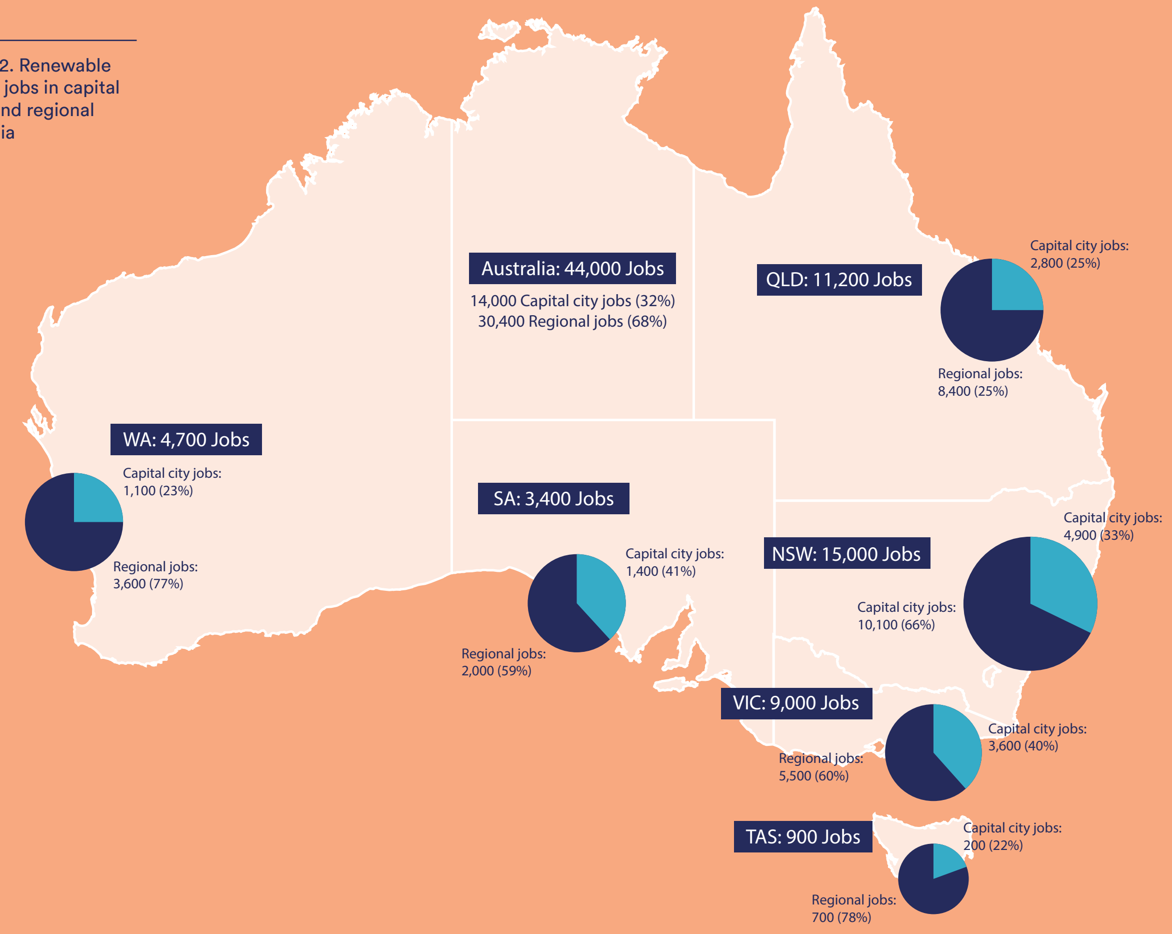


Figure 2. Renewable energy jobs in capital cities and regional Australia

Furthermore, there is some overlap between occupations in the traditional and renewable energy industry (e.g., technicians, construction and project managers, engineers, electricians). There is no direct occupational match for the core mining workforce, which consists of drillers, miners, and shot firers, or for the mechanical trades (Briggs et al., 2020a) – this is particularly the case for the metallurgical and thermal coal export industry, where the bulk of coal mining jobs are concentrated. Census data shows that the domestic coal (thermal mining and power generation) workforce in 2016 was 11,000 people nationally, which pre-dates the closure of the Hazelwood Power Station in the Latrobe Valley (Briggs et al., 2020a).

Among all the occupations identified in Renewable Energy Jobs in Australia (Briggs et al., 2020a), almost one-fifth of the workforce are electricians or electrical trade assistants. The most dominant technology sector – especially for laborers – is rooftop solar, which is predominantly an installation-focused effort. Given the sustained growth in installations, jobs in this area would be ongoing rather than focused on short-term construction. Figures 2 and 3 provides a further breakdown of renewable energy jobs across Australia averaged over the years 2020–2025.

Beyond Zero Emissions, an independent Australian think tank, suggests that a national clean energy workforce of close to 1.8 million people could be created in Australia by 2025 in their report, The Million Jobs Plan (Beyond Zero Emissions, 2020). This assessment takes a much broader view of the clean energy workforce than other studies, including energy efficiency, zero-emissions transport, clean energy technology manufacturing, land regeneration, and waste management jobs. However, it does indicate the potential size of the new workforce. The Million Jobs Plan also identifies that this workforce could include an additional 10,000 new jobs in training and research activities associated with the transition.

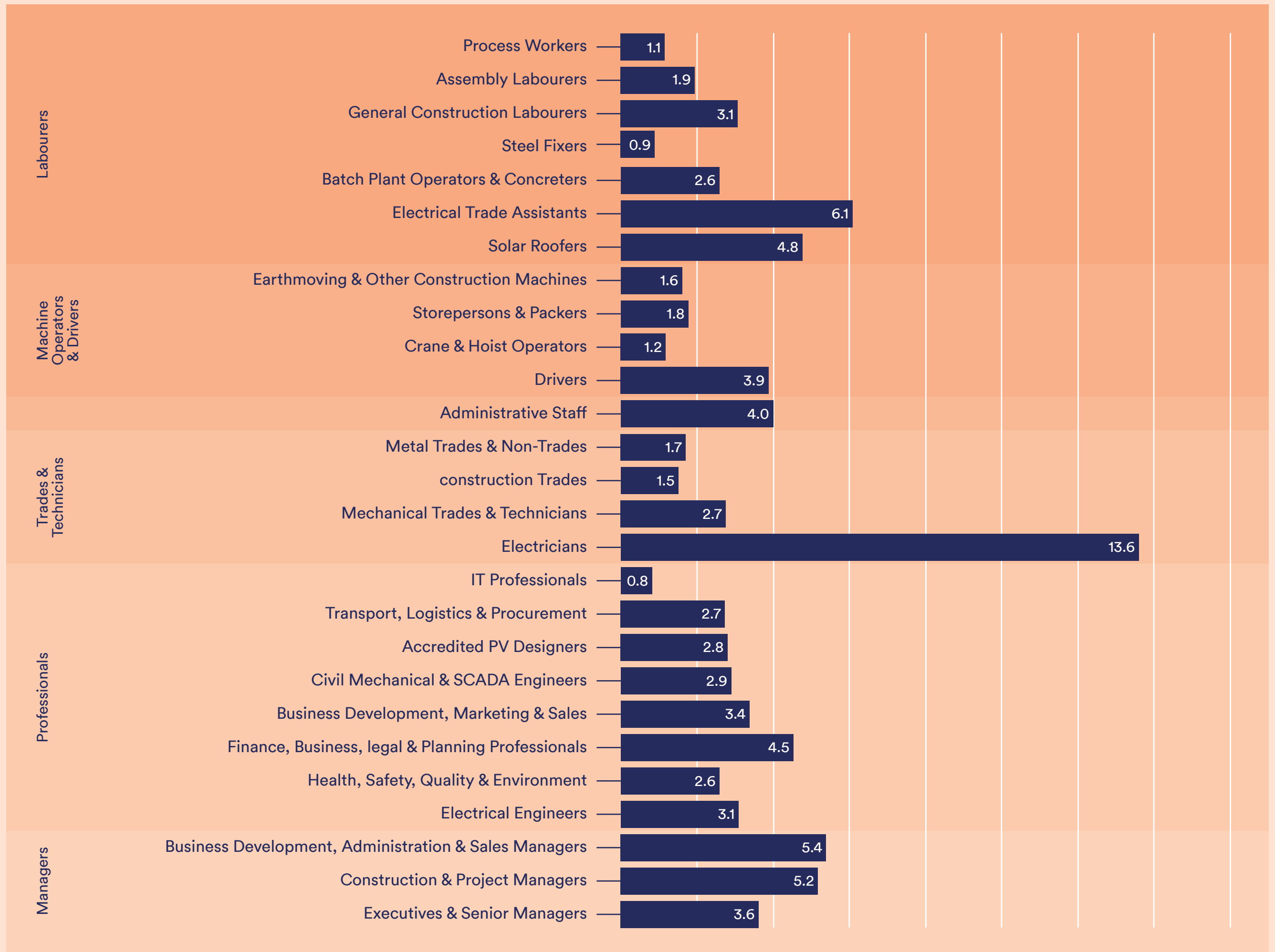
In March 2022, the Victorian Government released its Offshore Wind Policy Directions Paper as the next step towards Victoria establishing an offshore wind industry and meeting the Victoria Renewable Energy Target of supplying 50 per cent of the state's energy needs from renewable sources by 2030. Victoria aims to generate at least 2 gigawatts (GW) of offshore wind power by 2032, 4 GW by 2035, and 9 GW by 2040. The Directions Paper recognises that there is potential for 13 GW to be generated from fixed platforms and significant additional capacity (upwards of 33 GW) to be developed should offshore floating platforms also be employed, as a result of advance in that technology.

The Directions Paper suggests that with the 13 GW tranche, 3,100 development and construction jobs and 3,000 ongoing operations jobs could be created in Victoria. Of that 13 GW, 10 GW is anticipated to be created in the Gippsland zone, with 3 GW in the Portland West zone, suggesting that most operational jobs should be situated within Gippsland (see Figure 4).

Some local governments (e.g., South Gippsland Shire Council, Wellington Shire Council) have specifically identified growth in utility-scale renewable energy generation and transmission projects as core components of their economic development plans and strategies (South Gippsland Shire Council, 2021, Wellington Shire Council, 2020). However, support for renewable energy infrastructure is not consistent at the local government level, often reflecting specific community concerns (Hepburn Shire Council, 2022, Moorabool Shire Council, 2022). Based on the current state of the energy projects, there could also be significant numbers of jobs in public administration, safety, administration, and support services. An increase in demand has already been observed in the Gippsland region (Figure 5) as per Australian Bureau of Statistics (ABS) data collected in February 2022.

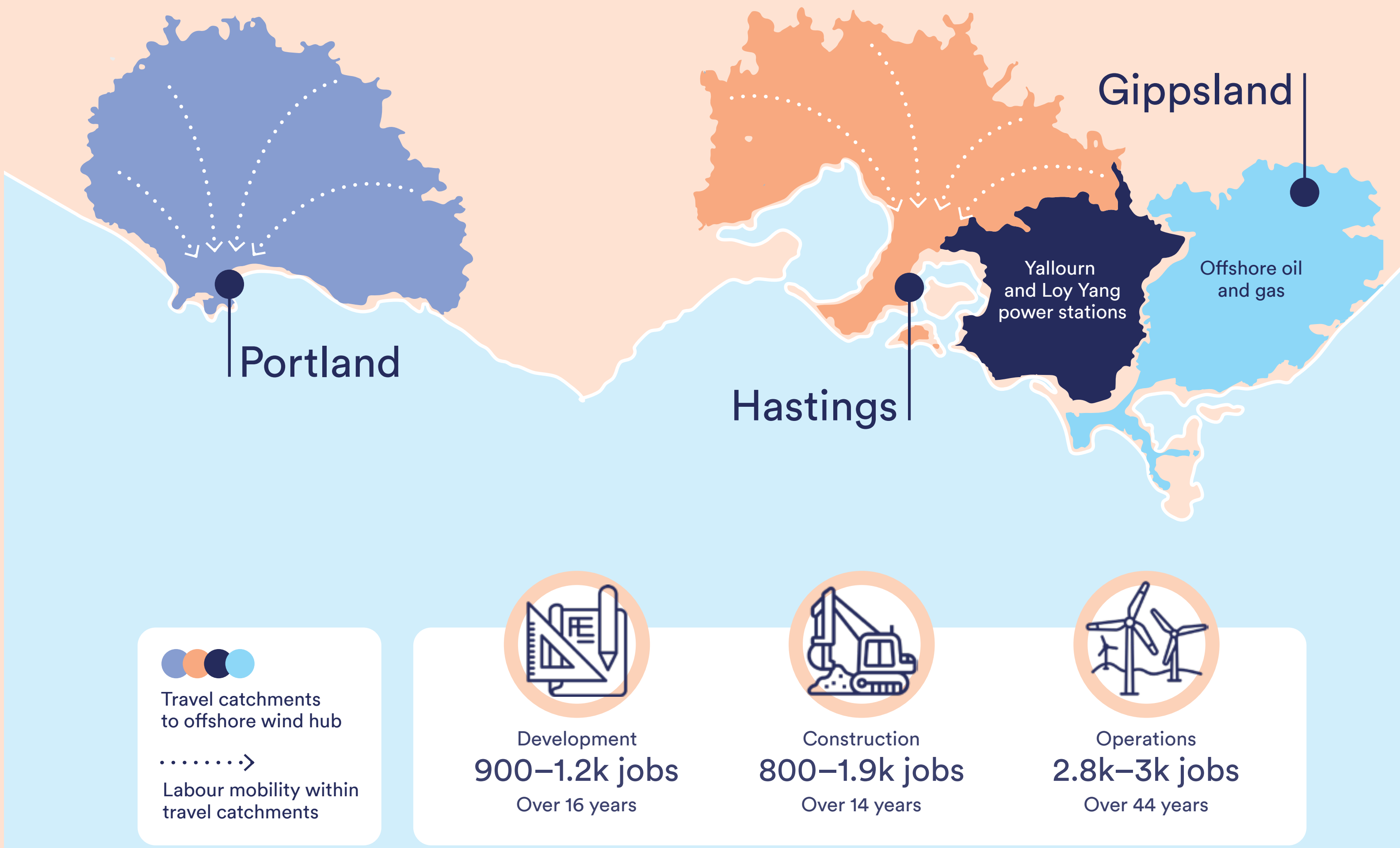
Figure 5 also shows that technical jobs in the energy sector are anticipated to experience steady growth. It is also evident that the manufacturing sector will remain one of the largest sources of employment, behind health, retail, and agriculture. Most jobs advertised in the Gippsland region in the energy and manufacturing sector asked for Certificate IV qualifications (30 per cent), followed by bachelor's degree qualifications or higher (25 per cent) (National Skills Commission, job adverts). Table 1 shows fossil fuel workers in the Gippsland region by local government area. It is evident that there are a significant number of trade and technical workers in the Gippsland region. Furthermore, it has been reported that 80 per cent of the workforce have medium-to-high skills transferability and are well-positioned to work in adjacent energy sectors (which is discussed further in Section 2).

Figure 3. Renewable energy jobs (%) by occupation (Briggs et al., 2020a)



Much of the skills and workforce development agenda, particularly in regional and remote areas, is affected by the lack of assurance provided during project development phases and the stop–go nature of project infrastructure construction (TEIWAC, 2020). Additionally, operating in regional and remote areas increases competition between projects for local resources and talent. The capacity and capability of local training institutions, ability to source quality trainers, and sustained demand to create new or varied training programs are also challenged by the geographical diversity of projects. In her discussion on regional employment opportunities presented to the Activating Gippsland's Renewable Energy Workforce Regional Forum hosted by the Australian Renewables Academy, Dr Sue Olney noted two significant value creators in developing a new workforce – local and diverse (Olney, 2021). In looking local, proponents and contractors are able to build a 'social licence' to operate and address skills shortages by creating pipelines into and through education directly linked to jobs, thereby harnessing local knowledge and strengths. By taking a broader look at the potential local workforce, proponents are also able to build diversity into their workforce, tap into less traditional employee pools (especially in a tight job market), and enable them to build creative, resilient, and competitive businesses.

Figure 4. Employment opportunities for offshore wind in Gippsland and Portland (Department of Land, Water and Planning, 2021)



Technicians and trade workers represent 17.8 per cent of Gippsland's population, which is higher than the state average of 13 per cent. Many of the region's technicians, trade workers, and labourers are highly skilled and experienced in the conventional energy sector. Gippsland contains a broad workforce with skills and experience that can be used to design and manufacture new energy technologies.

Table 1. Fossil fuel workers in Gippsland region (ABS, 2016)

Local Government Area	Managers	Professionals	Technical and Trades	Community and Other Service	Office and Admin	Machinery	Labour	Total
East Gippsland	30	32	73	0	44	63	34	276
Baw Baw	14	8	19	0	9	32	8	90
Bass Coast	27	23	28	0	38	41	15	172
Wellington	34	20	40	0	34	43	34	205
South Gippsland	17	17	48	0	36	38	18	174
Latrobe	215	285	982	21	189	351	199	2,242
Grand Total	337	385	1,190	21	350	568	308	3,159

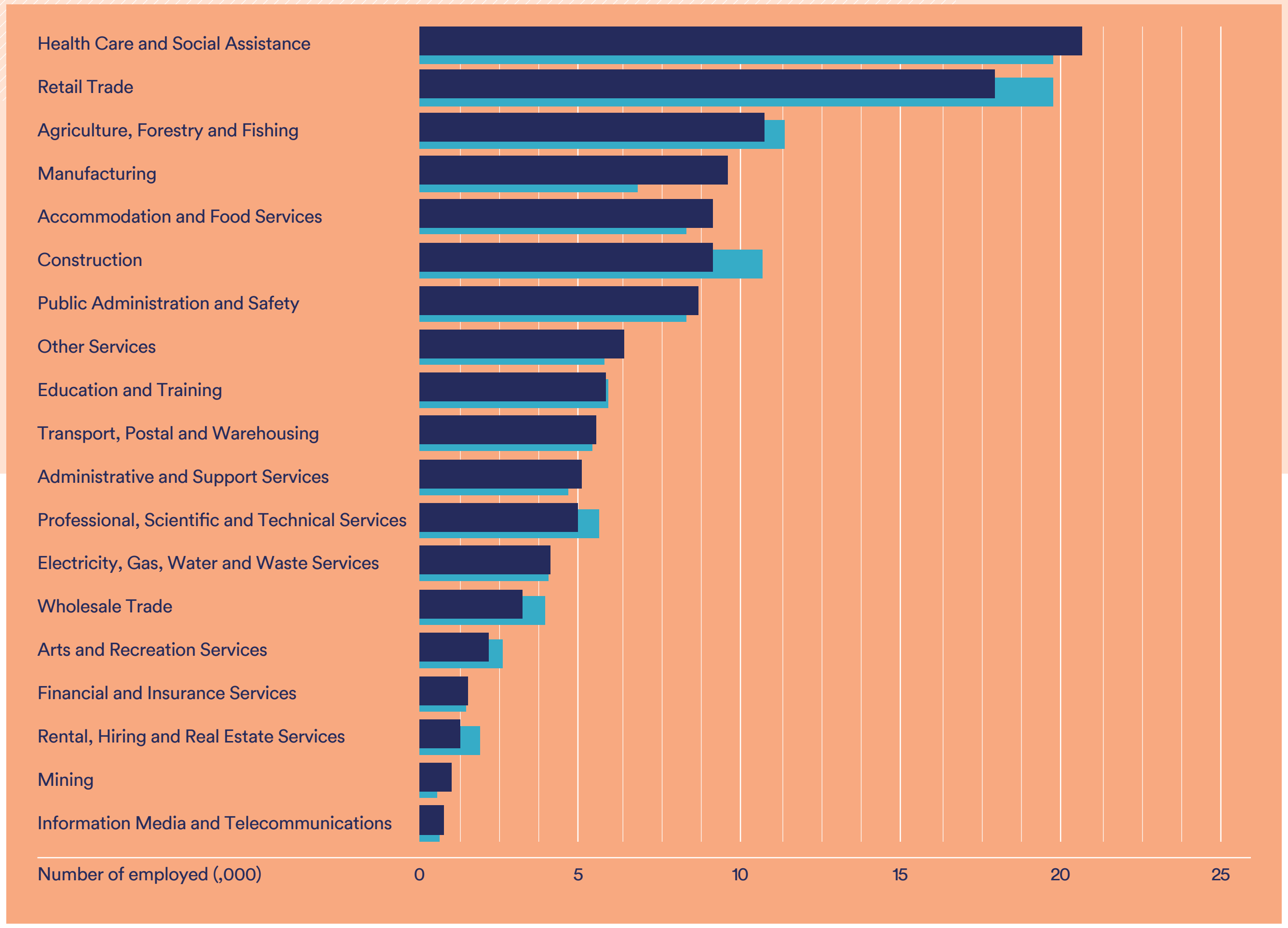


Figure 5. Labour force survey in Gippsland (ABS)

In this context, a review was undertaken to explore the key publicly available information on what is currently known regarding the skills and workforce demands associated with the development of renewable energy infrastructure in Australia and internationally as a precursor and foundation to understanding the current and future skills landscape in Gippsland.

The result of significant investment in renewable energy infrastructure in the region over the next decade is a predicted shortfall in the availability of a skilled, local workforce.

This is overlaid with ongoing dialogue regarding the transition of workers and businesses due to the closure of coal-fired power stations and mines in the Latrobe Valley over the corresponding period.

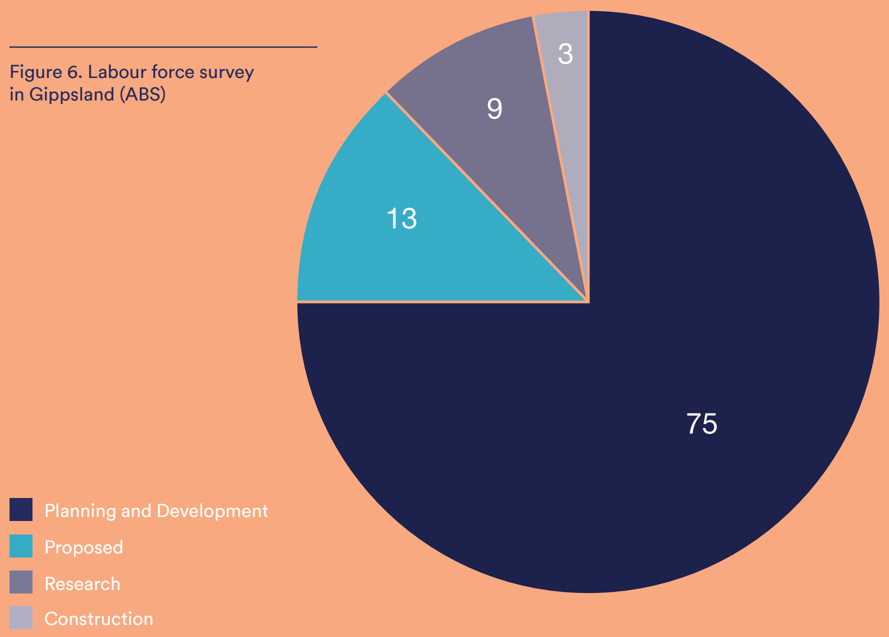
The energy sector in Gippsland already has a skilled workforce; understanding how we support and progress this workforce into new technologies is key to increasing the region's economic prosperity.

At the moment, there is a lack of understanding and reporting procedures in relation to existing skills, required skills, and transferable skills that are necessary for the future workforce of the energy sector in Gippsland.

This work addresses this gap and provides organisations with the evidence they require to deliver targeted programs and policies to re-skill and scale up Gippsland's energy workforce.

Significant numbers of the projects are at either the proposal or feasibility study phase. Owners/operators sceptical about the skills that will eventually be required. Therefore, it is difficult to estimate the exact number or types of jobs that will be created in the Gippsland region.

Figure 6. Labour force survey in Gippsland (ABS)



1.1— Renewable Energy Projects in Gippsland

There are over 32 large renewable energy projects currently underway in the Gippsland region. Solar, wind, and battery energy storage systems (BESS) are the dominant technologies. In addition, there are a few projects in biomass and hydrogen technology. Out of these 32 potential projects (see Table 2 for the complete lists), only 3 per cent are under construction, as shown in Figure 6.

Table 3 shows some of the anticipated clean energy projects in the Gippsland region. These projects are mainly at the community consultation and the pre-feasibility phase. Furthermore, Figure 7 shows the wind and energy storage penetrations anticipated in the Gippsland region based on the integrated system planning report published by the Australian Energy Market Operator. The steady growth of wind and energy storage systems is evident from the trends shown in Figure 7.

Table 2. Lists of energy projects in Gippsland

Proponent	Project/Technology
RATCH Australia Corporation	Morwell Solar Farm
OSMI Australia	Delburn Wind Farm
Octopus Investments Australia	Perry Bridge Solar Farm
Octopus Investments Australia	Fulham Solar Farm
Solis Gippsland Projects	Gippsland Renewable Energy Park
Copenhagen Investment Partners	Star of the South – Offshore Wind Project
Flotation Energy	Project Sea dragon – Offshore Wind Project
Macquarie / Green Investment Group	Great Southern Offshore Wind Farm
H2X Global	EV Assembly / Manufacturing
Gippsland Circular Economy Precinct	Hydrogen Energy
South Energy	Frasers Solar Farm
Heyfield Community / UTS	Heyfield Town Microgrid
DELWP Community Microgrid and Sustainable Energy Program	Mallacoota Microgrid / Energy Program
DELWP Community Microgrid and Sustainable Energy Program	Omeo Microgrid / Energy Program
Totally Renewable Phillip Island	Phillip Island Microgrid / Sustainable Energy Program
Radial Timber	Yarram Biomass Energy Hub
Energy Australia	Wooreen Energy Storage System
AGL	Loy Yang BESS
DELWP	Gippsland Renewable Energy Zone
Marinus Link	Project Marinus Link
Bluefloat Energy / Energy Estate	Greater Gippsland Offshore Wind Project
Synergy Wind	Gelliondale Wind Farm
Ramahyuck District Aboriginal Corporation	Solar Photovoltaic (PV)
Elecsome	PV Recycling Factory
Port Anthony Renewables	Port Anthony Renewable Energy and Hydrogen Park
Infinite Blue Energy	IBE / PAR Hydrogen Liquefaction and Storage
Pure Hydrogen	Port Anthony Green Hydrogen Project
Patriot Hydrogen	Port Anthony Biomass to Hydrogen Project
Maoneng	Mornington BESS
TILT Renewables	Latrobe Valley BESS
Utilitas Group Bio hub	Bio Energy Project

1.2— Scope and Issues in Gippsland

In Victoria, when examining an overlay of renewable energy zones with workforce projections, much of the operations and maintenance (O&M) workforce will be regionally located. Except for the Latrobe Valley, there is very little correlation between existing fossil fuel jobs and the location of new renewable energy jobs (Briggs et al., 2020a, 2020b). In the Gippsland region, there is some proximity between fossil fuel job locations (i.e., coal and power stations) and major renewable energy developments, particularly with the expansion and growth from developments associated with the Gippsland Renewable Energy Zone. Additionally, the fossil fuel job descriptions listed in the summary by Briggs et al. (2020b) focus on coal mining, power generation, and export, and do not appear to take into account offshore oil and gas extraction and processing – a fossil fuel industry also located in and offshore from Gippsland. The oil and gas and offshore wind sectors have been recognised as having many compatible and transferable skills (International Renewable Energy Agency [IRENA], 2018; GWEC, 2021b), creating the opportunity for a transition program between the two sectors (State of Victoria, 2022). Table 4 shows the potential jobs created by new energy projects during the construction and the operation phases. During the construction phase, 8,153 full-time equivalent (FTE) jobs are expected, and approximately 1,559 FTE ongoing jobs are also anticipated. Figure 8 shows future projections of clean energy jobs in Gippsland between 2025 and 2036. These projections were made based on the theory published by Briggs et al. (2020).

Table 3. List of projected energy projects in Gippsland

Clean Energy Projects	Project/Technology
Solar and battery projects	At least 20+ sites in Ausnet Network
Electric vehicle charging facilities	All shires and major transport route
Hydrogen fuel pumping stations (number determined by the feasibility study)	Major transport route from 2025
Pumped hydro projects (projected number: 3)	In mining site from 2025
Biomass generation plants in timber mills (projected number: 4)	From 2024
Large neighbourhood batteries (the number is yet to be determined)	From 2023
Offshore wind farms peak build phase	From 2026
Hydrogen fuel generation plants and fuel cells	From 2026
Recycling and waste-to-energy plants	From 2023

Table 4. Jobs in new energy projects in Gippsland 2022–2032

Type of Projects	Construction (FTE)	Ongoing (FTE)
Solar Projects	4,101	82
Wind Projects	2,446	551
Batteries	130	06
Hydrogen	486	540
HVDC	250	50
Renewable energy zone transmission upgrade project	740	330
Total	8,153	1,559

(a) Storage

Figure 7. Lists of energy projects in Gippsland (Australian Energy Market Operator, 2021)

Proponent	Suggested Storage for REZ (MW)				
		Depth	Projected		
			2029-30	2034-35	2039-40
Gippsland REZ has a strong 500 kV network connecting coal fired power stations to the Melbourne load centre as well as interconnection to Tasmania via Basslink. Due to the high network capacity, Gippsland REZ is a good candidate for storage. Storage has been projected in this REZ for the Step Change and Slow Change scenario.	Central	Shallow	0	0	0
	Step		0	0	0
	Fast		0	0	0
	High DER		0	0	0
	Slow		0	100	100
	Central	Medium	0	0	0
	Step		100	100	550
	Fast		0	0	0
	High DER		0	0	0
	Slow		0	0	150

(b) Wind Energy

Figure 7. Lists of energy projects in Gippsland (Australian Energy Market Operator, 2021)

Variable Renewable Energy outlook	Solar PV (MW)				Wind (MW)			
	Existing / Committed	Projected			Existing / Committed	Projected		
		2029-30	2034-35	2039-40		2029-30	2034-35	2039-40
Central	There is no existing or committed solar generation in this REZ. The modelling outcomes, for all scenarios, did not project additional solar generation for this REZ.				119	650	650	650
Step						50	50	1,150
Fast						0	0	0
High DER						200	200	200
Slow						900	900	900

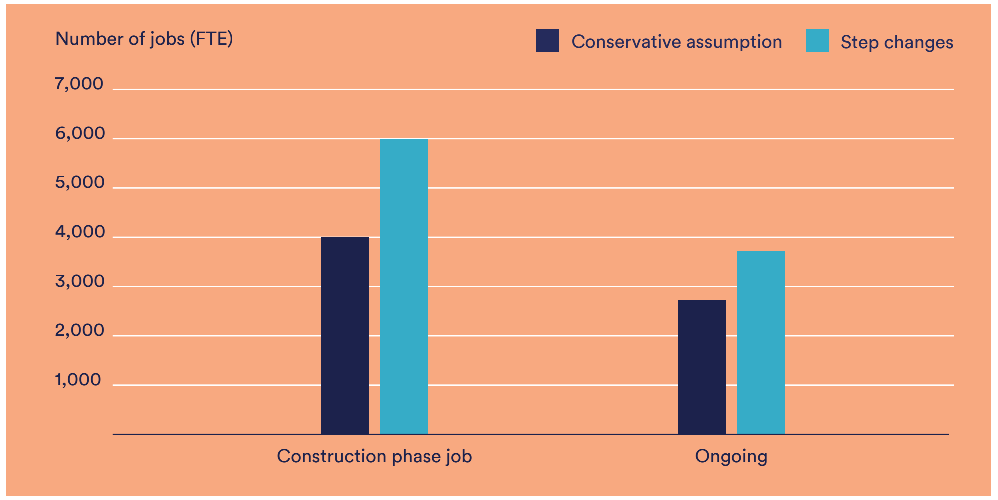
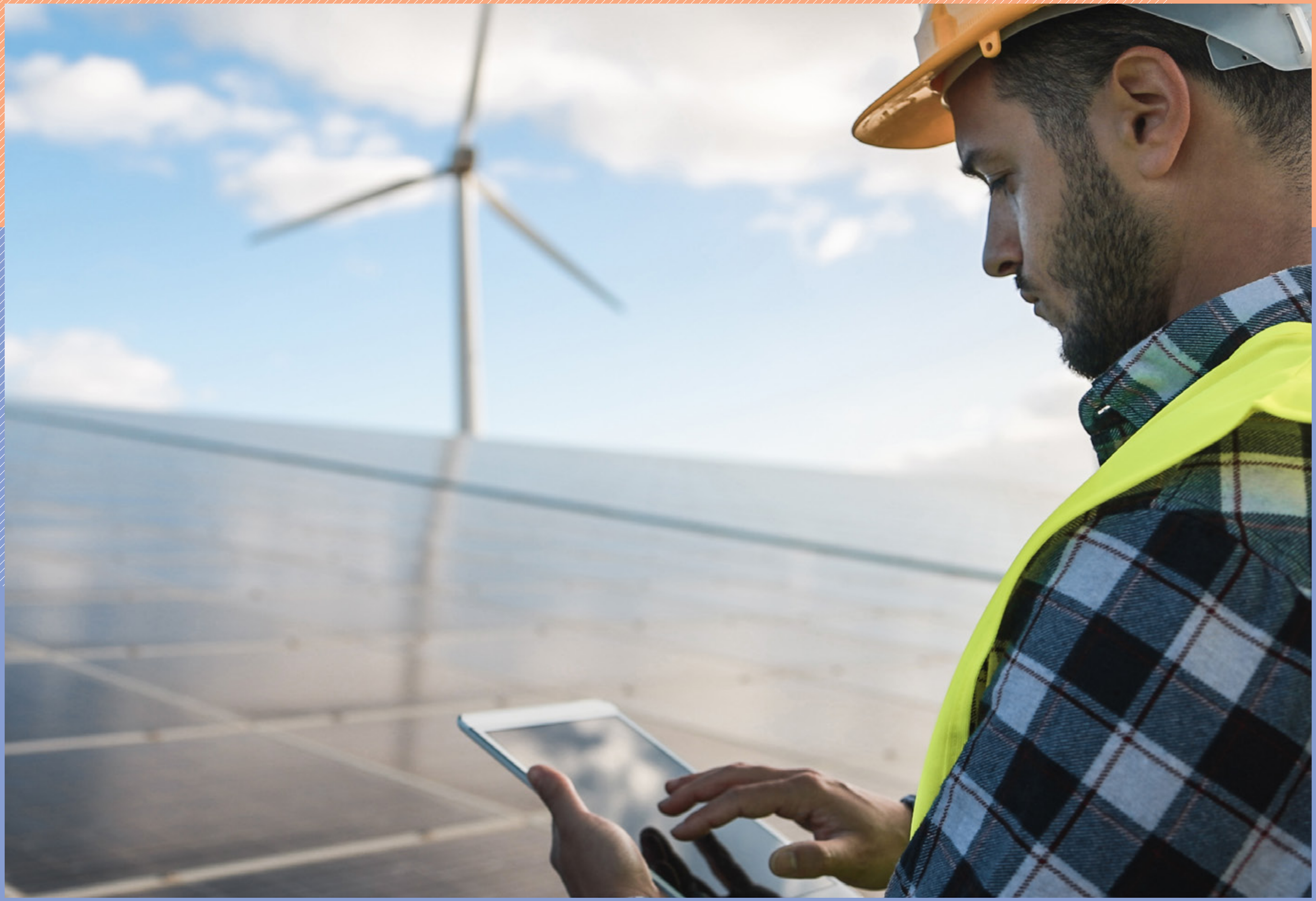


Figure 8. Projected jobs in new energy projects (Briggs et al., 2020)



2—
Skills and Skilled Workers Required for a Successful Energy Transition

Almost 80% of current renewable energy occupations are in the creation phase, with half of all roles expected to be in operations and management in the next 7 years.

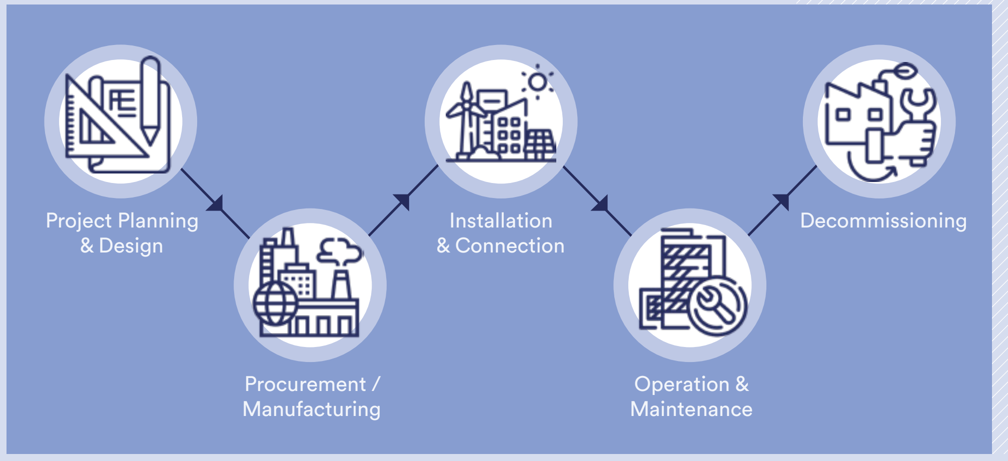


Figure 9. Value chain for different clean energy technologies (IRENA, 2018)

> "The energy industry doesn't completely understand what the whole industry is doing to train their workforce. At this stage, we are gathering the information."
>
> —Two interview participants

2— Skills and Skilled Workers Required for a Successful Energy Transition

Up to 80 per cent of renewable energy jobs are currently in design, manufacturing, construction, and installation phases. However, by 2030, almost 50 per cent of those jobs could be in O&M (Briggs et al. 2020). When considering the technical skills required for a clean economy, it is necessary to think about skills across the entire value chain. A simplified typology of the value chain – adapted from IRENA (2018) – indicates five phases, as shown in Figure 9. Taking a sectoral approach provides an additional lens for considering the required skills and jobs. The Decarbonisation Futures study by Climate Works Australia (2020) highlights electricity, buildings, transport, industry (including manufacturing, mining, and resources), and agriculture and land as the key sectors that need to fully decarbonise by 2050. Agriculture and land are less relevant from an energy transition perspective as the possible interventions in those sectors are largely non-energy related. Overlaying the value chain with this sectoral approach provides a detailed framework for analysing the required skills. This makes it possible to investigate which skills are required to design net-zero buildings, maintain battery storage systems, procure more energy-efficient equipment, or connect renewable energy systems to the grid. Another useful typology when considering the required skills to enable the energy transition is based on different occupations.

A good example is introduced by Briggs et al. (2020) specifically for renewable energy but is also applicable more generally.

They point out that the energy labour force can be broken down into laborers, machine operators, drivers, trades, professional services, and managers. These occupational groups require different types of training and qualifications, although further detail is needed on the specific occupations. One factor that cuts across the value chain and different sectors and occupations is the growing importance of digital skills in the energy sector (i.e., big data analysis, nowcasting of renewable resources, and energy market analysis). An earlier study into the skills required for electricity networks by Energy Skills Queensland (2016) refers to the emergence of a 'digitally enabled workforce' alongside the traditional energy workforce. Critical occupations within a digitally enabled workforce include:

- Data analytics
- Cyber–physical system specialists
- Software application and programming

These occupations are in high demand across the economy. Attracting people who have specialised digital skills and knowledge of the energy sector could be particularly challenging. Most workers in the energy systems of the future will need some level of digital skills (i.e., data analytics, cyber-physical systems, software, and programming), and studies in the water sector have highlighted how challenging it can be to develop or attract these skills (IRENA, 2018).

2.1— Current Shortages in Energy Skills in Australia

Research on the current and future Australian renewable and clean energy workforce has found that not enough people are taking up training to meet the current demands of the clean energy sector (Rutovitz et al., 2021), let alone to accommodate the growth in the sector workforce over the next 5–10 years. The authors also emphasise that a detailed mapping of future occupations and skills is required to enable the energy transition and meet demand for energy workers. This has now been recognised by the Australian Government (Department of Industry, Science, Energy and Resources, 2022) in their report Improving understanding of Australia's energy workforce, which addresses the need for good-quality data and workforce projections. This report also forecasts numbers of future jobs and where they will be located.

In its Clean Energy at Work report, the Clean Energy Council (2020a) points out the difficulties in filling construction and O&M roles and recruiting construction managers and wind blade technicians. For wind blade technicians – a role already in high demand and hard to fill – the increasing investment in wind farms, higher O&M requirements, and greater proportion of roles in the future having an O&M focus means there will be a heightened demand for these skills. When asked which roles were the most difficult to fill, respondents in the large-scale solar sector mentioned construction managers and engineers (civil, electrical, grid, supervisory control and data acquisition (SCADA)) most frequently. On the other hand, trades and technicians were said to be relatively easier to recruit. Experience, pay rates, and location were the three most common reasons given for recruitment difficulties.

Reports from Australia and around the world have outlined the immediate and long-term need for increased training system capacity to deal with the significant uptick in demand for a skilled renewable energy workforce (TEIWAC, 2020). The structure and suitability of the training system to meet industry demand need to be reviewed in collaboration with training bodies, unions, regional development agencies, and policymakers; this is a key recommendation of the Clean Energy Council's Clean Energy at Work report (2020a).

Current technical skills shortages highlighted in the literature include:

- Battery manufacturers
- Construction and site managers for large-scale wind, solar, and energy storage projects
- Internet of things (IoT) engineers / software engineers
- Electricians certified to install PV, particularly in remote regional areas
- Energy auditors / energy management system consultants
- Energy data analysts
- Energy managers with an adequate understanding of energy
- Electric vehicle (EV) infrastructure engineers
- EV mechanics for EV repair and service
- Grid engineers
- Fuel cell technology
- Occupational health and safety (OHS) officer
- Power system engineers
- Control engineers / renewable energy engineers
- Specialist truck drivers
- Wind turbine blade and turbine technicians

2.2— Current Shortages in Energy Skills in Gippsland

Federation University Australia, as part of preparing this report, has conducted a survey of Gippsland-based renewable energy project developers to collect additional information on the future energy skills required for Gippsland, with a particular focus on ongoing and long-term skills required for the renewable energy sector as it develops across the region. The short survey was sent to 32 participants.

A total of eight responses were received covering community energy, offshore wind, and utility-scale battery energy storage systems. Key results are listed below that provide additional information for understanding the long-term employment opportunities associated with renewable energy operations in Gippsland.

The two participants stated:

'An Operations and Maintenance contractor/ provider would likely be appointed to oversee O&M functions for the operational period of the facility.'

This is crucial as it impacts the developer's ability to forecast and commit to future skills and training needs, given that responsibility.

> An Operations and Maintenance contractor/ provider would likely be appointed to oversee O&M functions for the operational period of the facility.
>
> —Two interview participants

Figure 10 shows the timing for offshore wind farm development. After the developer concludes the feasibility study, significant jobs would be created during the construction phase. Then, following construction, the project would go into operation (sequentially). Consequently, there would be jobs in O&M from year 3 of the development.

There would be a high number of O&M jobs associated with offshore wind technology. The diversity of job types also increases with the project's generation capacity, especially one that incorporates marine and safety operations to work in the offshore environment (estimated at 0.33 FTE per megawatt). Based on the Australian Energy Market Operator's integrated system planning and offshore wind energy projection, there would be 4000–4500 FTE O&M jobs, including wind turbine technicians, electrical and mechanical technicians, SCADA engineers, blade repair technicians, and reliability and asset management specialists. The offshore wind projects showed a relatively even split across qualification types associated with O&M functions, although a complete list of roles was not provided (see Table 5).

Figure 10. Timing for offshore wind farm construction.

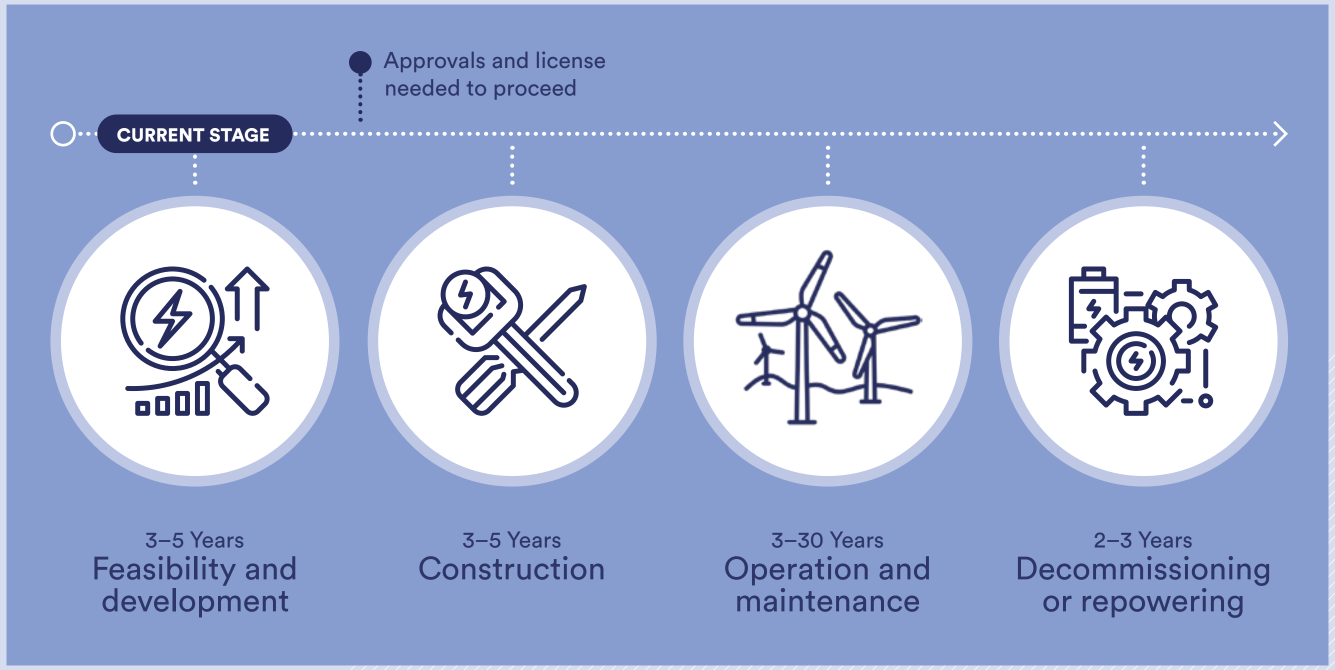


Table 5. Wind sector job opportunities based on survey data.

Professional	Trade/Technician
Project engineer	Apprentice hydraulics/mechanical fitter
Quality manager	Apprentice electrician
Grid connection engineer	Mechanical/hydraulics technician
Project manager	Electrical technician
Data analytics (wind yield performance)	Radio operator
Asset integrity manager	Electrical and instrumentation technician
Contract/commercial manager	Wind turbine technician
Procurement manager	Painter/rope access technician
Planner/project control manager	Blade repair technician
Electrical supervisor	Crane operator
Rope access manager	Warehouse storeman – onshore
Quality, health, safety, and environment manager	Crew transfer vessel crew
Supervisory control and data analytics	Control room technician
Permit manager	Heavy lift supervisor
Human resources manager	
Risk manager	
Site manager – onshore	
Marine Geo-Data Specialist	
Environmental Scientist – offshore and onshore (including collection and monitoring of biodiversity data)	
Permitting/Regulatory approvals specialists	
Land access liaison specialist	

Most of the identified roles require OEM-specific training rather than general training. Wind turbine and blade repair technicians are two specifically identified roles that have OEM-specific training requirements.

The O&M manager, together with the project and developer team, makes up the ongoing O&M team for a utility BESS project. The majority of the employees are likely to be degree/tertiary qualified staff, with some corporate/administrative roles. In addition, the BESS designers and installation staff are likely to be OEM-specific.

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The transmission group AusNet has revealed plans for a 10 GW renewable energy zone in Victoria's Gippsland region. Renewable energy zones are now seen as crucial to the massive rollout of wind, solar, and storage required to transition Australia's grid from fossil fuels to renewables over the coming decade or two. Based on a previous interview with AusNet, a list of required future skills is shown in Table 6. Table 7 shows the job skills required for storage and hydrogen. Table 8 shows the skill requirements in the bioenergy and geothermal sectors.

There are some indirect job opportunities associated with clean energy projects. Figure 11 shows the direct and indirect job opportunities related to the clean energy project supply chain.

> "The existing local agreements were in place for future training needs. Traineeships were indicated as potential opportunities for long-term training needs locally."
>
> —Project developer

Table 6. Skills required for the renewable energy zone development.

Skills Required	Stage of Life Cycle
Technical writer	Plan and design
Community stakeholder engagement	Throughout
Transmission line design	Plan and design
Project management	Throughout
Transmission station electricians	Construction
Network authorities	Construction and maintenance
Environmental advisers	Construction and maintenance
Non-network solution engineers	Throughout
Data analytics	Construction and maintenance
Construction work including rigging and traffic control	Construction phase
Vegetation clearance	Throughout
Network authorities	Construction and maintenance
Land valuer	Plan and design
Land surveyor	Plan and design
Statutory Planning	Plan and design
Land liaison officer	Throughout
Stakeholder engagements	Throughout

Table 7. Skills required for storage and hydrogen

Skills required	
Electrical engineer	Control engineer
Software engineer	Data analytics
Gas workers	Stakeholder engagement
Mechanical design	Statutory Planner
Chemical engineer	
Process and supply engineer	
Hydrogen safety officer	
Manufacturing engineer and trades in electrolysers, fuel cell and storage	
Control engineer	
Smart grid engineer	
Plumbers, pipe fitters	
Appliance installation trades	
Civil construction trades	

Table 8. Skills required in the bioenergy and geothermal sectors.

Skills required	
Electrical engineer	Land surveyor
Software engineer	Geologists
Gas workers	Health and safety manager
Mechanical design	Digger
Chemical engineer	Mechanical trade
Process and supply trade	Specialist engineers (e.g., chemical, mechanical, pipeline, drilling, electrical, Instrumentation, and control engineer)
Control engineer	Geo-Data Specialist - Seismic Processing
Smart grid engineer	Permitting/Regulatory approvals specialists Land access liaison specialist
Plumbers, pipe fitters	
Appliance installation trades	
Civil construction trades	
Heavy material movers	
Environmental specialists	
Mining engineering	

A wide range of supply chain and associated jobs will be required to complete the massive rollout of wind, solar, and storage required across Australia. Direct and indirect job opportunities will oversee a transition to clean energy over the coming decade or two.

Trade jobs

- Electrical
- Mechanical
- Builder
- Welder
- Metal fabricator
- Fencing contractor
- Carpenter
- Plumber
- Plant operator eg. Excavator driver
- Legal: Construction specialists

Engineering jobs

- Electrical: Power systems and telecommunications
- Civil: Road, foundations, trenching and buildings
- Geotechnical: Siting and construction
- Chemical: Soil analysis
- Hydropower specialists
- Fluvial-geomorphologists
- Mechanical: Machine and equipment design, assembly and operation
- Dam engineers
- Aquatic and terrestrial scientists
- Geologists
- Tunnelling

Other project roles

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

Support services

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

Figure 11. Renewable energy project supply chain and associated jobs.

On a state level, there are requirements for licenced tradespeople to meet annual continuing professional development (CPD) requirements, and the relevant licencing authorities are typically involved in approving CPD training. However, the fossil fuel workers would require formal fast-track training in the renewable or clean energy sector (including both gap training and reskilling into a new energy sector).

Tables 9–12 show the transition of fossil fuel workers to the clean energy sector and identify gaps in training and reskilling requirements, mainly in the hydrogen and smart grid domain.

Table 9. Crosswalk between fossil fuel and clean energy sector: laborers, service technicians, plumbers.

Blue text highlights gap training; + indicates new development opportunities

Fossil fuel occupation	Fossil fuel skill	Crosswalk occupation	Training skills
Laborers	Construction pathways, concreting	Construction labour in clean energy project	Construction Induction Card, Work Safely at Heights, License to Perform Dogging, License to Perform Rigging – Basic, Intermediate and Advanced
Service technician and mechanics	Certificate II in Technical Support; Certificate III in Engineering Fabrication and Mechanical	Wind turbine repair; monitoring; electric vehicle service technicians; solar roofers	Certificate III in Electrotechnology Electrician; Short course on grid-connected PV Solar Systems; Turbine Technician Courses+; Short course on Electric vehicle repair+; Certificate III in Automotive Electric Vehicle Technology; License class for high voltage installation
Plumbers, pipe fitters, and steamfitters	Post-trade gas fitting and REL; post-trade pumping and trade	Line supervisor; construction trades; electricians; solar roofers; hydrogen energy	Skills Set (possibly both Cert-III & Post Trade) – H2Technology for Gas fitters+; H2 Fuel Cells and Electrolysis; Advanced Hydrogen Technology (Tertiary education)+ Short course on Grid Connected PV Solar System; Certificate III in Electrotechnology Electrician

Table 10. Crosswalk between fossil fuel and clean energy sector: engineers, equipment operators, drivers.

Blue text highlights gap training; + indicates new development opportunities

Fossil fuel occupation	Fossil fuel skill	Crosswalk occupation	Training skills
Operating engineer and other construction	Civil, mechanical, and electrical engineering qualifications	Condition monitoring and asset management; data analytics; grid connection; transmission line engineering	Certificate and a short course in asset management and condition monitoring (tertiary education); Graduate Certificate in Power and Energy (Tertiary education); Short course in PSCAD for grid connection engineering+ (Tertiary education)
Equipment operators	HSR training courses; Certificate III in Civil Construction Plant Operations; Certificate III in Civil Construction	Extraction worker; equipment operation in construction sites in clean energy	License to operate cranes on offshore site; License to Perform Dogging, License to Perform Rigging – Basic, Intermediate and Advanced; Construction Induction Card.
Heavy and tractor-trailer drivers	Driving operations; HSR training courses	Crane and hoist operator; drivers	License to Operate a Slewing Mobile Crane; License to Perform Dogging, License to Perform Rigging – Basic, Intermediate and Advanced; Construction Induction Card;

Table 11. Crosswalk between fossil fuel and clean energy sector: service attendants, material movers and hand

Blue text highlights gap training; + indicates new development opportunities

Fossil fuel occupation	Fossil fuel skill	Crosswalk occupation	Training skills
Service attendants	Certificate II in Engineering - Trade; Certificate II in Technical Support	Storage person; electrical inspection of the clean energy sector	Work Safely at Heights; Certificate II in Electrical Inspection+; License class for high voltage installation; License class for hazardous areas.
Material movers and hand	Enter and work in a confined space; licence to operate forklift; driving operations	Clean energy construction site; packers, operation, and handling	Construction Induction Card, Work Safely at Heights, License to Operate a Slewing Mobile Crane; License class for hazardous areas.

Table 12. Crosswalk between fossil fuel and clean energy sector: general operation manager, line supervisor, welders, cutters

Blue text highlights gap training; + indicates new development opportunities

Fossil fuel occupation	Fossil fuel skill	Crosswalk occupation	Training skills
General operation manager	Building and construction (specialist trades); building and construction (management) – higher education (HE) qualifications	General operation manager in clean energy, manufacturing energy-efficient products, zero-emission building construction, operation, and retrofitting	Certificate IV in Building and Construction Diploma of Building and Construction
First-line supervisor for production and operation	ESI generation (operations); ESI generation; ESI generation maintenance – electrical	Wind energy or hydrogen energy operation manager; electrical inspection of high voltage	Advanced Hydrogen Technology (Tertiary education) +; Skills Set (possibly both Cert-III & Post Trade) – H2Technology for Gas fitters+; H2 Fuel Cells and Electrolysis+; Turbine Technician Courses; Certificate II in – Transmission Structure and Line Assembly+; Certificate III in ESI – Transmission Overhead+
Welders, cutters	Certificate III in Engineering – Fabrication Trade	Electrical power-line installer and fitter; EV repair and assembly	Short Course in Transmission Structure and Line Assembly Power Industry Induction Card Pathway to -Certificate II in – Transmission Structure and Line Assembly+; Certificate III in ESI – Transmission Overhead+; Certificate III Electrotechnology Certificate III Engineering – Mechanical

3— Training and Professional Development Program

There is a discrepancy between current education offerings and the demands of the future renewables industry. Many higher education courses require hands on training.

3.1— Current Vocational and Tertiary Education Training

Post-secondary education considered in this report includes vocational education and training (VET), higher education courses, industry accreditations, and CPD. Rutovitz et al. (2021) identified education and training gaps in the renewable energy sector. It is reported that there is a mismatch between offerings by the education system and industry demand, particularly when considering the quantity of higher education (HE) courses offered against high industry demand for hands-on training.

Table 13 lists the programs available. Universities in the Regional Universities Network (RUN) offer associate and Bachelor of Engineering Technology degrees specialising in power and renewable energy. However, the RUN universities do not offer specialised or advanced courses in renewable energy that are required by the industries. Furthermore, most RUN universities do not have specialised research centres for the new energy transition.

Table 13. Undergraduate programs specialising in renewable energy

University/State	Program Title	Comment
University of Newcastle, New South Wales	Bachelor of Renewable Energy Engineering	Accredited by Engineers Australia (EA)
Royal Melbourne Institute of Technology (RMIT), Victoria	Bachelor of Engineering (Sustainable System Engineering)	Accredited by EA
Monash University, Victoria	Bachelor of Resource Engineering (Renewable Energy)	Accredited by EA
Edith Cowan University, Western Australia	Bachelor of Engineering (Electrical and Renewable Energy)	Accredited by EA
Murdoch University, Western Australia	Bachelor of Engineering (Renewable Energy Major)	Accredited by EA
University of New South Wales, New South Wales	Bachelor of Engineering (Renewable Energy)	Accredited by EA
Australian National University, Australian Capital Territory	Bachelor of Engineering (Renewable Energy Major)	Accredited by EA

A key to addressing skills shortages is to make the industry more accessible and appealing to diverse groups. Three of the seven universities offering undergraduate programs in advanced renewable engineering are Victorian based.

Figure 12. Undergraduate and postgraduate programs in renewable energy at Victorian universities

University	Undergraduate/Degree Program	Post-graduate/Certificate Program
University of Melbourne	Bachelor of Engineering (Electrical)	Master of Electrical Engineering (3 years)
Monash University	Bachelor of Electrical and Computer Engineering, Bachelor of Resource Engineering (Renewable Energy)	Master of Electrical Engineering Master of Sustainable Energy
RMIT University	Bachelor of Engineering (Electrical) Bachelor of Engineering (Sustainable System Engineering) Associate Degree in Engineering	Master of Engineering (power) Master of Engineering (Renewable Energy)
Swinburne University of Technology	Bachelor of Engineering (Power) Associate Degree in Engineering	Master of Engineering
Deakin University	Bachelor of Engineering (Power)	Master of Engineering Electrical and Renewable Energy Graduate Certificate in Power and Energy
Federation University Australia	Bachelor of Engineering (Electrical & Communication) Bachelor of Technology (Renewable—proposed)	Master of Engineering (Renewable and Power System) Graduate Certificate in Community Energy and Microgrid
Victoria University	Bachelor of Engineering (Electrical)	Master of Engineering (Electrical Power) Graduate Certificate in Power and Energy

The listed undergraduate programs shown in Figure 12 are at basic and intermediate levels and cover different aspects and areas in electrical, sustainable, electronics, and communication fields of study. There are also some advanced-level courses and programs in power engineering with less of a focus on current industry requirements.

The high number of university degrees results from universities having a high degree of freedom to develop and offer new courses. The universities can self-accredit the development of the new courses, but the level of consultation with appropriate industries is quite vague. Federation University in Gippsland offers programs and courses suitable for clean energy technologies, including:

- Bachelor of Engineering in Civil
- Bachelor of Engineering in Electrical and Information Technology
- Graduate Certificate in Community Energy and Microgrid
- Bachelor of Environment and Conservation Science
- Master of Business Administration (MBA)

Courses available in VET, along with a reference to specific keywords in their course descriptions, are shown in Table 14. Course approval in the VET sector is highly centralised, and multiple registered training organisations can offer the approved courses. As a result, all the listed VET qualifications and accredited courses are available from many providers.

Over 85 per cent of VET program enrolments are in training package qualifications. Multiple training packages have been identified as potentially relevant for the skills required for a clean energy transition, including:

- Electricity supply
- Information and communication technology
- Resource and infrastructure
- Sustainability
- Transmission and distribution

The VET sector in Gippsland currently offers the following courses/programs align with clean energy sector

- Certificate II in Electrotechnology (Career start);
- Certificate III in Electrotechnology (Apprenticeship);
- Certificate III in Instrumentation and control;
- Certificate III in Instrumentation and control (Apprenticeship);
- Course in New Energy Technology System;
- Course in Working Safety in Solar Industries.

There are courses/programs also available in the VET sector covering renewable energy such as Certificate III in Renewable Energy - ELV, Certificate IV in Renewable Energy, and Diploma of Renewable Energy Engineering. All qualifications currently exist under training packages available within the vocational education sector, however, would require the development of curriculum and training facilities to support delivery.

UEE32020 Certificate III in Renewable Energy - ELV

This qualification covers competencies to select, install, set up, test, fault find, repair and maintain renewable energy (RE) equipment and systems. It does not include electrical work covered by licensing requirements declared by Electrical Regulatory Advisory council (ERAC) for an 'Electrician's license'.

UEE41611 Certificate IV in Renewable Energy

This qualification provides competencies to select, install, commission, fault find and maintain multiple renewable energy (RE) sources and equipment for control of energy use.

UEE50720 Diploma of Renewable Energy Engineering

This qualification provides competencies to develop, select, commission, maintain and diagnose faults/malfunctions on large-scale renewable energy (RE) equipment and systems.

Furthermore, the existing offering units are solar and low voltage system dominated. Modules and units of other renewables and big data analysis in energy systems need to be developed and integrated.

Tables 15–18 show the skills and qualifications required by renewable energy projects that are covered in the VET sector.

Table 14. Current nationally recognised training in renewable energy

Keyword	VET Qualifications and Accredited Courses
Renewable energy	9 (15 units of competency)
Energy efficiency	5 (6 units of competency)
Sustainable energy	1 (5 units of competency)
Electrical	41 (213 units of competency)
Solar	1 (3 units of competency)

Table 15. Available VET qualifications for managerial roles in renewable energy projects

Role	VET Qualification
Executive and general managers	Graduate Diploma of Strategic Leadership
Human resources, finance, and business administration managers	Business Services Training Package Diploma of Human Resources Management
Construction/project managers	Advanced Diploma of Building and Construction (Management)
Site managers (project builders)	Diploma of Building and Construction (Management)
Operations/asset managers	Diploma of Banking Services Management
Other managers	Advanced Diploma / Diploma of Leadership and Management / Advanced Diploma / Diploma / Certificate IV in Process Plant Technology

Table 16. Available VET qualifications for professional roles in renewable energy projects

Role	VET Qualification
Legal and planning professionals, policy and planning professionals	Diploma of Government
Human resource professionals	Certificate IV in Human Resources Diploma of Human Resources Management
Sales and marketing professionals	Advanced Diploma / Diploma in Marketing and Communication Certificate IV in Marketing and Communication
Community engagement workers, public relations professionals	Certificate IV in Local Government Diploma of Community Development
Surveyors	Certificate IV in Surveying
Civil engineers	Advanced Diploma of Civil Construction
Electrical engineers	Advanced Diploma of ESI - Power Systems
Grid engineers (industrial engineering)	Certificate III in Engineering – Industrial Electrician
Mechanical engineers	Certificate IV in Engineering (Pathway)
Solar PV designers, engineering professionals	Certificate IV in Electrical – Photovoltaic systems
Environment assessment professionals	Certificate IV in Local Government (Health and Environment) Diploma of Local Government (Health and Environment)
SCADA/telecommunications engineers	Diploma of Telecommunications Engineering
Geographic information system professionals	Advanced Diploma in Surveying
Health and safety professionals	Advanced Diploma in Work Health and Safety Certificate IV in Work Health and Safety
IT professionals	Certificate IV in Information Technology Diploma of Information Technology
Civil engineering technicians	Diploma of Civil Construction Management
Electrical technician support workers, power plant control room operators	Certificate II ESI Generation (Operations) Certificate IV ESI Generation (Maintenance) Certificate IV ESI Generation (Maintenance) Certificate IV ESI Generation (Fabrication) Certificate IV ESI Generation (Maintenance) – Electrical Electronic
Telecommunications trades	Diploma in Electronics and Communication Engineering
Mechanical trades, mechanical draftspersons	Diploma in Hydraulic Services Design, Diploma in Fire Systems Design
Transport and logistics	Certificate IV or Advanced Diploma in Material Logistics

Tables 13–18 show that both the VET and higher education sectors offer training and knowledge in the new energy sector relevant to managers, engineers, technicians, trade support, and others. However, there is always a moment of transition between the development of new technologies and relevant course offerings. Currently, courses in hydrogen, fuel cell-related technology, advanced asset management, and IoT application in energy systems are not well developed across the higher education and VET sector. Moreover, some of the qualifications related to transmission line model, structure, and development have either ceased or are no longer offered.

Furthermore, the project team has reviewed several jobs adverts in the renewable energy domain (offshore sector) and found the following short courses that are immediately required for new energy jobs. Table 19 shows the short qualifications needed for current renewable energy projects.

Table 17. Available VET qualifications for supporting roles in renewable energy projects

Role	VET Qualification
Earthmoving, grader operators	Certificate III in Civil Construction Plant Operations
Truck Drivers (large solar and wind)	Certificate III in Driving Operations
Drivers (distributed solar PV)	Certificate II in Driving Operations
Data entry operator	Certificate III Business Administration
Accounts Clerk	Certificate I in Basic Financial Literacy Diploma of Accounting
Program or Project Administrators	Certificate IV in Project Management Practice
Inspectors and Regulatory Officers	Certificate IV in Local Government (Regulatory Services) Diploma of Local Government (Regulatory Services)

Table 18. Available VET qualifications for labourer roles in renewable energy projects

Role	VET Qualification
Concreters	Certificate III in Concreting
Riggers	Certificate III in Rigging Skills Sets and Short Courses
Dogman	Certificate III in Construction Crane Operations
Electrical trade assistants	Certificate II in Technical Support
Mechanical trade assistants/labourers (mechanics assistant)	Certificate III in Engineering – Mechanical Trade
Civil trade assistants/labourers (Other labourers) (civil technicians)	Certificate II Construction Pathways

Table 19. Immediate training required by fossil fuel workers to work in the offshore wind energy sector

Short courses	RTO delivering this Skill Set	Locations
NDT Certifications (Specific NDT qualifications to be determined at project kick off)	Various course providers including ATTAR AQB, ALS Training Academy, Advanced Infrared Resourced Australia, Kuzer Technical, TAFE	WA, NSW, Queensland, SA and Victoria
GWO Basic Safety Training (BST)	Alitec Australia Pty Ltd, Canberra Institute of Technology, Federation University, Fire and Safety Australia, Skylar Safety, Thomson Bridge Pty Ltd, Vestas Wind Technology Australia, Wright Training,	Melbourne, Canberra, Adelaide, Sydney
Forklift Licence (LF)	Multiple providers in all states and territories, TAFE Gippsland	Multiple providers in all states and territories
Advanced First Aid	Multiple providers in all states and territories TAFE Gippsland	Multiple providers in all states and territories
Welding Inspector Certificate	Multiple providers including Techno weld, Weld Australia, Australian Welding Institute TAFE Gippsland	All states
NACE Coating Inspector Certificate#	AMPP, NACE	Brisbane, Perth, Adelaide, Sydney
Construction Industry White Card	Multiple providers in all states and territories, TAFE Gippsland	Multiple providers in all states and territories
Maritime Security Identification Card (MSIC)	Atlas Professionals, Veritas, Client View	Post office Australia wide or in person at office Perth or Adelaide
Basic Offshore Safety Induction and Emergency Training (BOSIET)	ERGT	Perth, Darwin, Melbourne
Short and Long-Range Radio Operator Certificate	Great Barrier Reef International College, Australian Maritime College, TAFE Newcastle, TAFE Ultimo, South Metro TAFE, TAFE Gippsland	Queensland, Hobart, Perth, Newcastle, Sydney
GWO Blade Repair Training Certificate#	RIGCOM, Vertical Horizons, Skylar Safety	Sydney, Brisbane
IRATA Rope Access Certification	Multiple providers in all states and territories	Multiple providers in all states and territories
Dogging and Rigging Certifications (DG, RB)	Multiple providers in all states and territories TAFE Gippsland	All states
Helicopter Underwater Escape Training (HUET)	ERGT, Life Flight Training Academy, Ace Training Centre	Perth, Darwin, Melbourne, Queensland (various cities), Sydney
E- learning service lift training- dependent on wind turbine manufacturer (i.e. Avanti Service Lift Operator)	Turbine manufacturer will determine, example of Avanti	Melbourne for Avanti - Alimak Group
High Voltage Certifications	High Voltage Training Solutions, Volt Edge, Site Skills Training, Optec, Competency Training, Power Supply Services and Training, Western Energy Training, Australian Maritime College, NECA	Sydney, Melbourne, Perth, Darwin, Tasmania, Canberra, Adelaide
Master 11/2 <3000GT (Unlimited)#	Australian Maritime College, South Metro TAFE, TAFE NSW- Newcastle	Hobart, Perth, Newcastle
ECDIS (Electronic Chart Display and Information System)	AMC, Smart Ship Australia, Perth Sim Centre, TAFE Newcastle, TAFE Sydney, Great Barrier Reef International Marine College	Hobart, Brisbane, Perth, Newcastle, Sydney, Cairns
Dynamic Positioning (DP) Offshore Unlimited Certification	AMC, Perth Sim Centre	Hobart, Perth
ISO 9001, ISO 14001 and ISO 45001 Integrated Management Systems Internal Auditor Training	Many providers including QMS Audits, PWC Training Academy, Bureau Veritas	All cities in Australia and online
Certificate of Safety Training (full course) - STCW Reg IV/1	TAFE Newcastle, TAFE Ultimo, ERGT (Darwin, Perth, Altona), Great Barrier Reef International Marine College, Maritime Career Training, Whitsunday Maritime Training Centre, Australian Maritime Centre, Fremantle Maritime Simulation Centre,	Newcastle, Sydney, Darwin, Cairns, Kulangoor, Airlie Beach, AMC, Altona, Perth, Fremantle
Food Safe Level 1 and 2 (SITXFSA001 Use Hygienic Practices for Food Safety & SITXFSA002 Participate in Safe Food Handling Practices)	CTA Training Specialists (online) TAFE Gippsland	Online
Lifting Equipment General (LEG) Advanced Program	Lifting Equipment Engineering Association	Online e-learning
Risk Management Course	Multiple providers in all states and territories and online	All states and online
Permit to work training	Multiple providers in all states and territories	All states
Working Safely at Heights	Multiple providers in all states and territories TAFE Gippsland	Multiple providers in all states and territories

Table 19. Continued

Short courses	RTO delivering this Skill Set	Locations
PMASUP 305 Operate Offshore Crane	Multiple providers in all states and territories	All states
Manual Handling Cert	Contextual course offered in Multiple TAFE including TAFE Gippsland	All states
LEEA Lifting equipment general (LEG) training	Online training provider	England, India, Australia and NZ. E-learning mainly or instructor-based training on your site
Elevated Platform (EWP) certification	Multiple providers in all states and territories TAFE Gippsland	All states
Dangerous Goods Cert	State Department of Transport and Multiple providers in all states and territories	Online
E-learning training for service lift model i.e., Avanti Service Lift Operator Training	Online training, avanti-online.com	Online
Confined Space entry certificate	Multiple providers in all states and territories TAFE Gippsland	All states
Current High Voltage (HV) certificate	Multiple providers in all states and territories	All states
AMSA Integrated Rating Certificate of Proficiency	Australian Maritime College, South Metro TAFE, TAFE NSW- Newcastle	Hobart, Fremantle, Newcastle
AMSA Chief Integrated Rating Certificate of Proficiency	Australian Maritime College, South Metro TAFE, TAFE NSW- Newcastle	Hobart, Fremantle, Newcastle
ADAS Diver Qualification	ADAS.org	Melbourne, Tasmania, Perth, Albany, Queensland, Sydney, NZ
Risk Management PMI-RMP Certification	Online and in class @ sprintzeal.com	All states
Aeronautical Radio Operator Certificate	droneit.com.au or casa.gov.au	Online
Flag State Medicals and Endorsements	As per flag state of installation and cable lay vessels	Flag state consulate
OGUK Medical	Multiple providers in all states and territories	All states
Chesters Step Test	Any GP can complete this test	All states
AMSA Medical	Multiple providers in all states and territories	All states
AS 2299 Dive Medical	spump.org.au to find doctors or Dive medicals Melbourne/Sydney	Perth, Melbourne, Sydney, Brisbane
GWO Technical training#	APRETC, Federation University TAFE	Mt Helen
Blade Repair Technician Apprenticeships#	APRETC, Federation University TAFE	Mt Helen

Table 20. Additional programs/courses/training required for higher education graduates

Job Title	Qualification	Additional Qualification and Skill Sought
Renewable Energy Engineer	B.Eng. in Electrical/Renewable	Clean Energy Council Certified Solar Designer Clean Energy Council Certified Battery Storage Designer
Electrical Engineer – Wind	B.Eng. in Electrical/Renewable	WAsP, WindPro, and WindFarmer
Renewable Energy technologist	B.Eng. in Electrical/Renewable/Mechatronics	QA and HSE Audits
Electrical Engineer – Testing	B.Eng. in Electrical	QC testing, product development or manufacturing
Solar Design Engineer	B.Eng. in Electrical/Mechatronics	Ensuring compliance with relevant HSE legislation
Grid Connection Engineer	B.Eng. in Electrical/Renewable	PSAD, PSS/E/DIgSILENT/HOMER

> “According to the major job searching website ‘Seek’, there were more than 40 jobs listed in Victoria on 12 June with the job title ‘renewable energy’. ”

The project team has reviewed several jobs adverts in the renewable energy domain which required higher education qualifications. According to the major job searching website ‘Seek’, there were more than 40 jobs listed in Victoria on 12 June with the job title ‘renewable energy’. Table 20 summarises the formal and additional qualifications required for those jobs. Many of the HE courses in Table 13 and Figure 12 do not entirely cover the additional qualifications sought by the industry.

Furthermore, Tables 21-24 summarises the pathway for the current power plant worker to different clean energy sector and training requirements including the gap training and reskilling.

However, this opportunity assessment was limited to an initial stocktake of the current training programs offered at tertiary and vocational levels in Australia. A deeper, course-level investigation may be required for more granular insights.

Furthermore, different peak bodies and industry organisations also offer training programs in the clean energy sector (e.g., Clean Energy Council, Energy Efficiency Council, Green Building Council).

These programs may include:

- Design and installation courses for solar, micro-hydro, small-scale wind, and battery energy
- Legislation training for installers
- Certified course for energy managers
- Measurement and verification professional certificates

These training programs are not equivalent to the formal qualifications offered by the VET and higher education sectors. However, they could be suitable for the fossil fuel-based workforce to transition into clean energy. All these organisations offer CPD training opportunities to maintain relevant industry certifications. Various other professional governing bodies, including EA, also offer CPD programs and require their members to complete a certain amount of professional training every year.

Table 21. Fossil fuel power industry skill mapping to wind

HV cable joiner — Certificate II in Transmission Structure and Line Assembly	Cable installer: Construction Induction Card; Work Safety at Heights	Electrician technician: Certificate III in Electrotechnology Electrician	Apprentice Electrician: Certificate II in Electrotechnology Electrician			
Rope access — Certificate II in Engineering	Rope access technician: Construction Induction Card; Work Safety at Heights	Rope access manager: Construction Induction Card; Work Safety at Heights	Blade/turbine repair technician: Post-trade skill set for turbine and blade technician ▲		Rigger foreman: Construction Induction Card; Work Safety at Heights	
Team leaders	Asset manager	Site manager (onshore)	Permit manager: Postgraduate in Asset Management		Fabrication supervisor: Construction Induction Card; Maritime training	
Engineers — Electrical, Civil and Mechanical	Grid connection manager transmission: Postgraduate in Electrical and Renewable Energy	Commissioning Engineer: Postgraduate in OHS, Project Management	Project engineer: Postgraduate in Electrical and Renewable Energy		Project planner: Postgraduate in Engineering Project Management	
Utility — Basic rigging	Rigger foreman: Construction Induction Card; Work Safety at Heights					
Mechanical fitter trade — Certificate III in Engineering (Mechanical)	Blade or wind turbine technician: Post-trade skill set for turbine and blade technician ▲	Installation technician: Construction Induction Card; Work Safety at Heights; High voltage installation license	Mechanical supervisor: Construction Induction Card; Work Safety at Heights; High voltage installation license		Mechanical fitter: Construction Induction Card; Work Safety at Heights; High voltage installation license	
Electrician and dual trade instrumentation — Certificate III in Electrotechnology or Instrumentation and control	Wind turbine technician: Post-trade skill set for turbine and blade technician ▲	Installation technician: Construction Induction Card; Work Safety at Heights; High voltage installation license	E&I technician: Construction Induction Card; Work Safety at Heights; High voltage installation license	Commissioning engineer: Construction Induction Card; Work Safety at Heights; High voltage installation license	Electrical supervisor: Construction Induction Card; Work Safety at Heights; High voltage installation license	Control room technician: Course on Working Safety in Industries
Boilermaker trades — Certificate III in Engineering (Fabrication or Welding)	Fabrication supervisor: Construction Induction Card; Maritime Training	Welders: Construction Induction Card; Work Safety at Height;	Installation technician: Construction Induction Card; Work Safety at Heights		Cable installation: Construction Induction Card; Work Safety at Heights; High voltage installation license	

Gap Training Reskilling ▲ New development opportunities • Working Safety at Heights & Health and Safety Representative Training

Table 22. Fossil fuel power plant skill mapping to hydrogen

HV cable joiner — Certificate II in Transmission Structure and Line Assembly	Fuel cell installation and maintenance: H2 Fuel Cells and Electrolysis ▲; Construction Induction Card	Instrument and electrical technician: Certificate III in Electrotechnology Electrician; Certificate III in Instrumentation and Control			
Rope access — Certificate II in Engineering	Fuel cell maintenance: H2 Fuel Cells and Electrolysis ▲	Pipeline technician: H2 Technology for Gas fitters ▲	Gas fitter: Skills Set (possibly both Certificate III & Post Trade); H2 Technology for Gas fitters ▲		
Team leaders	Project manager	Planner			
Engineers — Electrical, Civil and Mechanical	Surveyors: Licence class for hazardous materials; Short course in Hydrogen Technology ▲	System integration engineer: Postgraduate in Power and Energy; Certificate of short course in Advanced Hydro Technology ▲	Industrial designers: Postgraduate in Power and Energy; Certificate of short course in Advanced Hydro Technology ▲		
Utility — Basic rigging	Service station workers	Fuel cell installation and maintenance: H2 Fuel Cells and Electrolysis ▲			
Mechanical fitter trade — Certificate III in Engineering (Mechanical)	Fuel cell maintenance: H2 Fuel Cells and Electrolysis ▲	Pipeline technician: License class for hazardous materials	Gas fitter: Skills Set (possibly both Certificate III & Post Trade); H2 Technology for Gas fitters ▲	Plumber and engineering trade: Skills Set (possibly both Certificate III & Post Trade); H2 Technology for Gas fitters ▲	Mechanical fitter: License class for hazardous materials
Electrician and dual trade instrumentation — Certificate III in Electrotechnology or Instrumentation and control	Hydrogen process operator: Skills Set (possibly both Certificate III & Post Trade); H2 Technology ▲	Instrument and electrical technician: Certificate III in Electrotechnology Electrician	Quality and safety manager: Course on Working Safety in Hydrogen Industry ▲	Electrolyser technician: H2 Fuel Cells and Electrolysis ▲	Power plant operators
Boilermaker trades — Certificate III in Engineering (Fabrication or Welding)	Equipment certifier: Course on Working Safety in industries •	Pipeline technician: H2 Technology for Gas fitters ▲	Instrument technician: Certificate III in Electrotechnology Electrician	Manufacturing worker: Course on Working Safety in industries •; Certificate III in Engineering Fabrication	

Gap Training Reskilling ▲ New development opportunities • Working Safety at Heights & Health and Safety Representative Training

Table 23. Fossil fuel power plant skill mapping to battery, solar, biomass

HV cable joiner — Certificate II in Transmission Structure and Line Assembly	Apprentice electrician: Certificate III Electro-tech	Electrical inspector: Certificate II in Electrical Inspection ▲	Electrician: Course in New Energy Technology System	Gas pipe technician: Licence class for hazardous area/material				
Rope access — Certificate II in Engineering	Pipe line technician for biomass: Course on Working Safety in industries ●	Installation side technician for solar battery: New Energy Technology Course; Certificate III in Renewable Energy						
Team leaders	Commission and engineering manager	Project engineer and risk manager: Graduate certificate in Reliability and Asset Management	Planner					
Engineers — Electrical, Civil and Mechanical	Smart grid engineer: Post graduate in Power and Energy	Control engineer: Post graduate in Power and Energy	Risk manager: Course on Working Safety in industries ●	Energy yield analysis: Graduate certificate in Power and Energy	Data analytics: Graduate certificate on Data Analysis	Geologist: Graduate course in science	Software engineer: Graduate Certificate in IT	Commission and engineering manager: Postgraduate in project management
Utility — Basic rigging	Biomass installation: Construction Induction Card	Construction side worker: Licence class for hazardous area/ material						
Mechanical fitter trade — Certificate III in Engineering (Mechanical)	Electrical technician: Certificate III in Electro-technology Electrician	Electrical inspection: Certificate II in Electrical Inspection ▲	Risk manager: Course on Working Safety in industries	Solar roofer: Course in New Energy Technology System	Solar cleaning technician: Course on Working Safety in industries ●			
Electrician and dual trade instrumentation — Cert III in Electrotechnology or Instrumenta-tion and control	Control engineer	Electrical technician for the solar and battery: Course in New Energy Technology System	Electrical inspection: Certificate II in Electrical Inspection ▲	Solar roofer: Course in New Energy Technology System				
Boilermaker trades — Certificate III in Engineering (Fabrication or Welding)	Installation trade: Construction Induction Card	Electrical technician: Certificate II in Electrical Inspection ▲	Gas worker: Licence class for hazardous area/material	Process and supply trade: Course on working safety in industries ●				

Gap Training   Reskilling   ▲ New development opportunities   ● Working Safety at Heights & Health and Safety Representative Training

Table 24. Fossil fuel plant skill mapping to renewable energy zone

HV cable joiner — Certificate II in Transmission Structure and Line Assembly	Cable installer: Certificate III in ESI Power Systems — Distribution Cable Jointing; Work Safety at Heights	Electrician technician: Certificate III in Electrotechnology Electrician			
Rope access — Certificate II in Engineering	Cable installer: Certificate III in ESI Power Systems — Distribution Cable Jointing; Work Safety at Heights	Electrician technician: Certificate III in Electrotechnology Electrician	Electrical power line installer: Certificate III in ESI Power Systems — Transmission Overhead		
Team leaders	Project manager	Stakeholder engagement: Certificate in Project Management	Planner and project engineer: Certificate in Project Management	Environmental adviser: Postgraduate in Environmental Science	Risk manager: Graduate certificate or short course in Asset Management, condition monitoring
Engineers — Electrical, Civil and Mechanical	Smart grid engineer: Post graduate in Power and Energy	Grid connection engineer: Post graduate in Power and Energy	Transmission line design: Post graduate in Power and Energy	Construction site manager: Short course in Asset Management	Data analytics: Post graduate in IT or Engineering
Utility — Basic rigging	Installer: High voltage installation license; Work Safety at Heights	Construction work and traffic control: Construction Induction Card			
Mechanical fitter trade — Certificate III in Engineering (Mechanical)	Transmission line design: Certificate III in Transmission Structure and Line	Electrical inspection: Certificate II in Electrical Inspection ▲	Technician: New Energy Technology System; Certificate III and IV in Renewable Energy ▲	Surveyors: Diploma in Surveying; Diploma in Spatial Information Surveying	
Electrician and dual trade instrumentation — Certificate III in Electrotechnology or Instrumentation and control	Electrical technician: Course in New Energy Technology Systems	Electrical installation inspection: Certificate II in Electrical Inspection ▲	Installation and commissioning engineer: Course on working safety in industries ●		
Boilermaker trades — Certificate III in Engineering (Fabrication or Welding)	Cable installer: Certificate III in ESI Power Systems — Distribution Cable Jointing;	Electrical technician: New Energy Technology System	Electrical power line installer: Certificate III in ESI Power Systems — Transmission Overhead	Technician: Course in New Energy Technology Systems; Certificate III and IV in Renewable Energy ▲	

Gap Training   Reskilling   ▲ New development opportunities   ● Working Safety at Heights & Health and Safety Representative Training

3.2— Why Skills Shortages Persist Despite Training Programs

Despite a supply of post-secondary education related to clean energy and industry engagement in the development of these programs, skills shortages exist, and the situation is expected to worsen. A persistent enrolment decline is observed in the tertiary education and VET sectors between 2014 and 2019. In Australia, the number of people working as electrical engineers fell from 19,300 in 2014 to 16,600 in 2019 (ABS, 2019). The 2018 enrolments for domestic students in engineering were down to the 2010 level. The graduation numbers are at an all-time high, but less than 12,000 per year (ABS, 2019). VET program completion for 'Certificate III in Electrotechnology Electrician', the essential requirement for a licenced electrician, declined from 6,735 in 2015 to 5,400 in 2019.

Across four other diplomas or advanced diplomas related to electrical engineering, completions declined from 425 in 2015 to 255 in 2019. Even general accreditations such as the Certificate IV in Engineering saw a drop from 1,515 in 2015 to 655 in 2019. This figure is even lower for the regional areas.

Therefore, attracting enough people to be trained is a significant workforce challenge in Australia, particularly in regional areas like Gippsland (e.g., Federation University has seen a decline in overall engineering enrolment from 23-30 in 2016 to 14 in 2020). Furthermore, the pool of students interested in pursuing engineering from the Gippsland area did not grow significantly in the last five years. Specifically, attracting enough people to engineering studies is an issue for the energy sector.

It is clear that, despite numerous courses on offer, the vocational and tertiary education sectors are not able to attract and graduate enough students to meet the growing industry demand. Table 25 identifies problems related to the persistent skills shortage that exist despite the available training programs.

Table 25. Challenges associated with workforce development and transition

No.	Problems
1	Insufficient numbers of people taking up studies in the relevant technical fields
2	The time commitment and energy investment to complete the programs
3	Training programs not fully meeting skill or workforce needs
4	Evaluating the success of renewable energy education programs
5	Significant lags between identification of industry needs and updates to training packages

“[There is a] lack of understanding or interest among students in years 10–12 about a career in the new energy sector.”

—Survey respondent

4—
How to Close the Skill Gap

There has been a continued decline in technical course availability and student enrolment. The five key issues for workforce development and transition towards renewables are:

- Suitable training programs
- Improving coordination and collaboration among stakeholders
- Making the industry more attractive to join
- Diverse community inclusiveness in the clean energy sector
- Victorian senior secondary school pathway reform

4.1— Suitable Training Programs

Training programs exist, but existing and future energy professionals need professional development pathways with CPD opportunities mapped out for working across the renewable energy sector.

Generally, traditional higher education and VET programs can deliver skilled and qualified workers over the medium to long term (i.e., >5 years), but the required time commitment can be an issue for many mature and young people. Therefore, a new pathway to deliver the program and courses in a shorter time frame is required.

In this case, multiple entry and exit point programs can be developed. For example, Federation University has proposed an opportunity for such a program with technical and further education (TAFE).

The proposed program is designed to include different exit points embedded within the degree. Students will be able to exit with:

1. A Diploma of Applied Technologies (22460VIC) from the TAFE institution at the end of Year 1

2. An Associate Degree in Renewable Energy from the higher education at the end of Year 2

3. A Bachelor of Engineering Practice (Renewable Energy) from the higher education after successful completion of all three years

The program is also designed to facilitate two entry points at the start of Years 1 and 2, subject to an applicant meeting entry requirements. Each of these entry points is aimed at different cohorts (as shown in Figure 13).

Upon completion of the proposed Bachelor of Engineering Practice (Renewable Energy) degree, students will have the opportunity to work as an engineering technologist or continue to the Master of Engineering Technology (Renewable Energy and Electrical Power Systems) with one-semester credit to graduate and work as a professional engineer. A similar program could be developed for construction management and design drafting since most jobs will be in construction during the development of the renewable energy projects. Appendix B shows the detail of such an example program.

Similar to the tertiary education sector, the VET sector can also develop pathway programs with multiple entries and exit points. For example, Federation TAFE has developed a wind turbine technician pathway program, as shown in Figure 14. School leavers, mature people, and people with other skills can enter this program and leave from multiple exit points at Certificate II or Certificate III level or become a wind turbine technician.

Furthermore, engagement with stakeholders has revealed that the private sector could contribute to skills delivery in three important ways:

- Delivering industry-based courses
- Transferring knowledge from industry to training providers
- Offering more work-based learning and apprenticeship opportunities

Furthermore, not all skill acquisition needs formal training. Institutional learning is often impractical for busy employees. From a worker's perspective, incremental upskilling is important because it can be difficult to find the time to undertake full qualifications while in the workforce.

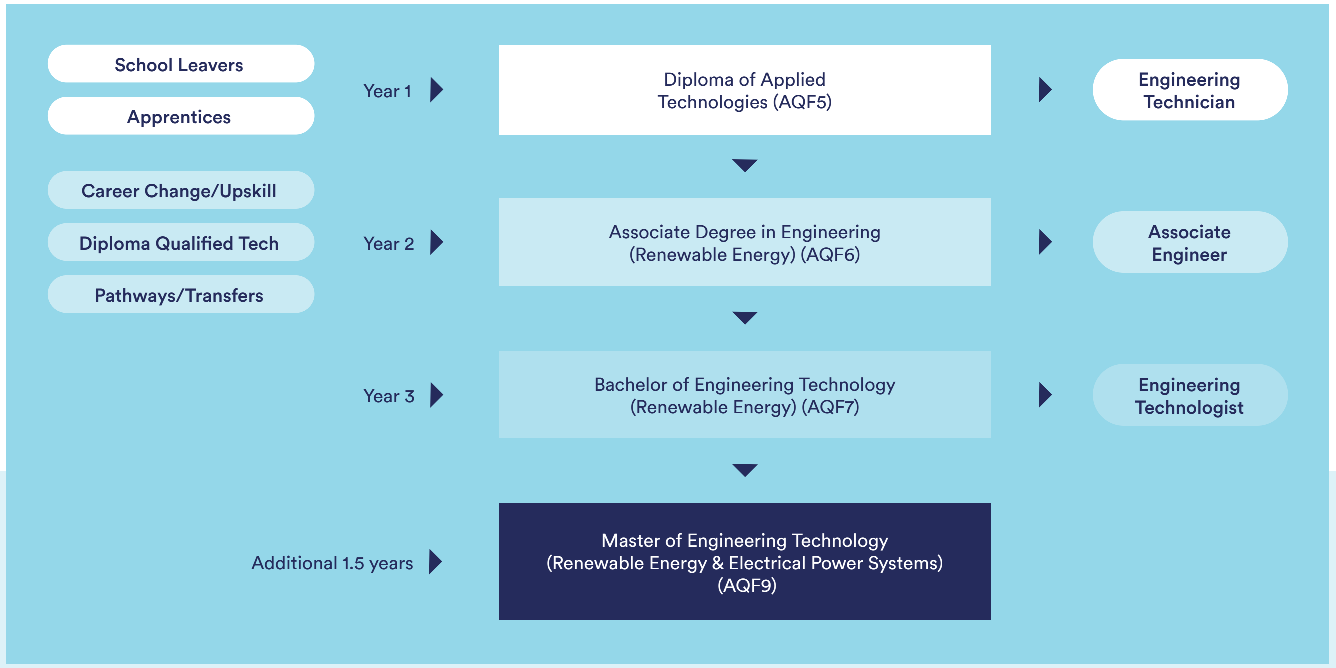


Figure 13. Proposed Bachelor of Engineering Practice (Renewable Energy)

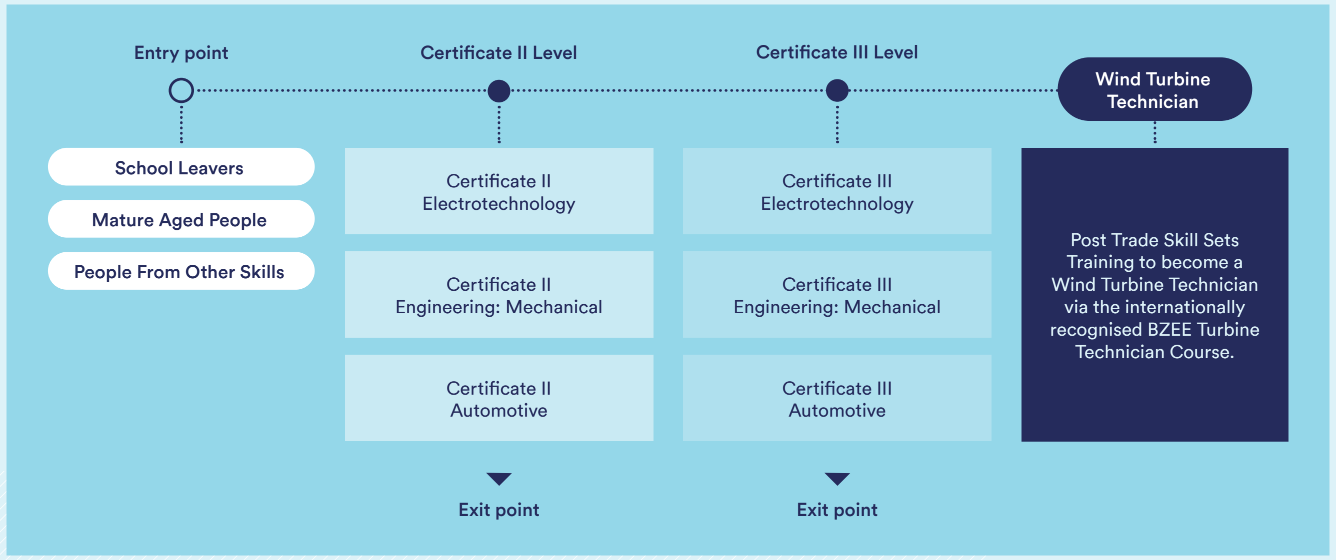


Figure 14. Wind turbine technician education program.

Micro—credentials may be the future of the renewable sector.

From an employer perspective, and as Steven Joyce's 2019 review of Australia's vocational education and training system highlighted, 'Employers often didn't need to train workers for full qualifications and preferred to train them for the parts of qualifications relevant at the time'. 'Short courses' is the term often used for this type of training. Recent major reviews in Australia have dedicated significant attention to the better use of micro-credentials as an effective method of upskilling existing workers.

4.2— Improving Coordination and Collaboration Among Stakeholders

There is a need for greater coordination and collaboration between various training providers and industries. Each offering from the post-secondary education sector, the VET sector, higher education providers and industry training providers has unique strengths and characteristics, suggesting that the system can be reformed to ensure they are complementary. Training providers should engage with a range of frontier employers, including start-ups and small and medium-sized enterprises with high growth potential, to align innovation in skills development with industry growth and renewal.

4.3— Making Industry More Attractive to Join

This research has shown that an inadequate number of people are taking up training opportunities or joining the energy industry. One barrier for people joining the industry is uncertainty linked to policy developments and the related market conditions. In addition, the boom–bust nature of current renewable developments makes it a less attractive field and may make the retraining of workers challenging.

Moreover, the project-based nature of many constructions and installation jobs has led to limited job security. Projections of workforce requirements in renewable energy industries suggest that demand for skilled workers will continue to increase highlighting the need to incorporate operational workforce planning into energy sector planning (Briggs et al. 2020).

Competition with other industries is another critical barrier for the renewable energy sector. Electricians, for example, are the most likely to be employed among all technicians and trade workers, with high demand for their services in construction, mining, electricity, gas, water, and waste service industries across Australia (no difference in Gippsland).

Career pipeline opportunities effectively introduce and market the clean energy economy to all prospective workers. More energy-related minor courses and non-degree programs for business and humanities students can be designed or offered to allow more people to become engaged in clean energy careers.

Fast-track certificate programs, short courses, or micro—credentials can also allow students, skilled tradespeople, and professionals from adjacent sectors to quickly learn the basics of energy science, technology, and adoption.

An initial task would be to identify the appropriate mechanisms to make the industry more attractive and to involve the key stakeholders.

4.4— Diverse Community Inclusiveness in Clean Energy Sector

A key to addressing skills shortages in the sector and unlocking additional gains is to make the industry more accessible and appealing to diverse groups. Women are significantly underrepresented in the energy industry, but opportunity abounds. People from other diverse backgrounds (e.g., people with a disability, indigenous people) are also underrepresented in the energy sector. There are some key reasons behind this under-representation. These include:

- Low familiarity with the sector; most females and people with disabilities don't consider it as a career option
- Poor engagement with STEM subjects; many females are not supported to engage in STEM, and their disconnect can begin in primary school
- The sector being regarded as challenging, male-dominated, and not as impactful or fulfilling as other STEM-related careers
- Little awareness about the impact of a career in the energy sector career, including clean energy
- The energy sector and engineering often being badged in school as 'science' or 'design and technology'.

This gap can be reduced by considering the interplay between key drivers (see Figure 15) and creating targeted interventions to remove barriers as recommended below:

- Foster familiarity with engineering and the clean energy profession through reforms to school curricula that currently lack the 'E' of STEM. For example, include science syllabus requirements, introductory modules, and research on what clean energy discipline involves.
- Raise awareness of clean energy as a viable career option for both men and women from different backgrounds.
- Improve support for females and people from other diverse backgrounds in STEM subjects in junior years.
- Create introductory pathway STEM courses for women, the unemployed, and people with disabilities, and improve support for them.
- Conduct an awareness campaign across society as a whole; ensure that teachers and parents don't actively discourage females from pursuing careers in engineering and clean energy.
- Establish regional scholarships with priority given to aboriginal people, women, and people with disabilities.

4.5— Victorian Senior Secondary School Pathway Reform

Senior secondary education and vocational and applied learning builds critical and creative thinking, communication skills, teamwork and collaboration, and innovation. It provides students with real-world knowledge, workplace awareness, and practical and transferable skills. Victoria's economy is rapidly changing, and the skills and capabilities we provide our students must meet the needs of our dynamic world. Thousands of new jobs relying on VET qualifications in community services, construction, and hospitality will drive our state's economic recovery. Based on John Firth's review into vocational and applied learning pathways in senior secondary schools, reform is proposed from 2023 to improve access to a broader range of high-quality VET courses for all students. The core offering contains 12 VET pathways, including 6 priority pathways and 6 flexible pathways.

The priority pathway programs are:

a) Health

b) Community service and early childhood

c) Building and construction

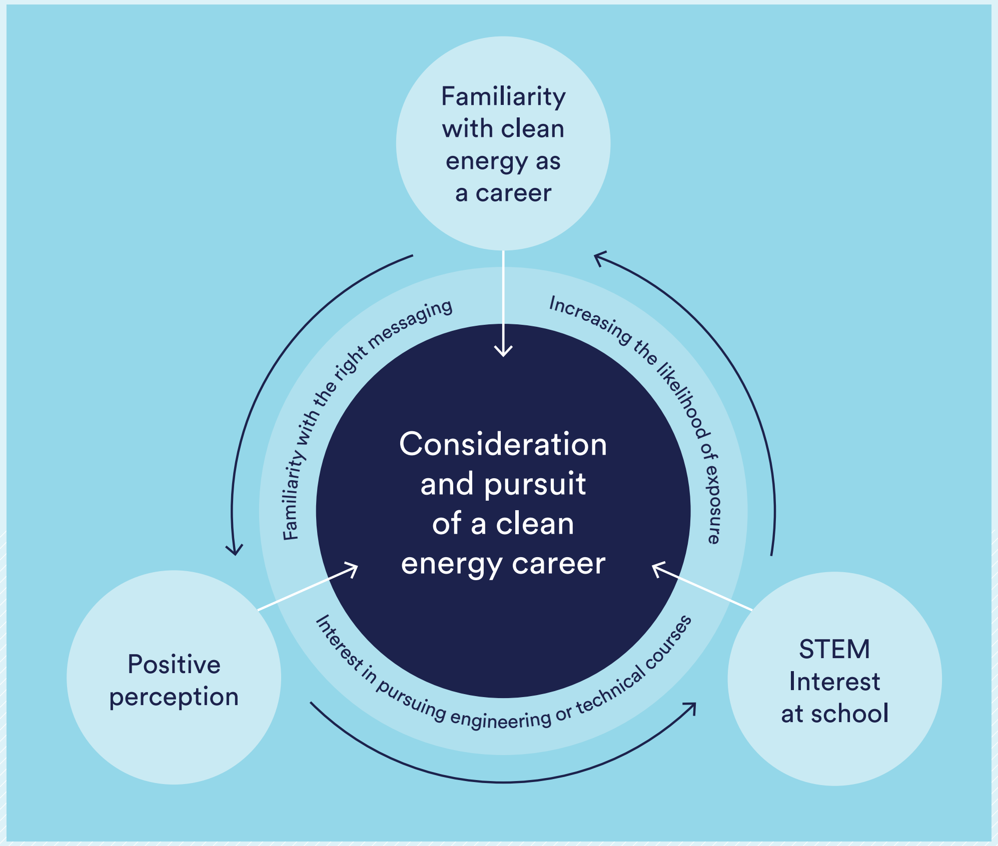
d) Digital media and technology

e) Civil infrastructure and laboratory skills – engineering

f) Hospitality

Considering the significant workforce required in the clean energy sector in the next 5–15 years, as demonstrated in Sections 2–3, clean energy-related VET programs should be included as a priority pathway in the senior secondary schooling reforms.

Figure 15. The interplay between key drivers



Summary & Appendices

Whilst there is a clear pathway for many skillsets in the future renewables based workforce, both training and retraining is essential for the future success of the region.

The possibility of almost 10,000 jobs in the development pipeline means the Gippsland renewable energy sector needs a diverse range of personnel, from school leavers to current trades, and underrepresented people from different backgrounds and walks of life.

Key Summary

- There is overlap between the fossil fuel and renewable energy sectors in many broad occupations (e.g., technicians, construction and project managers, engineers, electricians).
- New and emerging skills and occupations are required in the renewable energy sector – such as data analytics, IoT engineers, and smart grid specialists – which are not required in the fossil fuel sector.
- Further development of training requirements in the battery and hydrogen sectors is required to ensure development of workforce skills are available to meet emerging industry jobs.
- Over 8000 development and construction jobs and 1500 ongoing operations jobs could be created in the Gippsland energy sector based on current projects in the development pipeline.
- There will be a high number of O&M jobs in offshore and onshore wind farms and other renewable energy projects. Blade technicians are already in high demand and hard to recruit in Gippsland, along with construction workers and retail trade workers.
- The most commonly advertised jobs in the energy and manufacturing sectors in the Gippsland region ask for certificate IV qualifications (30 per cent), followed by jobs asking for a bachelor's degree and higher qualifications (25 per cent).
- There are vocational and higher education qualifications covering the renewable energy domain. However, it is difficult to attract enough people to complete the training.
- Women and people from diverse backgrounds are significantly underrepresented in the energy industry.
- Fast-track certificate programs, short courses, or micro credentials would be suitable for students, skilled tradespeople, and professionals from adjacent sectors to upskill the basics of energy, science, technology, and adoption.

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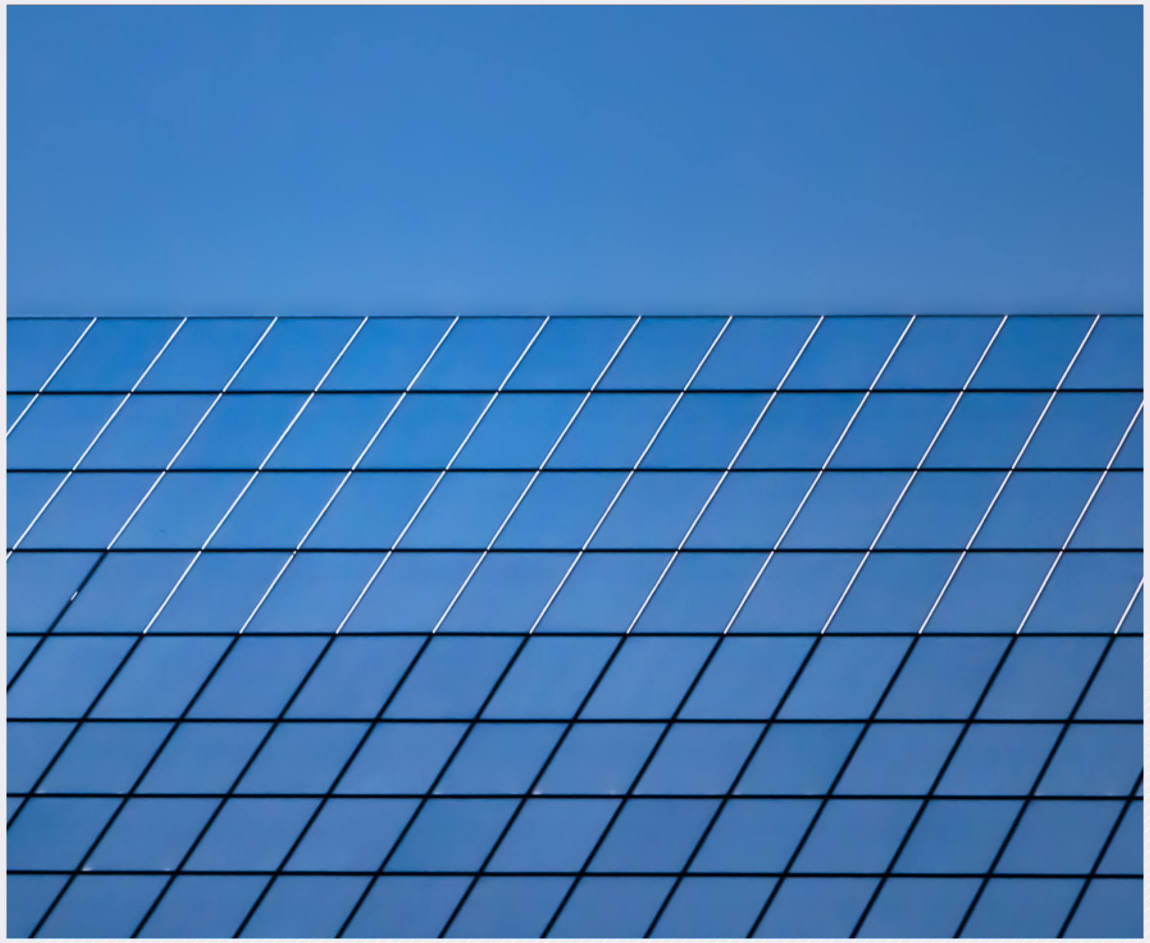
Appendix A: Survey Questions

The survey focused on operational/ongoing roles in the region.

Survey Questions:

1. What is the project and main technology?
2. Will you own and operate the facility (for generation facilities), or do you expect to appoint an O&M contractor?
3. How many O&M or long-term/ongoing roles do you anticipate?
4. What jobs/roles/skillsets do you anticipate being required?
5. What is the split between general labour, skilled trade, professional (tertiary qualified), and corporate/administrative positions? (in %)
6. To what extent do you anticipate OEM-specific training vs general training to be required? What roles will be OEM-specific?
7. What partnerships/relationships have you already initiated to cater to your local workforce training/skills requirements?
8. Do you have, or are you likely to have specific long-term employment commitments (e.g. apprenticeships, traineeships, cadetships)?



Appendix B: Program Structure – Bachelor of Engineering Practice in Renewable Energy (Example)

The new courses proposed at Federation University will be heavily skills-based, drawing upon the expertise of TAFE partners in vocational education teaching and training. Thus, on-campus skills development and assessment will be central to the successful delivery of the degree program. Students enrolled in flexible mode will be required to attend the campus in blocks, alongside on-campus students, to complete the skills training and assessment.

It is proposed that the new degree will initially be offered at both Mt Helen and Gippsland campuses. Both campuses are located within the energy hub of Victoria and have existing relationships with local industries. This decision also considers the available space at the Mt Helen and Gippsland campuses to house the required laboratory facilities for the program.

Year 1: Engineering Foundation and Diploma (AQF 5)

Year 1 of the program is comprised of two semesters in which students will undertake a mix of purely HE courses and HE courses with integrated TAFE units. The topics covered will primarily include introductory concepts relating to the electrical and renewable energy engineering discipline. The proposed structure of the first part of the program is shown in Figure B1.

The tentative courses in the first year are shown in Table B1. The program will introduce seven new HE courses (NC1, NC2, NC3, NC4, NC5, NC6, and NC7). Six of these will comprise a combination of TAFE units that cover skills development and training in the renewable energy engineering field (NC1, NC2, NC3, NC4, NC5, and NC6). The delivery of the course and assessment of the TAFE component will be performed by TAFE staff. The seventh course (NC7) will integrate content from both TAFE and HE to provide students with the foundation of HE mathematics necessary to undertake an engineering degree.

Year 2: Associate Degree (AQF 6)

In the second year of the program, students will build on their first-year introductory knowledge and hands-on skills to develop intermediate knowledge and skills in different areas of renewable energy engineering. The proposed structure is presented in Figure B2. The structure includes six existing HE courses covering topics on mathematics (MATHS2016 and MATHS3001), electronic systems (ENGIN2105), electrical machines (ENGIN2404), and principles of renewable energy sources (ENGIN2103) that cover mainly wind and solar energy. One elective course will be taken from the Bachelor of Engineering Practice in Advanced Manufacturing and Automation Engineering. Furthermore, a new course on hydrogen and new energy technologies needs to be developed for this program to focus on the growing hydrogen industry for clean, flexible, storable, and safe fuels. After successful completion of Year 2, a student can exit the program with an Associate Degree in Manufacturing and Automation Engineering at AQF level 6 from Federation University.

Table B1. Proposed tentative mapping of the HE courses with the Bachelor of Engineering Practice in Renewable Energy program with TAFE units, mostly from Diploma of Applied Technology (22460VIC)

HE Courses	TAFE Units
Introduction to Renewable Energy Engineering (NC1)	Write specifications for renewable energy engineering projects Carry out basic repairs to renewable energy apparatus Develop strategies to address environmental and sustainability issues in the energy sector
Introduction to Electrical and Circuit Systems (NC2)	MEM30025A Analyse a simple electrical system circuit MEM23111A Select electrical equipment and components for engineering applications MEM30007A Select common engineering materials
Introduction to Electrical Management (NC3)	MEM234028A Produce and manage technical documentation BSBPMG417 Apply project life cycle management processes Apply principles of occupational health and safety in the work environment
Introduction to ICT in Energy Systems (NC4)	VU22311 Commission a cyber–physical system VU22317 Analyse and manage big data in cloud-based systems
Introduction to Electronics and Digital Control (NC5)	VU22314 Troubleshoot digital control systems VU22313 Implement and problem solve a program logic controller (PLC)-based industrial control system VU22315 Use SCADA system to monitor and control an industrial process
Introduction to Electrical Maintenance (NC6)	ICTTEN202 Use hand and power tools VU21106 Plan, implement, and apply preventative maintenance procedures VU22310 Work in Industry 4.0
Foundation to Technical Mathematics (NC7)	MEM12024A Perform computations MEM23004A Apply technical mathematics

Figure B1. Proposed structure of Year 1 of the new Bachelor of Engineering Practice (Renewable Energy) program, demonstrating the integration of TAFE units into the degree program

22460VIC Diploma of Applied Technologies (AQF 5)

Year 1 Semester 1	Introduction to Renewable Energy Engineering (NC1)	Introduction to Electrical and Circuit Systems (NC2)	Introduction to Electrical Management (NC3)	ENGIN1001 Professional Engineering Practice
Year 1 Semester 2	Introduction to ICT in Energy Systems (NC4)	Introduction to Electronics and Digital Control (NC5)	Introduction to Electrical Maintenance (NC6)	Foundation to Technical Mathematics (NC7)

Integrated TAFE Units · Existing Higher Education Course · New Higher Education Course with Integrated TAFE Units

Figure B2. Proposed second-year structure of the new Bachelor of Engineering Practice (Renewable Energy) program

Associate Degree in Engineering (Renewable Energy) (AQF 6)

Year 2 Semester 1	MATHS2016 Modelling Continuous Change	ENGIN2105 Digital Logic and Electronic Systems	ENGIN3101 Power Electronics	Hydrogen and New Energy Technologies
Year 2 Semester 2	MATHS3001 Modelling and Change (Advanced)	Elective from B. Tech in Manufacturing and Automation	ENGIN2404 Electromechanical Energy Conversion	ENGIN2103 Principles of Renewable Energy Sources

Redesigned Existing/New Higher Education Course · Existing Higher Education Course

Figure B3. Proposed third-year structure of the new Bachelor of Engineering Practice (Renewable Energy) program

Bachelor of Engineering Technology (Renewable Energy) (AQF 7)

Year 3 Semester 1	ENGIN3404 System Dynamics and Control	ENGIN3102 Power System Analysis	ENGIN5102 Microgrid and Energy Storage	ENGIN4101 Electrical Power Distribution
Year 3 Semester 2	ENGIN4102 Power Electronics Application to Renewable Energy	ENGIN5101 IoT in Smart Energy System	Elective from B. Tech in Advanced Manufacturing and Automation	Design Project

Redesigned Existing/New Higher Education Course · Existing Higher Education Course

Year 3: Bachelor of Engineering Practice (AQF 7)

In the final year of the program, students will build on their second-year intermediate knowledge and skills to develop advanced knowledge and skills in different areas of renewable energy engineering. The proposed structure is presented in Figure B3.

The structure includes six existing HE courses covering control engineering, power electronics, power distribution system, microgrids, storage, IoT application in smart energy systems, and basic power system analysis. Two elective courses will be considered from the Bachelor of Engineering Practice in Advanced Manufacturing and Automation Engineering.

There will be one project design course based on the relevant topic of renewable energy. Existing HE courses in design need to be modified. Following successful completion of Year 3, students will receive a Bachelor of Engineering Practice (Renewable Energy) at AQF level 7 from Federation University.

The proposed Bachelor of Engineering Practice (Renewable Energy) program will embed cross-cutting skills using Model 1, as shown in Figure B4.

Figure B4. Embedded cross-cutting skills withing the proposed Bachelor of Engineering Practice (Renewable Energy) program.

Appendix C: Program Structure – Associate Degree in Design and Construction Management (Example)

Figure C1 represents the proposed qualification development and pathways for the Associate Degree in Design Drafting and Construction Management program.

The proposed program is designed to include 2 different entry points and 2 different exit points. Students can enter the program at the beginning of Year 1 and Year 2, subject to meeting entry requirements. Each of these entry points are aimed to target different cohorts, as shown in Figure 1. Students will be able to exit with a Diploma of Building and Construction (Building) from Federation TAFE at the end of Year 1 or finish this program and graduate with an Associate Degree in Design Drafting and Construction Management from Federation University after the successful completion of two years of the program (Figure C1).

On completion of the proposed Associate Degree in Design Drafting and Construction Management, students will have the opportunity to work as an Associate Engineer or continue their studies at Federation University's Bachelor of Engineering (Civil) – Honours with three semesters credit and eventually graduate and work as a professional engineer.

Each academic year of the program is described separately below and illustrated in Figures C2 and C3. Note: The course names, content, and TAFE-HE mappings are tentative and may change as the institute engages our TAFE partners in deeper discussion on the design and delivery of the program.

Year 1: Engineering Foundation and Diploma (AQF 5)

Year 1 of the program is comprised of 2 semesters in which students will undertake a mixture of purely HE courses and HE courses with integrated TAFE units from the Diploma of Building and Construction (Building). The topics covered will primarily be the introductory concepts of construction design and management. The proposed structure of the first year of the program is shown in Figure C2.

After successful completion of Year 1, a student may exit the program with a Diploma of Building and Construction (Building) (CPC50220) at AQF level 5 from Federation TAFE. To facilitate this, students will be jointly enrolled in the Diploma of Building and Construction (Building) (CPC50220) and will be awarded a result in the TAFE qualification at the same time as being awarded a result in the HE courses. The units of competencies in the TAFE Diploma will be packaged into HE courses. The TAFE courses are equivalent to six HE courses (approximately 900 hours with 150 hours for each HE courses). There will also be two existing HE courses included in the first year. The draft mapping of the integrated TAFE and HE courses is presented in Table C1. The total hours of each integrated HE-TAFE course will be confirmed in future conversations with TAFE partners.

Year 2: Associate Degree (AQF 6)

In the second and final year of the program, students will build on their first-year introductory knowledge and hands-on skills to develop intermediate knowledge and skills in different areas of construction, management, and building technology. The proposed structure is presented in Figure C3. The structure includes four existing HE courses and covers topics on concrete technology and civil construction, engineering surveying, engineering mechanics, project management, and sustainability design. One HE course (infrastructure management) that used to be part of the Bachelor of Civil Engineering program until 2018 will be re-designed and offered in the second year of the Associate Degree program (RC1). This course covers important aspects of infrastructure management that are highly suited to the proposed Associate Degree.

Two new courses are proposed to be developed in the HE context: Digital and Automated Construction (NCHE1) and Building Information Management (NCHE2). It is also proposed that the new laboratory facilities of the Bachelor of Engineering Technology (Advanced Manufacturing and Automation Engineering) be used as part of the new Digital and Automated Construction course. These two additional courses can also be added to the current Bachelor of Engineering (Civil) (Honours) program as specialisation electives. The Foundation to Technical Mathematics course is not part of the Diploma of Building & Construction but will be partly delivered by TAFE.

The program will introduce a total of seven new HE courses integrated with TAFE units (NC1, NC2, NC3, NC4, NC5, NC6, and NC7). Six of these will comprise a combination of TAFE units that cover the skills development and training required in the building and construction field (NC1, NC2, NC3, NC4, NC5, and NC6).

Table C1. Proposed tentative mapping of the HE courses with Associate Degree in Design Drafting and Construction Management program with TAFE Units in Diploma of Building and Construction (Building) (CPC50220)

HE Courses	TAFE Units
Introduction to building plans and principles (NC1)	CPCCBC4012 Read and interpret plans CPCCBC4014 Prepare simple building sketches and drawings CPCCBC4010 Apply structural principles to residential and commercial buildings CPCCBC5018 Apply structural principles to the construction of buildings up to 3 stories
Introduction to legal requirements and contracts (NC2)	CPCCBC4009 Apply legal requirements to building and construction projects CPCCBC5007 Administer the legal obligations of a building and construction contractor CPCCBC5013 Manage professional technical and legal reports on building and construction projects CPCCBC4003 Prepare and administer a construction contract
Building codes and standards in construction (NC3)	CPCCBC4008 Supervise site communication and administration processes for building and construction projects CPCCBC4001 Apply building codes and standards to the construction process for class 1 and 10 buildings CPCCBC5001 Apply building codes and standards to the construction process for type B buildings CPCCBC4053 Apply building codes and standards to the construction process for class 2 to 9 buildings
Introduction to construction project management (NC4)	BSBWHS513 Lead WHS risk management BSBOPS504 Manage risk CPCCBC5011 Manage environmental management practices and processes in building and construction projects CPCCBC5010 Manage construction work
Tender documentation, costs, and finances (NC5)	CPCCBC5019 Manage building and construction business finances CPCCBC4004 Identify and produce estimated costs for building and construction processes CPCCBC4013 Prepare and evaluate tender documentation CPCCBC5002 Monitor costing systems on complex building and construction projects
Management of building construction projects (NC6)	CPCCBC4005 Produce labour and materials schedules for ordering CPCCBC4018 Apply site surveys and set-out procedures to building and construction projects CPCCBC5003 Supervise the planning of onsite building and construction work CPCCBC5005 Supervise and manage building and construction contractors
Foundation to Technical Mathematics (NC7)	MEM12024A Perform computations MEM23004A Apply technical mathematics

Figure C1. Proposed qualification development and pathway for the new Associate Degree in Design Drafting and Construction Management program

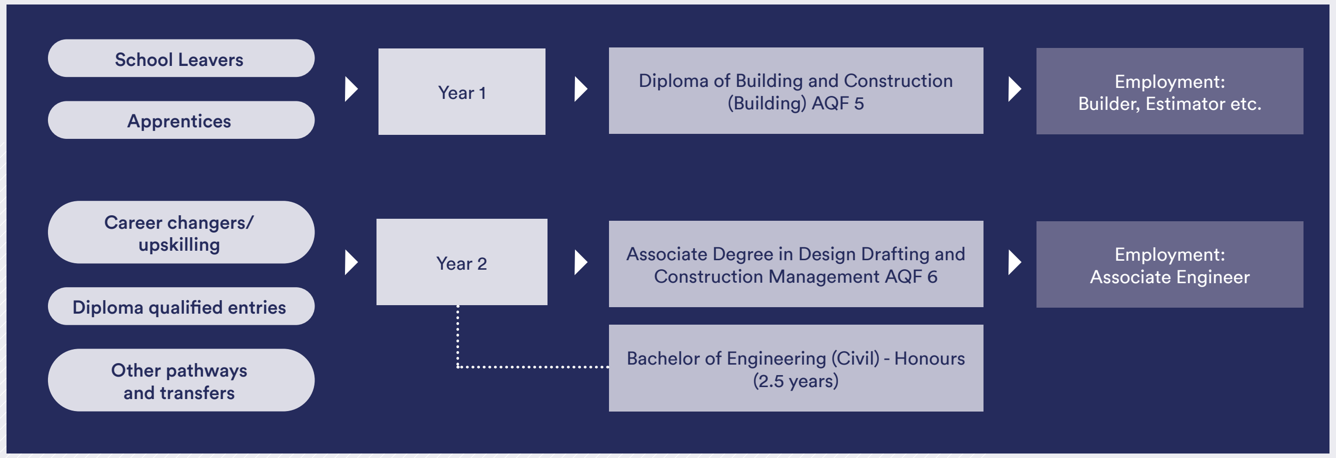


Figure C2. Proposed structure of Year 1 of the new Associate Degree in Design Drafting and Construction Management program, demonstrating integration of TAFE Diploma of Building and Construction (Building) (CPC50220) into the degree program

CPC50220 — Diploma of Building and Construction (Building)

Year 1 Semester 1	Introduction to building plans and principles (NC1)	Introduction to legal requirements and contracts (NC2)	Building codes ad standards in construction (NC3)	ENGIN1003 Materials in Engineering
Year 1 Semester 2	Introduction to construction project management (NC4)	Tender documentation, costs and finances (NC5)	Management of building construction projects (NC6)	ENGIN1004 Engineering Design and Drafting

Integrated TAFE Units | Existing Higher Education Course

Figure C3. Proposed structure of Year 2 of the new Associate Degree in Design Drafting and Construction Management program

Associate Degree in Design Drafting and Construction Management (AQF 6)

Year 2 Semester 1	Digital and Automated Construction (NCHE1)	ENGIN2202 Concrete Technology & Civil Construction	ENGIN3204 Engineering Surveying	Building Information Management (NCHE2)
Year 2 Semester 2	ENGIN1005 Engineering Mechanics	ENGIN3207 Infrastructure Management (RC1)	ENGIN2002 Engineering Project Management and Sustainability Design	Foundation to Technical Mathematics (NC7)

Redesigned Existing Higher Education Course | Existing Higher Education Course | New Higher Education Course with Integrated TAFE Units | Newly Developed Higher Education Course

Appendix D: Wind Turbine Technician Vocational Pathway

A modern wind turbine manufactured in the 2020's is typically made up of a number of key components (see Figure D1) including mechanical, electrical, hydraulic and meteorological systems. With the number of independent and dependant systems intersecting with both the electrical and mechanical trades no single apprenticeship exist to serve the needs of the industry. Rather the industry has historically employed electricians, mechanical fitters or automotive technicians and assumed the responsibility to train employees internally to undertake the role as wind turbine technician.

With the industry reluctant to employ an apprentice given the nature of the interdependent mechanical, electrical and hydraulic systems and the lack of formal vocational pathway existing, Federation University has undertaken to deliver post trade training utilizing the globally recognised BZEE Wind Turbine Technician Training Course, under exclusive license (https://www.bzee-network.com).

Integral to working as a wind turbine technician is the employees capacity to work at heights, in confined spaces, with a buddy at all times, being cognisant of the need for safe working procedures, use of fire extinguishers and first aide at high level. All these skills are gained through globally recognised Global Wind Organisation Training (https://www.globalwindsafety.org/trainingstandards/trainingstandards) a mandatory requirement prior to commencing employment or undertaking any work on a wind turbine.

The pathway to becoming a Wind Turbine Technician under development by Federation University can be seen in the Figure D2.

It should be noted that there is a current Certificate IV of Large Scale Wind Generation – Electrical (UEP40622), however this qualification and its predecessor have not been delivered since the industry doesn't recognise the qualification as the pathway to becoming a wind turbine technician due to it's limited scope of delivery being electrically focused.

The BZEE qualification delivered as a skill set over 6 months inclusive of a single month of internship on a working wind farm, will cover electrical, hydraulic, mechanical, operational, health and safety and wind energy technology skills. The qualification will be developed by Federation University in 2022/23 following the completion of teacher training in the USA in the 3rd and 4th quarters of 2022. Table 1. Below lists the skills sets from the BZEE qualification that have been mapped to Australian Units of Competency, which will be delivered as skill sets for the duration of the BZEE Wind Turbine Technician Training.

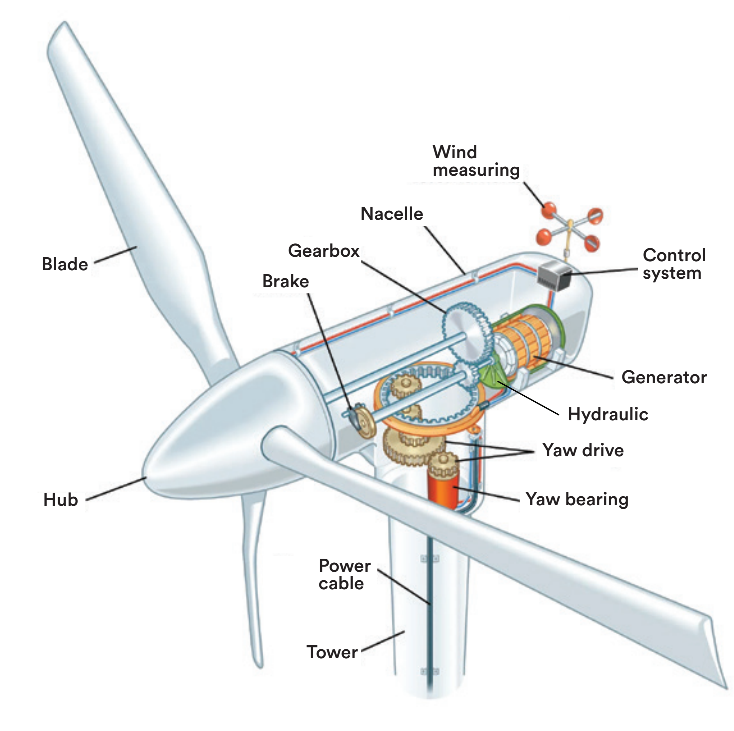


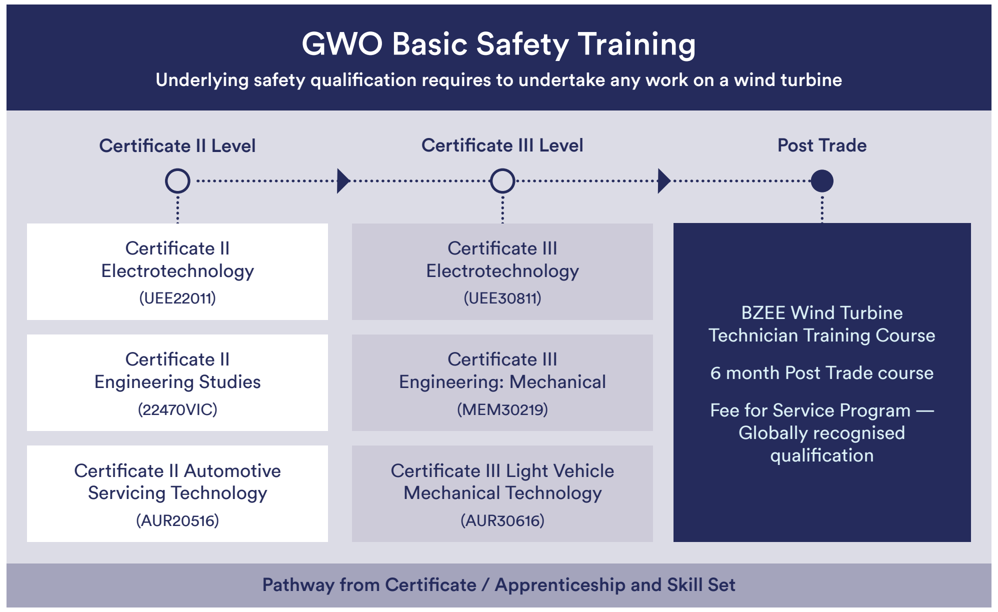
Figure D1. Inside of a wind turbine

Appendix D: Wind Turbine Technician Vocational Pathway (Cont.)

Table D1. BZEE Wind Turbine Technician Training Skills Sets

Code	Module	Duration (Hrs)
HSE	Health & Safety	
BZEE-HSE-01	Health and Safety regulations	4
BZEE-HSE-02	Emergency first aid for working at height	16
BZEE-HSE-05	Working at heights and rescue training, basics	16
BZEE-HSE-15	Lifting and attachment of loads	16
BZEE-HSE-16	Fire awareness and fire-fighting, basic training	4
BZEE-HSE-17	Fire awareness and fire-fighting on wind turbines	4
BZEE-HSE-18	Handling of hazardous materials	8
BZEE-HSE-25	CSE – Confined Space Entry	24
	Total	92
ELT	WT Electrics	
BZEE-ELT-01	Principles of electrical engineering	40
BZEE-ELT-08	Cable finishing	8
BZEE-ELT-09	Generators and electric motors	24
BZEE-ELT-10	Transformers	8
BZEE-ELT-11	Inverter maintenance and trouble- shooting	4
BZEE-ELT-12	Electrical measurement techniques	8
BZEE-ELT-13	Sensor installations in wind turbines	24
BZEE-ELT-14	Wind turbine electronics	40
BZEE-ELT-15	Wind farm networks, data transmission, optical fiber technology	16
BZEE-ELT-16	Lightning protection maintenance	8
	Total	180
MEC		
BZEE-MEC-01	Materials engineering	16
BZEE-MEC-02	Mechanical systems and components - basics	40
BZEE-MEC-03	Inspection of bearings, shafts, gears	16
BZEE-MEC-04	Brake systems maintenance	4
BZEE-MEC-05	Lubricants functions and deployment	8
BZEE-MEC-06	Power drive sockets (hydraulic, electric, mechanical)	8
BZEE-MEC-07	Function and maintenance of yaw systems	8
BZEE-MEC-08	Coating systems and corrosion protection	8
	Total	108

Table D1. BZEE Wind Turbine Technician Training Skills Sets



Appendix E: Wind Turbine Blade Repair Technician Vocational Pathway

Context

The repair and maintenance of wind turbine blades is a distinct skill requiring the technician to be able to work with composite materials, whilst potentially either working in a confined space or supported via a rope from the hub of a Nacelle. The blades are extremely large, measuring up to 100 metres in length (See Figure E1).

Currently the repair of blades is undertaken by skilled professionals who have either come from a background in working with composites or alternatively come from the factories making the blades. Largely the workforce employed in Australia currently is made up of a mix of locally skilled professionals or imported workers from overseas. Increasingly since the pandemic access to skilled overseas workers has been significantly constrained.

No current vocational pathways exist for a wind turbine blade repair technician other than the skill sets training offered via the Global Wind Organisation which is a two week training course delivered by a few private registered training organisations. Federation University however is in the process of developing the first Australian apprenticeship for wind turbine blade technicians based on the Certificate III Engineering – Composites (MEM31119).

Federation University has received industry and state government funding to establish the new apprenticeship and anticipates delivery to commence in the 4th quarter of 2022, following the completion of refurbishments to an existing building at their Mt Helen Campus.

The apprenticeship will be contextualised to the role of a wind turbine blade technician role but will have applicability across the automotive and marine industries at a very minimum. The units being developed and the delivery plan can be seen in Table E1.

Integral to working as a wind turbine blade technician is the employees capacity to work at heights, in confined spaces, with a buddy at all times, being cognisant of the need for safe working procedure, use of fire extinguishers and first aide at high level. All these skills are gained through globally recognised Global Wind Organisation Training (https://www.globalwindsafety.org/trainingstandards/trainingstandards) a mandatory requirement prior to commencing employment or undertaking any work on a wind turbine.

Figure E1. Wind turbine blade being manufactured

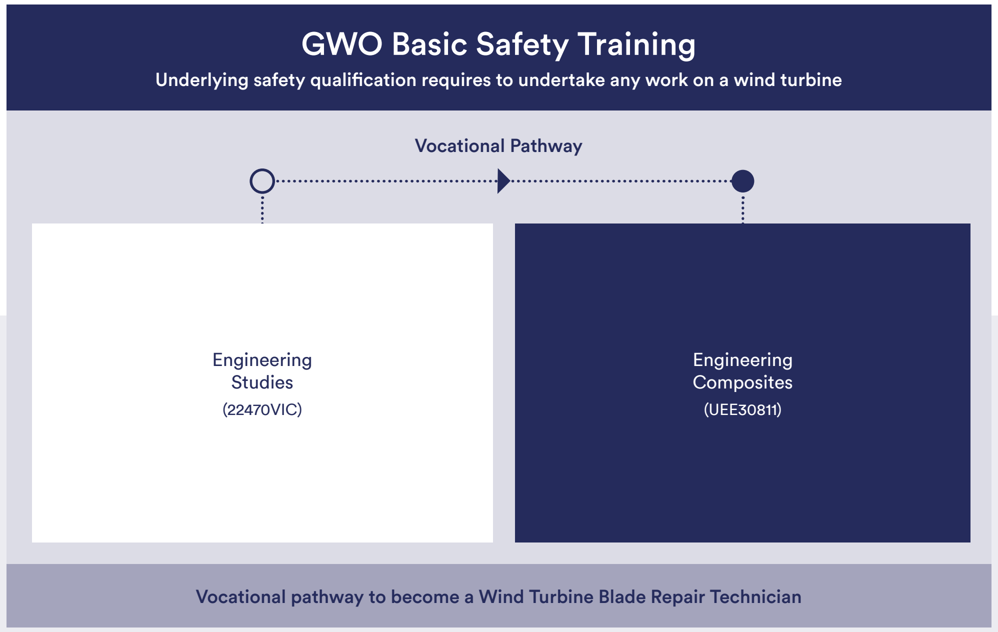
Federation TAFE | APRETEC |
Cert III in Composites for wind.

Table E1. Certificate III Engineering – Composites (MEM31119)

Turbine blade repair technician apprenticeship		Delivery Sequence	Unit Code	Unit Title	Points
1st Year on the Job as a blade repair apprentice.	Cluster 1: Induction Orientation and Inspection.	1	MEM13015	Work safely and effectively in manufacturing and engineering	2
		2	MEM16006	Organise and communicate information	2
		3	MEM16008	Interact with computing technology	2
		4	MEM11011	Undertake manual handling	2
		5	MEM15004	Perform inspection	2
		6	MEM18001	Use hand tools	2
		7	MEM18002	Use power tools/hand held operations	2
	Cluster 2: Blade fundamentals and basic techniques used in industry.	8	MEM13003	Work safely with industrial chemicals and materials	2
		9	MEM26010	Store and handle composite materials	2
		10	MEM26020	Identify and interpret required standards for composites	2
		11	MEM26017	Prepare composite or other substrate surfaces	4
		12	MEM26006	Mark and cut out sheets for composite use	4
		13	MEM26001	Layup composites using open moulding techniques	6
		14	MEM26019	Finish a composite product	4
2nd Year on the Job as a blade repair apprentice.	Cluster 3: Blade repair intermediate	15	MEM13002	Undertake work health and safety activities in the workplace	3
		16	MEM09002	Interpret technical drawing	4
		17	MEM12023	Perform engineering measurements	5
		18	MEM12024	Perform computations	3
		19	MEM26002	Layup composites using vacuum closed moulding techniques	6
		20	MEM26007	Select and use reinforcing appropriate for product	4
		21	MEM26008	Select and use resin systems appropriate for product	4
		22	MEM26009	Select and use cores and fillers appropriate for product	2
3rd Year on the Job as a blade repair apprentice.	Cluster 4: Blade repair advanced	23	MEM14006	Plan work activities	4
		24	MEM26015	Select and apply repair techniques	6
		25	MEM26011	Determine materials and techniques for a composite component or product	6
		26	MEM26013	Select and use composite processes or systems appro-priate for product	4
		27	MEM26016	Select and use joining techniques	6
	Cluster 5: Composite manufacturing, Mentorship and Environmental stewardship	28	MSMENV272	Participate in environmentally sustainable work practices	3
		29	MEM26003	Layup composites using pressure closed moulding techniques	6
		30	MEM17003	Assist in the provision of on-the-job training	2

The vocational pathway for a person to become a wind turbine blade technician can be seen in Figure E2 below.

Figure E2. The vocational pathway to become a wind turbine blade technician

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LATROBE VALLEY AUTHORITY

VICTORIA State Government

Federation University Australia

GIPPSLAND RENEWABLE ENERGY TRAINING CENTRE

BUSINESS CASE

OCTOBER 2022

PREPARED BY: FEDERATION UNIVERSITY

Executive Summary

This business case details the investment and delivery case for the establishment of the Gippsland Renewable Energy Training Centre (GRETC), based at the Morwell Innovation Centre (MIC).

The establishment of GRETC does not require the construction of a new facility. GRTEC will leverage existing infrastructure at the MIC and Ballarat campus of Federation University. GRETC is being established in response to the forecast demand for skilled workforce needed to support growth of the renewable energy industry in Gippsland as well supporting the transition of exiting workforce in the energy and mining sectors.

GRTEC builds on existing capabilities of Federation University in the area of electrical and renewable energy engineering as well as working cooperatively and collaboratively with industry in areas such as course design, content, work placements and development of industry accreditations.

Proposed courses being offered through GRETC have multiple entry and exit points, recognise prior learning and are integrated with TAFE training pathways. The GRTEC solution has been tailored to meet the specific needs of Gippsland and the renewable energy industry.

GRTEC will address several major problems that require strategic intervention

Over the next decade it is estimated that around 8,200 Construction and 1,600 ongoing FTE positions will be needed to support industry development in Gippsland. Of these between 3,520 – 4,475 FTE positions are needed to support the development of the offshore wind industry.

A high proportion of these positions require higher education qualifications. With a percentage of the population with higher education qualifications amongst the lowest in Victoria, there is a need to increase the quality of the region's human capital in Gippsland to meet the demand arising from the growth in the renewable energy sector.

In addition, there are around 5,500 of the region's existing workforce working in mining and utilities sectors. These sectors will be the most dramatically impacted with the closure of the region's power stations over the next decade. There is therefore an identified need to provide a range of reskilling opportunities for this workforce, as well as other sections of the economy which will also be affected by the closures.

The demand for skills deployable in renewable energy, and more specifically in offshore wind are also in high demand from proposed decommissioning of the oil and gas infrastructure in Bass Strait. Offshore gas production has reduced by over 60% since 2017. With limited drilling for new reserves underway, it anticipated that this work, together with mine rehabilitation activities will create additional demand and competitive pressures over and above that being created from the renewable energy sector.

In response to these pressures, the establishment of the GRETC will provide a pipeline of graduates to the market and continue the proud tradition of energy generation in Gippsland. Able to commence in 2024, GRETC will provide a unique combination of skills and experience to the Gippsland renewable energy market. This pipeline of skills will not be developed without intervention of the type proposed in this business case.

Current supply of renewable energy engineering and construction graduates is limited. Nationally, seven institutes offer courses accredited by Engineers Australia, with only RMIT and Monash offering specific renewable energy courses in Victoria. Both courses are heavily weighted towards 'softer skills' with a high theoretical and technical content. They do not meet many of the needs of the renewable energy sector, which is placing a premium on practical, work ready, industry qualified graduates.

The intent with GRETC will be to produce graduates that have the necessary theoretical and technical underpinnings together with work ready skills and the necessary industry accreditation and qualifications through a balance of traditional in place learning methods and direct industry engagement. This provides additional certainty to employers as to graduate quality and suitability.

GRTEC will deliver significant benefits to Gippsland, Federation and to Victoria

GRTEC will deliver significant benefits to the Gippsland region. The courses will be accessible to students and the existing workforce, overcoming through its design and integrated pathways, what are currently major barriers to graduate production in the region. To meet workforce skills demands, industry will need to source new entrants from Gippsland. With studies indicating 70% of regional students who study regionally stay and live in the regions, compared to the national average of 20% the establishment of GTRETC will support youth retention in the region, as well as improving the region's human capital.

Higher retention rates of qualified youth and a higher level of educational attainment among the population has flow on social benefits as well as positive economic benefits that impact the local economy including labour productivity spillovers, increased tax receipts associated with productivity gains and wage premiums and will help to reverse the trend away from younger people leaving the future for meaningful work opportunities.

The lifetime public value of a university degree is estimated at $891,000 and the economic benefit to the graduate is a 37% lifetime earnings premium, valued at $674,000. In addition to the market benefits, there are non-market benefits including positive family and health outcomes which are associated with higher levels of education.

The program offers an opportunity for Federation to build a competitive advantage in renewable energy engineering, increasing total enrolled students to around 300 in this stage. The program can continue to rebuild student numbers which were significantly impacted by the pandemic. EFSTL numbers dropped by 37% from 2019 to 2022. The program utilises existing building infrastructures delivering efficiency benefits.

The benefits GRTEC will deliver are important to government, supporting the renewable energy strategy, renewable energy action plan, renewable energy target and creating local investment and jobs for a region in transition.

Proposed solution

The proposed solution is an investment of $3m to establish GRTEC. The centre will be located at the MIC and leverages existing assets at the Gippsland High Tech Precinct, where key stakeholders including industry, Gippsland TAFE and Morwell Tech School are also located. These have been identified as important industry partners providing pathways into higher education and improved linkages to industry.

The key features of the program that provide the competitive differentiation for the course include

- Multiple entry and exit points
- Strong integration with TAFE and TAFE pathways
- Links to the Tech School
- Build on Federation's strengths in engineering, renewable energy, renewable energy and sustainability
- Recognition of prior learning (specifically for existing workforce)
- Workplace integrated learning / physical placements
- Providing access to industry qualification so graduates are "work ready"
- Industry partnership approach to co-design/create the course to ensure the course meets employer needs
- Providing industry opportunities for co-delivery aspects of the program
- Flexible delivery models (virtual, connected classrooms, block mode)
- Integration of digital skills across all programs
- Integrate critical work skills across the program platform (interpersonal, innovation, digital literacy, problem solving, leadership)
- Quality academics, with national and international credibility
- Use of 3rd party providers to deliver aspects of the course, likely industry training components

Federation already has extensive renewable energy and sustainability capabilities through existing academic and research centres including Centre for New Energy Transition Research, C4NET, Australia Pacific Renewable Energy Training Centre and the Future Regions Research Centre. It is proposed this course will integrate with and draw from these existing capabilities and be housed in the Institute of Innovation, Science and Sustainability. The program aligns with Federation's strategy and campus vision statement.

The higher education plan is built around two stages. The courses in the first stage are Bachelor of Engineering (Renewable Energy) and a hybrid course, Bachelor of Engineering Technology (Renewable Energy) with the first year delivered by TAFE as a Diploma of Applied Technology. The third offering is an Associate Degree in Design Drafting and Construction Management program. These course offerings and program structure have been developed and are included in the business plan.

The second stage involves developing courses in the areas of mine rehabilitation, social planning and renewable engineering. These programs need to be further developed as priority as the centre seeks to expand.

All programs across stages one and two have been developed with attributes that respond to (1) industry needs and expectations and (2) local (regional) needs, including being able to meet the needs of current and future energy and mining workforces.

The stage one programs are largely developed, with around two thirds of course material and curriculum already in place. The materials are integrated with TAFE programs providing multiple exist and entry points and there is a major emphasis on industry partnerships. GRETC will be based in Gippsland but courses will be offered from Gippsland, Ballarat and on line, as well as including various study modes and work integrated (physical placements) learning.

Program implementation can begin in 2023 with marketing, awareness and industry partnership development key activities together with curriculum development. It is proposed student enrolments commence in 2024.

The initial student commencements are for 30 in year one (2024), building to over 100 commencements by 2029 and 150 by 2033. The Federation demand of 150 EFSTL commencements represents 1.8% of current national annual engineering enrolments. It is expected that at least half of the total students will complete their course at the Gippsland campus.

Financial analysis has been completed based on the $3m investment, which shows a positive BCR of 1.15, IRR of 15.8%, and NPV @7% of $3.7m over 15 years,

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PART 1 – INVESTMENT CASE

1. Background

Federation University is one of the few dual-sector education providers in Australia, delivering both university Higher Education (HE) and Vocational Education and Training (VET) courses.

Federation University Australia was established when the former University of Ballarat and the Gippsland campus of Monash University were amalgamated in 2014. However, the university has existed under various names since 1870, when it was founded as the Ballarat School of Mines.

Historically, the university has had around 15,000 students utilising its facilities across seven campuses in regional Victoria (with one in Brisbane).

Federation University's purpose and principles, set out in its Strategic Plan 2021-2025, are as follows:

As Australia's leading regional university:

Purpose
We transform lives and enhance communities.

Scope
We provide innovative and integrated lifelong learning, job skills and impactful research that enable people and communities to prosper locally, regionally and globally.

Enabling principles

- *Excellent* – We pursue continuous improvement and excellence in everything.
- *Relevant* – We regularly renew our activities to ensure their relevance.
- *Inclusive* – We champion access, diversity and inclusion for all, acknowledging our Aboriginal and Torres Strait Islander heritage, culture and knowledge.
- *Empowering* – We create an environment of opportunities, trust, fairness and respect, taking informed risks in pursuit of shared goals.
- *Innovative & Agile* – We innovate to transform. We are agile and responsible to emerging opportunities.

The Strategic Plan 2021-2025 sets out three strategic objectives:

- Strategic objective 1: Transform lives
- Strategic objective 2: Enhance communities
- Strategic objective 3: A strong and sustainable University

The plan outlines several strategic responses which are relevant to this business case:

Becoming the partner of choice for regional employers, and industry and government

Grow the economic and cultural opportunities of the regions and communities we serve

Create new ways of working together

The capabilities identified that support the strategic plan, and this project include:

- Effective stakeholder engagement
- Campus based employment precincts
- Rapid course development and renewal
- Client driven model for industry partnerships
- Shared infrastructure, assets and services

Federation University's Campus Vision 2021-2025 is a plan to create a university for the future. It presents the case for significant change in the way the university's assets enable teaching and learning, opening the way for rethinking the future uses of individual buildings and campuses as a whole.

The Campus Vision is integral to a wider set of transformative initiatives designed to build a strong and sustainable dual sector university, including product portfolio improvement, greater agility, increases enrolments, and more efficient use capital resources.

At high level, the Campus Vision involves creating a University Town culture in central Ballarat, encouraging more industry partners to relocate to Mt Helen, expanding the Berwick Campus and establishing teaching facilities in community buildings right across Gippsland.

The vision outlines a plan to become Gippsland's university, making education and job opportunities more accessible to all Gippslanders. Specifically, the vision:

- Seeks to create innovative ways to increase Federation's presence in Latrobe City
- Envisages mixed education and employment facilities, building on the success of the Morwell Innovation Centre
- Expands the study hub network and outreach
- Looks to utilise the university's high-quality labs and associated learning environments to continue to drive the educational experiences of our students across Gippsland

Consistent with these strategies and objectives, Federation is seeking to develop the Gippsland Centre for Renewable Energy (GCRE). This centre builds on Federation's renewable energy (RE) capabilities developed at the Mt Helen campus, including the Centre for New Energy Transition Research (CNETR) and the Asian Pacific Renewable Entry Training Centre (APRETC) and seeks to address the shortage of a suitably qualified workforce in the Gippsland region needed to support the growth and development of the Victorian renewable energy sector.

Initially proposed to support demand for a higher education qualified workforce in Gippsland needed to support a range of RE projects, including offshore and onshore wind and solar projects, GCRTE is also expected to play a major role in assisting the existing energy and mining sector to transition to new employment opportunities as these industries are closed over the next decade. GCRTE will provide a visible and tangible pathway for youth of Gippsland, as well as opportunities for transitioning workers.

This business case builds the investment case, details the delivery case for the development of Gippsland Renewable Energy Training Centre (GRETC).

2. Defining the problem

GCRE seeks to address a core issue that is consistent with Federation's vision and if left unaddressed will negatively impact Gippsland.

> *Attracting enough people to engineering studies is an issue for the energy sector…..(the) tertiary education sector is not able to attract and graduate enough students to meet growing industry demand* (Shah & Syed, 2022)

The specific problems identified in the region and relevant for this business case are as follows:

Problem	Summary	Impact
Current workforce does not possess suitable HE RE skills required to meet current and future workforce needs	Current skills base of the Gippsland workforce does not possess the critical RE skills needed to support future industry development There are significant shortfalls in the number of RE workforce needed across all stages of the RE development (planning, construction, operations)	• Workforce demands of industry not met.
Typical education and training response approaches cannot meet industry needs	Exiting RE higher education training is based around the teaching domains of electrical, mechanical, data and regulation. There are limited engineering sustainability courses. These courses do not meet industry needs. Industry RE demands a wider technology-based approach to developing the skills needed to support the RE industry. Existing courses have a very theoretical approach to learning, which limits critical skill development – there is a need to integrate work-placed learning in HE. The course structure of existing HE courses does not cater for recognition of prior learning, TAFE pathway and multiple entry and exist points.	• Existing training models do not meet industry or student needs • Adds cost to business to train post-HE graduates • Creates barriers for students / existing workforce to develop RE HE skills and capabilities • Transition of current workforce less likely to occur • Workforce demands of industry not met.
There are limited RE education and training opportunities in Gippsland	Gippsland residents and workforce do not currently have immediate access to the necessary education and training requirements needed to either acquire the skills needed or transition existing skills to work in the RE workforce. Pathways through secondary school are also problematic, with few students in Gippsland having the prerequisite or preferred VCE students.	• Major barrier to workforce development. • Transition of current workforce less likely to occur • Workforce demands of industry not met.

Table 1: Problem Definition

The investment logic map supporting the project is as follows:

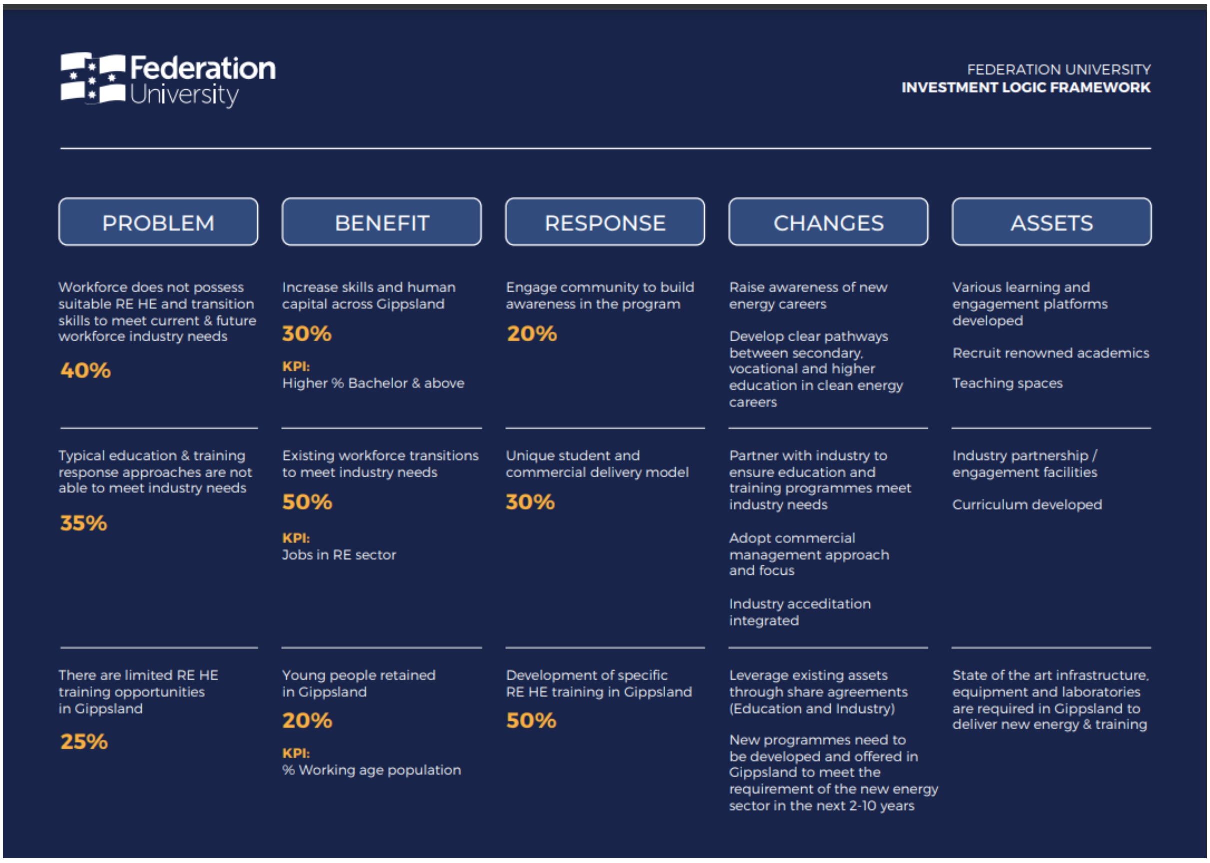

Figure 1: investment logic map

3. Evidence of the problem

3.1 Workforce does not posses suitable HE RE and transition skills to meet current and future industry needs

3.1.1 Offshore wind

Gippsland is home to one of four offshore wind zones. The Federal Government has recently legislated to unlock investment in offshore energy projects. A framework for the construction, operation and maintenance and decommissioning of offshore electricity projects is currently under development.

To move potential project forward, the Victorian Government released a directions paper in March 2022, with further industry consultations currently underway.

Initial estimates of production in Victoria include 2000MW of offshore wind by 2032, 4000MW by 2035 and 9000MW by 2040 (The Australian, 2022). The offshore wind industry could sustain up to 3100 jobs during construction and 3000 jobs during operations (Figure 2) (Department of Environment Land Water and Planning, 2022). There is currently 4700MW under feasibility along the Bass Coast and the Gippsland coast.

Total offshore wind energy production is estimated to be around 13,000MW, of which 10,000MW (77 per cent) is expected to be in the Gippsland Zone. Most of the operational jobs, as well as those supporting the industry, such as the offshore wind hub and innovation district, will be in Gippsland.

Using a pro rata approach, 77 per cent of the offshore wind jobs identified in the directions paper will be located in Gippsland, totalling around 700 – 925 development jobs, 620 – 1,240 construction and 2,200 – 2310 operational positions, a total of 3,520 – 4,475 FTEs

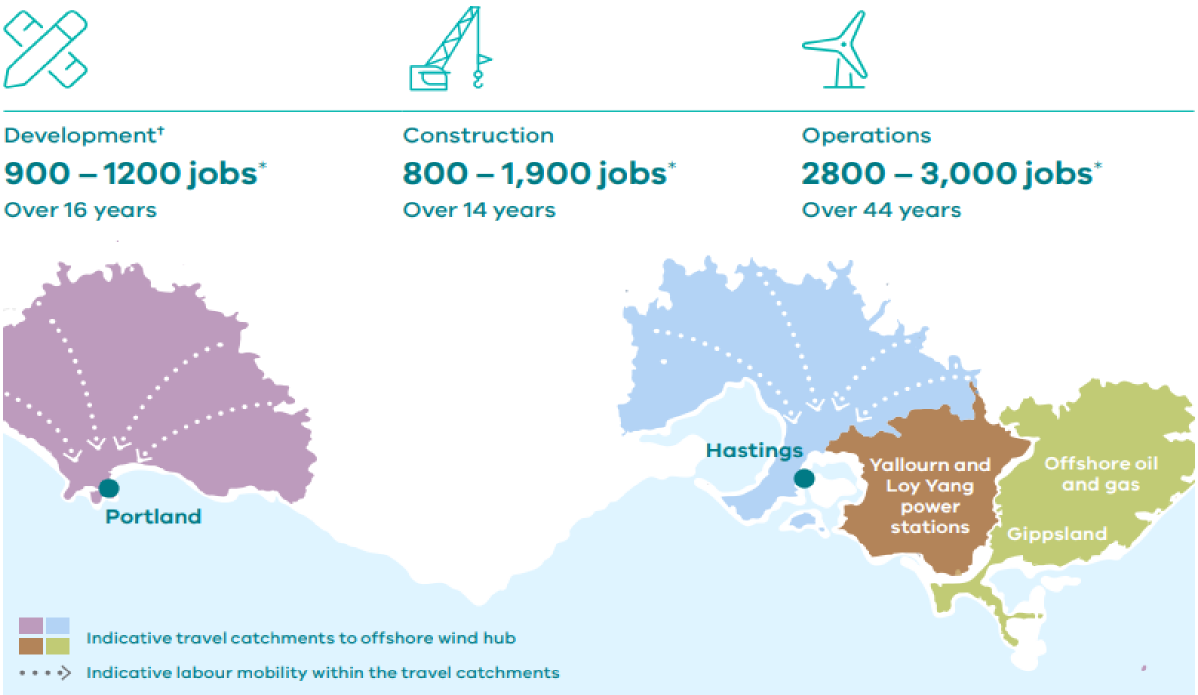

Figure 2 – Localised employment opportunities from offshore wind

3.1.2 Broader RE skills demand

Across the broader RE sector, the workforce requirements are larger.

Type of projects	Construction (FTE)	Ongoing (FTE
Solar projects	4,101	82
Wind projects	2,446	551
Batteries	130	06
Hydrogen	486	540
HVDC	250	50
Renewable energy zone transmission upgrade project	740	330
Total	**8,153**	**1,559**

Table 2: Workforce needs (FTE)

The estimate for the period 2022 – 2032 contained in the Gippsland Renewable Energy Skills Mapping Report (Shah & Syed, 2022) is that between 2022 – 2032 around 8200 construction FTE and 1600 ongoing FTE will be needed to support renewable jobs in Gippsland, based off current projects.

A similar study covering the period 2025 – 2036 and using clean energy jobs, rather than renewable energy jobs, estimates construction needs to be between 4000 – 6000 FTEs and ongoing positions 2750 – 3750 (Clean Energy Council , 2020) .

While there is no consensus on the exact number of positions needed, over the next decade at least 5000 construction FTEs and up to 3000 ongoing positions will need to be filled to meet expected RE workforce demand.

3.1.3 Skills shortfall

The challenge is not just the quantum of workers required to plan, construct and operate the RE projects; the skills needed to complete these tasks are also in short supply. Skills have to be responsive to local industry conditions and needs.

There are not enough people taking up training to meet the current demands of the clean energy sector (Rutovitz, Briggs, Dominsh, & Nagrath, 2020) let alone accommodate the growth of the sector over the next decade (Shah & Syed, 2022). Construction managers and engineers (civil, electrical, grid and SCADA), in particular, are in short supply. Trade and technicians are easier to recruit. Experience, pay rates and locations were the most common reasons listed for recruitment difficulties (Clean Energy Council, 2020). Digital skills, and a digitally enabled workforce are identified as the major shortcomings of existing workforces with skills in data analytics, cyber-physical systems, software and programming required (Shah & Syed, 2022). These skills have proven challenging to develop and attract in other infrastructure / utility environments (International Renewable Energy Agency, 2018).

There is a particular need for managerial roles – these are required across the economy and skilled professional roles – as well as accredited skills in engineering and ICT (for example) for highly technical aspects of large projects (Tasmanian Energy and Infrastructure Workforce Advisory Committee, 2020).

Industry estimates point to strong demands in degree qualified staff across the development and early construction phases. Most of the employees are likely to be degree / tertiary qualified staff with some corporate / administrative roles (Shah & Syed, 2022).

These factors point to the need for the local workforce to develop higher level skills to be able to support the RE sector.

3.1.4 Available labour supply

Estimates by the Committee for Gippsland point to 1200 people being directly employed in the mining sector, with related energy and resource jobs employing numerous others. Analysis suggests this figure has varied quite widely over time, with the average jobs (part and full-time) in Gippsland in the sector around 1450 (ABS, 2022). There are around other 4000 employed in the broader category of electricity, gas and wastewater (ABS, 2022). These are the sectors most often pointed to as being able to support RE projects. There are comparable and transferrable skills across the oil and gas and offshore wind sectors (International Renewable Energy Agency, 2018), suggesting that there is potential for some form of transition plan, as existing employment in these sectors tapers off over the next decade.

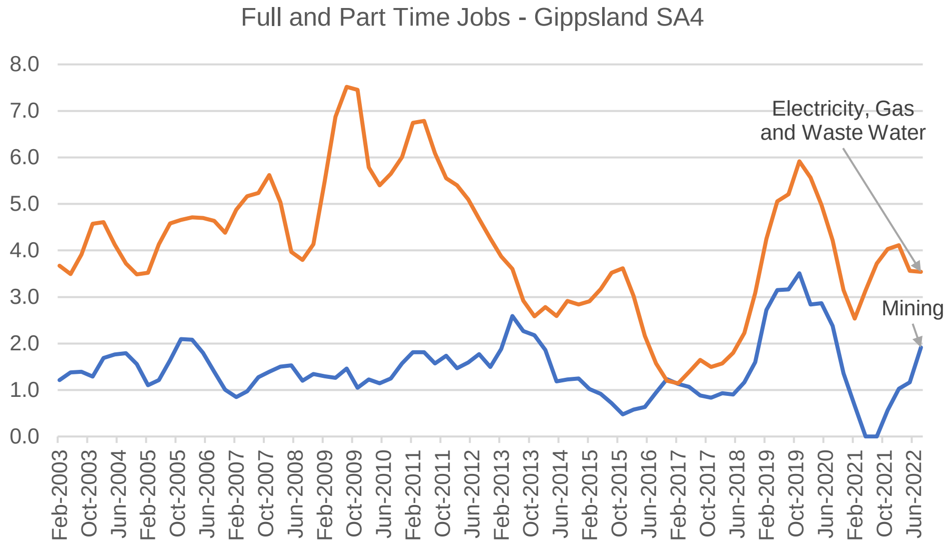

Figure 3: industries directly affected by transition

The challenge for the region is that this workforce is not appropriately skilled, with the average workforce being around 26% – 27% bachelor qualified, compared to the Victorian average of around 46%.

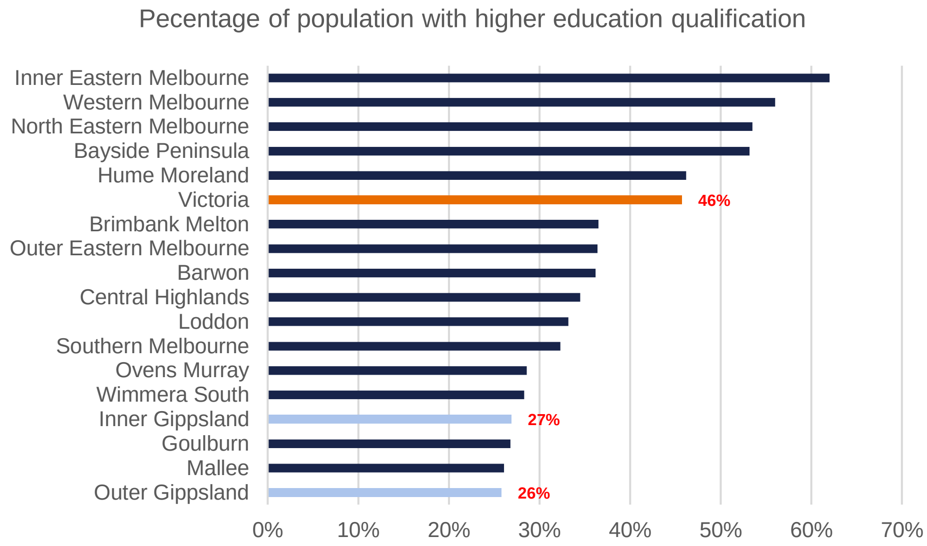

Figure 4: Percentage of population with higher education qualifications

Consultation conducted by Energy Australia with 500 of its workforce in the region points to only 74 of the staff having a bachelor degree or above, around 12% of the surveyed workforce. The majority hold certificate / diploma level qualifications – around 48%, while 20% hold secondary school or trade qualifications. Only 3% of the workforce has a training preference for further diploma and graduate certificate study and less than 2% a degree or higher. These results are comparable to the results attained from the automotive workforce when it faced major transition after the closure of local manufacturing.

The supply analysis suggests that the *skills needed* to support the RE sector will not be available locally, thereby it requires some form of intervention to ensure the industry can meet the government's policy objectives.

This situation is being compounded by current and expected increases in skills needed to decommission power plants and mines and rehabilitate these sites.

In addition, there are currently 23 offshore platforms and installations in Bass Strait. Production of offshore gases is declining, from 21.3PJ in 2016-17 to 8.2PJ in 2020-21, with limited exploration drilling underway. (Earth Resources Regulation, 2022). As these sites progressively reduce production there is expected to be heightened demand for like skills, particularly those related to maritime industries competing for workforce and skills.

3.1.5 Workforce quantity

In terms of the quantity of the workforce, Gippsland, like most of regional Victoria, has a declining workforce dependency ratio, meaning there is a lower proportion of the population of working age. The current ratio of 1.04. The ratio is forecast to decline over the next 10 years to around 0.95 by 2031 and beyond, placing pressure on the population to meet employment needs of the existing economy, let alone the increased demands that are forecast to arise from the RE sector.

The cause is a decline in the relative size of the workforce, which is forecast to shrink from 51% (Victorian average 61%) to 49% by 2031 and continue to fall over the foreseeable future.

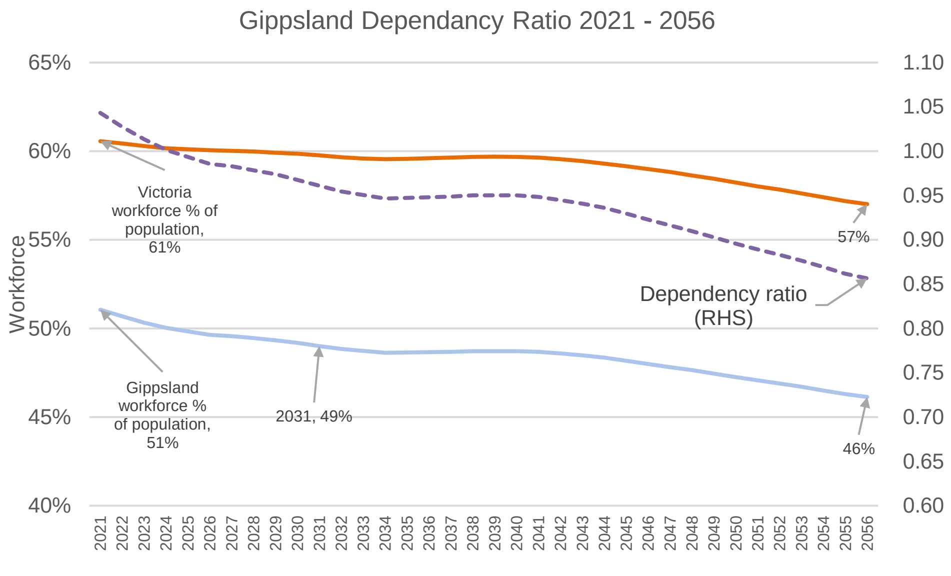

Figure 5: Gippsland dependency ratio

These results are consistent with industry estimates of around 29% of the current workforce expecting to retire. Only 14% indicate a desire to work in offshore wind, with the majority suggesting a desire to work in mine rehabilitation and decommissioning of existing power stations.

Using Victoria in the Future Analysis (Department of Land Water Environment and Planning, 2019), Gippsland's workforce is expected to increase from around 150,000 to 161,000 by 2031. To meet the expected RE needs of the region, almost all of this increase will need to be employed in the RE sector. This is unrealistic, with other factors creating demand for workforces, such as residential construction, ageing, health and education.

This analysis suggests that with large numbers of the existing workforce not expected to transition to RE opportunities, RE sector needs can only be met by an increase in the region's workforce, over the next decade and beyond, over and above current forecast numbers.

3.2 Typical education and training response approaches are not able to meet industry needs

Various national and international reports have highlighted the immediate and long-term need for increased training capacity to deal with the significant increase in demand for a skilled renewable energy workforce (Tasmanian Energy and Infrastructure Workforce Advisory Committee, 2020). The Clean Energy Council has recommended that the structure and suitability of the training system to meet industry demand needs to be reviewed in collaboration with industry bodies, unions, regional development agencies, and policymakers (Clean Energy Council, 2020).

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. 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. (Tasmanian Energy and Infrastructure Workforce Advisory Committee, 2020).

There are a number of recognised shortcomings with the existing training and skills development model that are incongruous with future industry needs, for example customising training according to future demand and industry input, enhancing trainer capacity, building technical expertise through combining practical and academic training, creating clear industry and learning pathways, using the projects as a training ground to shape and nurture the future workforce and considering skills portability.

3.3 There are limited RE HE training opportunities in Gippsland

Gippsland residents and industry do not have access to any well located HE courses with a substantial RE component. Current HE course offerings through Federation Gippsland that have some relevance to RE include:

- Bachelor of Engineering in Civil
- Bachelor of Engineering in Electrical and Information Technology
- Graduate Certificate in Community Energy and Microgrid
- Bachelor of Environmental and Conservation Science

Seven universities in Australia offer RE Programs.

University/State	Program Title	Comment
University of Newcastle New South Wales	Bachelor of Renewable Energy Engineering	Accredited by Engineers Australia (EA)
Royal Melbourne Institute of Technology (RMIT) Victoria	Bachelor of Engineering (Sustainable System Engineering)	Accredited by EA
Monash University Victoria	Bachelor of Resource Engineering (Renewable Energy)	Accredited by EA
Edith Cowan University Western Australia	Bachelor of Engineering (Electrical and Renewable Energy)	Accredited by EA
Murdoch University Western Australia	Bachelor of Engineering (Renewable Energy Major)	Accredited by EA
University of New South Wales New South Wales	Bachelor of Engineering (Renewable Energy)	Accredited by EA
Australian National University Australian Capital Territory	Bachelor of Engineering (Renewable Energy Major)	Accredited by EA

Table 3: National HE RE Undergraduate Programs

3.3.1 RE Industry concerns

RMIT and Monash offer programs in Victoria; however, these are heavily "soft skill focussed" with a high theoretical and technical content. The emphasis on traditional engineering approaches does not meet the needs of the RE industry, which is seeking skills that are equally practical as theoretical. The courses have been developed out of either a mechanical (RMIT) or electrical (Monash) domain and are not built to RE as a specialist engineering domain.

The courses do not meet the broader needs of the RE environment, which includes high level competency in data sciences, as well as understanding of a completely new regulatory / compliance environment (Shah & Syed, 2022). The need is as much for courses in RE Technology as RE Engineering and in RE Construction.

There are a further five courses in Victoria, including Federation, that offer basic and some intermediate RE learning across the areas of electrical, sustainability, electronics and communications. Self-accreditation means universities can design and offer the courses without the need to consult with industry.

3.3.2 Gippsland student concerns

In addition to content related issues, being able to access courses out of region is challenging for many in Gippsland. Lower socioeconomic backgrounds and ATAR requirements of 85 Monash and 78 RMIT present dual challenges for students wishing to study suitable courses at present.

Regional universities tend to have a different student profile to metro HE institutions and this requires a program model that caters for these profiles and presents the best chances of successful program completion. Many have a higher-than-average share of mature aged students, students from regional and remote backgrounds, indigenous students, students from low SES backgrounds, and students who are "first in family" to attend university. A high proportion of students are part-time or study externally or on a multi-modal basis. Many students have substantial work and/or caring responsibilities (Regional Universities Australia, 2018).

Not all secondary schools offer specialist maths and physics in VCE in a face-to-face mode. These subjects can be challenging for distance education learning, making students feel cut off from the pathways these subjects lead towards (STEM).

The training program to be deployed supporting RE must be region specific and cater for the regional profile of students.

3.4 Timing considerations – why now ?

There are several demand sources driving the market at this time, each essentially competing with developing RE industries for the similar capability sets:

- Decommissioning of oil and gas infrastructure in Bass Strait
- Planning for closure and decommissioning of existing power stations
- Rehabilitation works associated with the closure of mines in the region

The window to develop the necessary capabilities to support the RE sector requires activation of this project over the course of 2023, with graduates by 2024.

3.5 Consideration of the broader context

3.5.1 Post-pandemic recovery opportunities

This project presents as an opportunity to springboard its post-pandemic recovery. Federation was particularly hard hit by the pandemic. Only three of 37 universities experienced a greater pandemic revenue downturn than Federation (Larkins & Marsham, 2021). There are several factors impacting the sector more broadly (EY, 2021); however, Federation was particularly exposed to international students, with 51% of enrolments being international, the highest amongst Victorian universities, which averaged 40%, and the Australian university average of 30%. The average for regional universities was 19%.

With a narrower revenue source than larger universities, Federation was more significantly impacted by border closures and has a greater need for a robust post-pandemic recovery strategy that includes both domestic and international students.

The net result of the pandemic is that Federation enrolments dropped by 37%, from 2019 EFSTL of 12,755 to a projected enrolment in 2022 of EFTSL of 7,950.

In addition to overall student numbers a comparison to other regional universities (members of the regional universities network – RUN), suggests that Federation is underrepresented in engineering enrolments, particularly if the region in which the university is based has a specific capability or requirement to meet local demand.

	% of RUN enrolments	% Engineering enrolments	% of Domestic Eng (RUN)
Federation	10%	4%	6%
Charles Sturt	25%	0%	3%
Southern Cross	11%	2%	4%
New England	14%	0%	0%
CQ	15%	7%	21%
Southern QLD	15%	14%	58%
Sunshine Coast	10%	3%	8%
RUN Total	**100%**	**4%**	**100%**

Table 4: Engineering Enrolments, RUN Universities

Federation is responsible for around 10% of total RUN enrolments, but only 6% of domestic engineering enrolments.

The leaders in regional engineering enrolments are CQ and Southern QLD, with 7% and 14% respectively of students enrolled in engineering courses. These universities are supporting major local demand in construction and mining. These pockets of specialisation are common across all regional universities, including Federation, which has a similar strength in ICT where around 30% of students are enrolled.

The development of the RE specialisation is a unique and timely opportunity for Federation to expand its offering and to build out its capability, creating revenue opportunities and reducing risks associated with a narrow revenue base.

4. Benefits to be delivered[1]

4.1 Increase skills and human capital across Gippsland

The link between higher levels of human capital and economic outcomes is well known at both an individual level, through the ability to derive a higher lifetime income (private benefit), and also at a national level (public benefit) (Deloitte Acess Economics, 2020). The greatest contribution to the observed differential between the earnings of university graduates and others is, indeed, their university education (with innate ability, prior education and other factors accounting for around two-fifths), i.e. not because someone has a degree, but because of the skills they learned while completing the degree.

	Private	Public
Market	Labour market outcomes (where the qualification increases likelihood of employment, or attracts a wage premium)	Labour productivity spill-overs, increased tax receipts associated with productivity gains and wage premiums
Non-Market	Positive family, health outcomes associated with higher levels of education	Positive social outcomes associated with a higher level of educational attainment among the population

Table 5: Benefits of Higher Education

With studies indicating that around 70% of students who study in regional Australia remaining in regional Australia for employment (Regional Universities Australia, 2018), this program can potentially make a step jump improvement in the quality of Gippsland's skill and human capital base.

4.2 Existing workforce transitions to meet industry needs

With around 5,200 direct FTE involved in mining and utility sectors in together with downstream supply chain firms, the region has a workforce transition issue that needs to be addressed as many of these positions will become redundant over the next decade or so as existing power stations are closed.

The establishment of the GRETC will provide immediate training and skills development opportunities for those in the existing workforce who wish to re or up skill, together with work placements through making the centre and its courses highly accessible.

The program has been designed to accommodate mature workforces with competing commitments through employing multiple teaching methods including block and virtual. The course is being designed to be practical as well as theoretical. Recognition of prior learning (RLP) is also a feature. Integration into TAFE pathways and multiple exit and entry points also support skills development of the local of the workforce.

4.3 Young people retained in Gippsland

The region's dependency ratio (proportion of working age population compared to non-working age population) is low and declining (see above) due to a declining proportion of the population being of working age. This is because Gippsland suffers from a relatively high percentage of young people, the majority of whom are working age, leaving the region, with Gippsland having around 5% fewer people aged 15-29 and people aged 30-44 than the Victoria (not Melbourne) average. Without intervention this problem is forecast to get worse over the foreseeable future.

The impact on Gippsland is that compared to the Victorian average the region has a shortfall of around 14,000 people aged 15-29 and around 17,000 for people aged 30-44.

[1] A Benefit Management Plan has been prepared to support this Business Case. Refer Appendix I

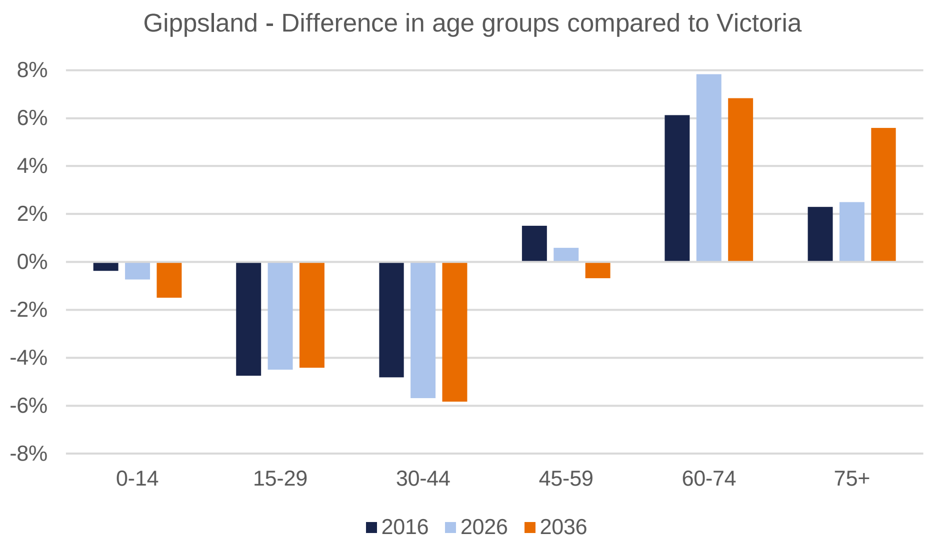

Figure 6: Age differences between Gippsland and Victoria

The reasons for "youth outmigration" are varied, from seeking education and employment opportunities, to the lure of an urban lifestyle. However, studies have shown that 70% of regional students who study regionally stay and live in the regions, compared to a national average of 20% who work in regional areas. (Regional Universities Australia, 2018).

One of the benefits this business case supports is the ability of the region to retain younger people within the region through addressing two of these three factors; the provision of greater educational opportunities, importantly, linking this directly to employment opportunities.

4.4 Importance of benefits to government

The Victorian Government's commitment to renewable energy is central to the need to develop renewable energy training capacity and TAFE in this state. Moreover, APRETEC supports several other significant issues of strategic importance to the government.

4.4.1 Renewable Energy Strategy

The commitment to the renewables sector is evident in the 2016 New Energy Technology Sector Strategy, which sets out a plan to work with industry and education providers to grow the renewable energy sector and lists more than $1.2 billion in funding applicable to the sector. The strategy states that:

> *We will explore options to collaborate with universities, TAFEs and other educational and training institutions to continue to ensure the curriculum and focus of energy-related vocational courses and degrees are aligned with the workforce requirements of the new energy technologies sector* (Department of Economic Development, Jobs, Transport & Resources, 2016) .

4.4.2 Renewable Energy Action plan

This project specifically supports the Victorian Government's Renewable Energy Action plan, which seeks to:

- Empower and engage households, businesses and communities, supporting community energy projects, and ensuring affordable energy supply
- Ensure our energy system is smart, safe and reliable by advancing energy storage, smart grids and microgrids, creating value through data and other energy innovations; and
- Create jobs, attract investment and grow our economy through boosting the new energy technologies sector (Department of Energy, Environment and Climate Change, 2017).

4.4.3 Victorian Renewable Energy Target

The Victorian Renewable Energy Target is to achieve 33 percent renewable supply by 2025 and 50 percent by 2030. By 2050, the target is zero emissions. The size and short timeline for the change indicates the need for the development of an appropriately trained workforce for what is expected to be a rapidly growing industry.

The mechanism for achieving these targets is the Victorian Renewable Energy Auction Scheme, whereby renewable energy providers submitted bids to supply renewable energy.

In September 2018, it was announced that stage one was oversubscribed, with 928MW of renewable power (673 MW of wind, 255 MW solar) having been approved through a reverse auction process.

Stage two VRET auction was recently completed. With a budget of $1 billion, VRET S2 secured 623MW of new generation and 600MWh of battery storage. Two of the six projects funded were in the Gippsland REZ, Frasers solar farm (77MW solar) and Fulham solar farm and battery (80MW solar and 100MWh of storage) (Department of Environment, Land, Water and Planning, 2022).

With industry demonstrating its interest in securing access to the reverse auction "contracts of difference" over and above the target established in stage one of 650MW, there is evidence of strong demand for the development of the sector into the future.

The recently released Offshore Wind Farms Direction Paper notes that to achieve net zero emissions by 2050, around 15 times the current renewable energy installed capacity will be needed (Department of Environment Land Water and Planning, 2022).

4.4.4 Support the commitment of 100% renewable electricity for government by 2025

A key plank in the strategy to achieve the renewable energy reduction targets is for the Victorian Government to be using 100% renewable energy by 2025. The training and development of the workforce needed to develop the necessary generation and distribution infrastructure is vital to this goal being achieved.

4.4.5 Local investment and job creation

Renewable energy projects under the VRET auction processes are required to support new investment and jobs in the renewable energy supply chain and broader economy and assist with Victoria's long-term recovery from COVID-19.

Using the Industry Capability Network, the Victorian Industry Participation and Local Jobs First Policies have been applied to the VRET process. The process measures a project's contribution to economic development in Victoria, including jobs, supply chains, manufacturing, and service industries. It also ensures that projects maximise local content (Table 6) to promote development of local industry, jobs, and economic activity in Victoria.

Project content	Solar	Wind (≤4.2 MW, ≤4.5m)	Wind (>4.2 MW, >4.5m)
Total local content	67%	65%	61%
For operations & maintenance phase	90%	90%	90%
For steel products and components using locally milled steel	95%	95%	Maximise use to extent possible

Table 6: Local content requirements

5. Response options development

Department of Treasury and Finance's Business Case Guidelines require that as part of the business case process there should first be a wide exploration of possible response options to address a problem before considering what specific project solutions are available.

Response options differ from project options. Response options are a mix of discrete high-level interventions that could be taken to respond to an identified problem.

This chapter examines potential high-level responses. The next chapter examines the preferred response in more detail and expands on the various ways it might be further developed.

5.1 Method and criteria

A range of strategic interventions is available to resolve the problems outlined in the Investment Logic Map. To determine the strategic direction of this project, the following methodology was employed:

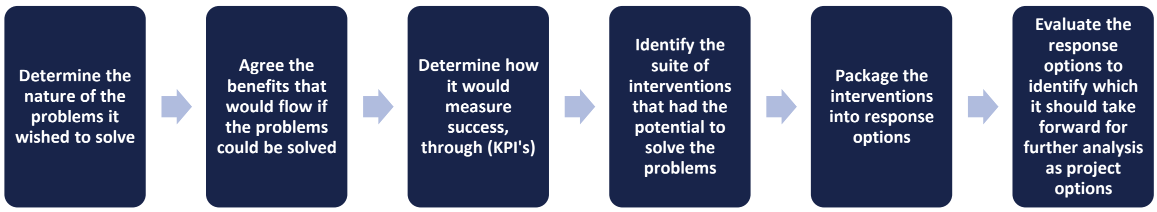

Figure 7: Option response selection methodology

5.2 The base case

The Base Case is to do nothing, with existing providers acting to address the problems outlined above. Under the base case scenario, the following outcomes are more likely than not:

- Challenges for industry to meet the skills and workforce needs required to deliver the project, which will likely be addressed through FIFO employment models
- Continuation of the challenges the region has providing education and employment outcomes for young people
- Fewer workforce transition outcomes from the closure of power stations in the region over the next decade
- Significant loss of economic opportunity as economic benefits, to the extent they arise, are transitory and fail to be embedded in the regional economies

5.3 Interventions

Five interventions have been identified and assessed as part of the business case development process. The table below presents these interventions and their links to the problems identified in the Investment Logic Map.

Intervention	Workforce does not possess suitable HE RE and transition skills to meet current & future workforce industry needs	Typical education and training response approaches are not able to meet industry needs	There are limited RE HE training opportunities in Gippsland
Build engagement across region to encourage RE opportunities	✓		
Expand Engineering to include RE		✓	✓
Expand Engineering to Gippsland			✓
Encourage external parties to market			✓
Develop HE RE training model		✓	✓

Table 7: Response options

5.4 Strategic interventions and response options

This section presents the response options that have the potential to address the problems identified in the Investment Logic Map. A response option comprises either one, or a mix of the strategic interventions presented in the previous section. The five response options below (including the base case) have been developed by grouping the shortlisted strategic responses into alternative combinations of interventions:

The project options considered are based on possible operating and governance models. There are five options explored in the table below

Option	Model feature	Advantages	Disadvantages
Base case	Business as usual, no direct intervention		
Federation lead	Federation undertakes all course work delivery in a traditional academic model, being responsible for producing graduates with Bachelor and Associate Degrees run from Gippsland	• Federation control over assets, quality, curriculum • Utilise Federation assets and capabilities • Low risk approach	• Likely slow to market • May not meet industry needs • Pathways into / out of program may not be optimal
Cooperative	Federation undertakes formal HE education but partners with industry for work placements and course development, other suppliers are bought into provide additional skills development such as specific industry training	• Speed to market • Leverage Federation assets and capabilities • Aligns to strategic intent • Pathways in / out • Industry engagement benefits • Offers unique selling propositions to students and industry	• Federation quality control role is new, some risk • Potential loss of control over assets and relationships • Partnership and industry model needs investment
Virtual	Program delivered entirely on-line, complemented by block lab sessions	• Speed to market • Utilise Federation assets and capabilities • Lowest cost model • Widest potential reach	• Does not meet student and industry expectations • Limited ability to partner • Regional benefits not delivered
Ballarat	Mt Helen campus has established RE programs, assets, and infrastructures. These capabilities are leveraged through the immediate commencement of the program from the Ballarat campus entirely under Federation auspice	• Speed to market • Utilise Federation assets and capabilities already in situ • Lowest cost "physical" model • Lower risk because builds on existing capability	• Unlikely to meet industry needs • Regional benefits not delivered

Table 8: Project options

An analysis of the different disbenefits and interdependencies arising from the response options is shown in Table 9

Business as usual	Federation solo	Cooperative model	Virtual model	Build out at Ballarat
<u>Disbenefits</u>				
Excess capacity at Churchill not utilised		Excess capacity at Churchill not utilised	Excess capacity at Churchill not utilised	Excess capacity at Churchill not utilised
		Potentially Limits Federation student exposure		
<u>Independencies</u>				
Private market capable of supporting needs	Links to APRETC & other Federation RE centres	Links to APRETC & other Federation RE centres	Virtual platform capable of delivering project	Links to APRETC & other Federation RE centres
		Industry partnerships and engagement	Block training with lab needed to support project	
		Infrastructure and assets can be accessed		
		Licencing of key materials via partners		

Table 9: Disbenefits and interdependencies

5.5 Benefits assessment

A benefits assessment has been undertaken using the following measures.

Score	Impact
0	No impact on achievement of benefits
1	Minimal impact of achievement of benefits
2	Limited impact of achievements of benefits
3	Potential achievement of benefits
4	Deliver majority of benefits
5	Completely delivers benefits

Table 10: Benefits assessment model

Raw scores (0-5) were then weighted according to the weighting assigned to each benefit in the Investment Logic Map. The weighted scores for each option were then summed to determine the total weighted score.

	Benefit	Weighting	Business as usual	Federation solo	Cooperative model	Virtual model	Build out at Ballarat
Benefit 1	Increase skills and human capital across Gippsland	30%	15%	30%	30%	15%	15%
Benefit 2	Young people retained in Gippsland	50%	25%	25%	50%	50%	25%
Benefit 3	Existing workforce transitions to meet industry needs	20%		20%	20%	10%	10%
	% of full benefit to be delivered		**40%**	**75%**	**100%**	**75%**	**50%**
Rank			**5**	**2**	**1**	**2**	**4**

Table 11: Benefit delivery

The cooperative model provides 100% benefit delivery.

KPI	Weighting	Business as usual	Federation solo	Cooperative model	Virtual model	Build out at Ballarat
Higher % Bachelor & above	30%	1	3	4	2	3
Jobs in RE Sector	50%	1	4	4	2	2
% Working age population	20%	1	3	4	2	2
Raw score		**3**	**10**	**12**	**6**	**7**
Weighted score		**1.0**	**3.5**	**4.0**	**2.0**	**2.3**
Rank		**5**	**2**	**1**	**4**	**3**

Table 12: KPI delivery

The cooperative model is expected to provide the highest delivered level of benefits as defined by the proposed KPIs.

5.6 Risk assessment

Risk have been assessed based on three risk categories, delivery, speed to market and estimated costs. These risk types consider the primary challenges identified with the project during the business case process, those being the risks in delivering the project, the need to meet the market demand in terms of time to market and the potential for excessive costs and budget challenges. Risks have been weighted accordingly.

Delivery Risks	Weighting	Business as usual	Federation solo	Cooperative model	Virtual model	Build out at Ballarat
Student numbers not achieved	35%	5	2	2	4	3
Industry needs not meet	35%	5	2	1	3	2
Quality standards are not achieved	10%	3	2	3	3	2
Administrative complexity	10%	0	2	3	2	2
Pathways not developed	10%	4	2	3	3	4
Total score		**17**	**10**	**12**	**15**	**13**
Weighted score		**4.2**	**2.0**	**2.0**	**3.3**	**2.6**
Rank		**5**	**1**	**1**	**5**	**3**

Table 13: Delivery risk assessment

The Federation model and Cooperative model have the lowest delivery risk profile.

	Weighting	Business as usual	Federation solo	Cooperative model	Virtual model	Build out at Ballarat
Delivery risk	50%	4.2	2.0	2.0	3.3	2.6
Time to delivery	30%	3.0	4.0	2.0	2.0	3.0
Estimated costs	20%	0.0	4.0	3.0	4.0	2.0
Raw score		**7.2**	**10.0**	**7.0**	**9.3**	**7.6**
Weighted score		**3.0**	**3.0**	**2.2**	**3.0**	**2.6**
Rank		**3**	**3**	**1**	**5**	**2**

Table 14: Risk assessment

The Cooperative model has the lowest overall risk profile.

	Business as usual	Federation solo	Cooperative model	Virtual model	Build out at Ballarat
Benefit score	1.0	3.5	4.0	2.0	2.3
Risk score	3.0	3.0	2.2	3.0	2.6
Net score	**-2.0**	**0.5**	**1.8**	**-1.0**	**-0.3**
Rank	**5**	**2**	**1**	**4**	**3**
Relative benefit	**0.3**	**1.2**	**1.8**	**0.7**	**0.9**
Rank	**5**	**2**	**1**	**4**	**3**

Table 15: Benefit and risk assessment

5.7 Recommended response option

The recommended response option is to build on the cooperative model, which has a benefit / risk score of 1.8. The only other positive scoring option is to deliver an existing academic model through Gippsland. The cooperative model has the highest benefit score and the lowest risk score.

6. Project option assessment

To deliver the cooperative model there are two locations that have the necessary infrastructure and attributes, namely the Federation Churchill campus and the Morwell Innovation Centre. This section assesses the suitability (benefits, risks) of these locations for program delivery.

6.1 Enterprise Centre at the Federation University Campus

This site is in an established facility on the Churchill Federation Campus. The proposed location is Building 9N on this site (Stage 1). as shown in Figure 8:

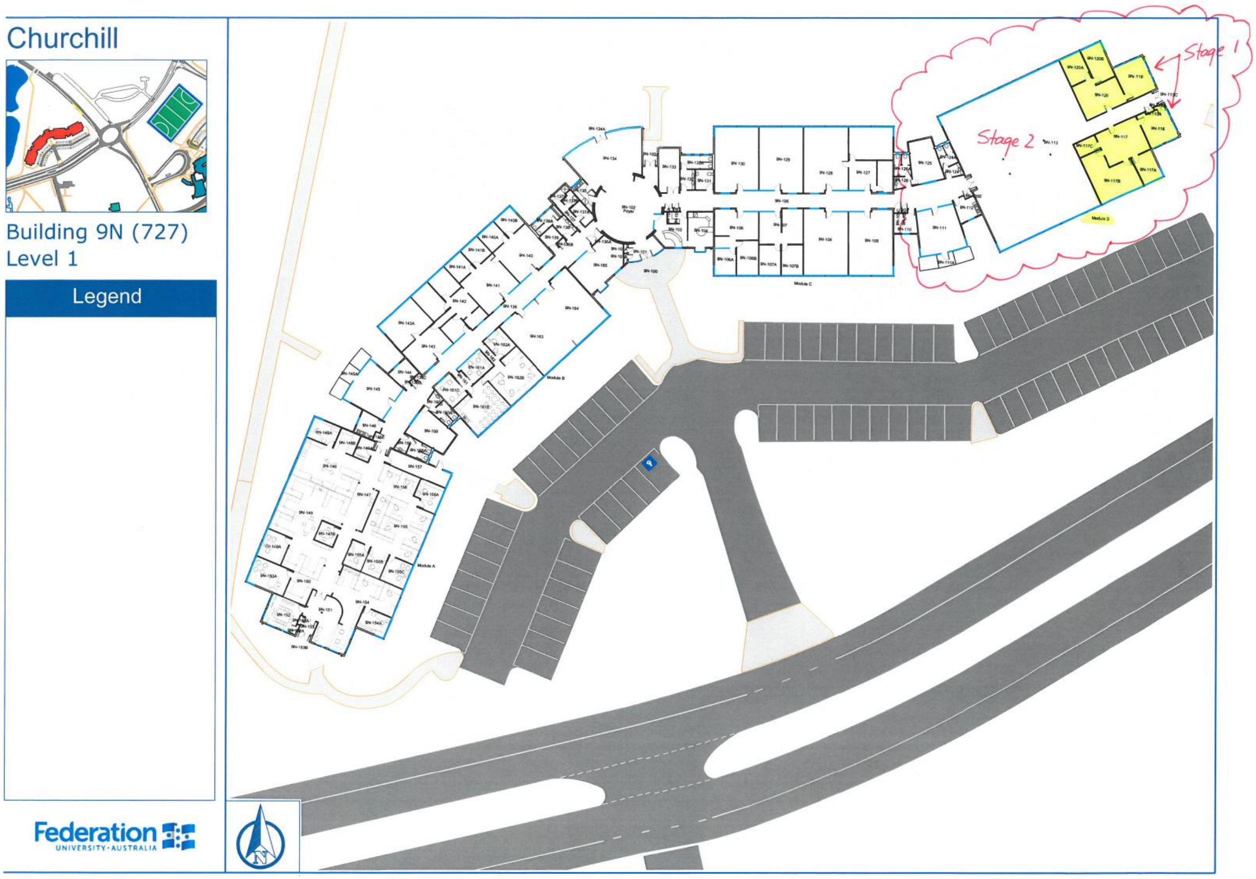

Figure 8 - Enterprise Centre

The Enterprise Centre currently has 510m^2 available, sufficient for the establishment of the centre, lab space and accompanying office and industry engagement. Longer-term development of the centre can also be accommodated (Stage 2).

6.2 Morwell Innovation Centre

MIC is in Morwell and operated by Federation. Co-tenants on the site include the Gippsland Tech School and TAFE Gippsland. The co-location of these parties on the site, together with the dedicated industry engagement infrastructure, provides significant support for the pathways and partnerships aspects of the preferred cooperative option. The site is “built for” these purposes.

Within the proposed building, the proposed space is identified as tenancy, which totals 305m^2 in Figure 9:

Figure 9 - MIC floorplan

The building would likely need some reconfiguration works to make best use of the available space. One of the interdependencies identified is to be able to access infrastructure at TAFE Gippsland to manage growth and longer-term lab space. Common classroom technology will be required and conversion of part of the space into a dedicated computer lab will also be needed.

6.3 Stakeholder identification and consultation

As a leading employer and contributor of social economic and health benefits within its regions, the university is in regular communication with a wide range of regional stakeholders.

Stakeholder	Interest
Minister for Training and Skills and Minister for Higher education, the Hon. Gayle Tierney MP	The Minister has an interest in the ongoing success of the university. The university has had ongoing periodic consultation with the Minister.
The University Council/executive, as well as programs, TAFE – division and staff	Interest in strategic direction. The university must communicate effectively re. whole of institution strategic direction, and the role of the campus footprint activities in this.
Co-tenants (MIC)	Possible co-location requires ongoing partnerships and consultation with co-tenants. Specific interests with TAFE around course and curriculum development and integrated pathways.
Industry	Significant consultation with industry has been undertaken with industry to determine skills and workforce needs.
Latrobe City	The university conducts regular consultation with Latrobe City.
Local schools	Interested in post-secondary education. Federation has met with schools and principals in its catchments to work towards alignment between the university's offerings and student needs.
Morwell Tech School	The Tech School can play a major role in increasing awareness amongst secondary students of the career opportunities in RE.
Staff upgrade project	Key to the university delivering on its purpose.
Student body	The university's primary customer group.
Community	Interest in training provision in their local area. Most community engagement occurs through LGA Councils.

Table 16: Stakeholder engagement

6.4 Social impacts

At a regional level this benefit is highlighted, showing the relationship across Victoria's LGA of the number of people with a higher education qualification to the SEIFA score (higher is better socio-economic outcomes).

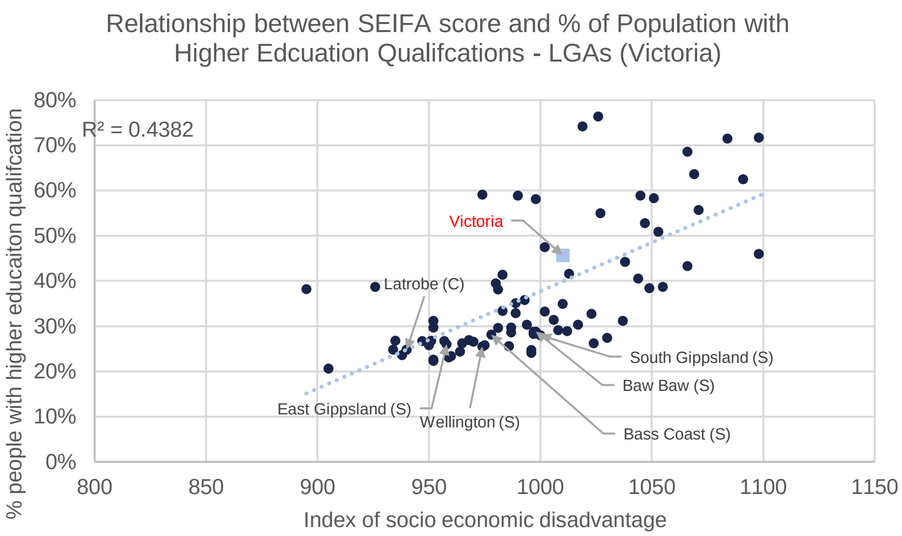

Figure 10: SEIFA *scores* and higher education

All of Gippsland LGAs are below average for percentage of people with higher education qualifications, so it is unsurprising that they have significantly below average SIEFA scores. Regionally Gippsland has two of the four lowest levels of percentage of people with higher education qualifications and SIEFA index.

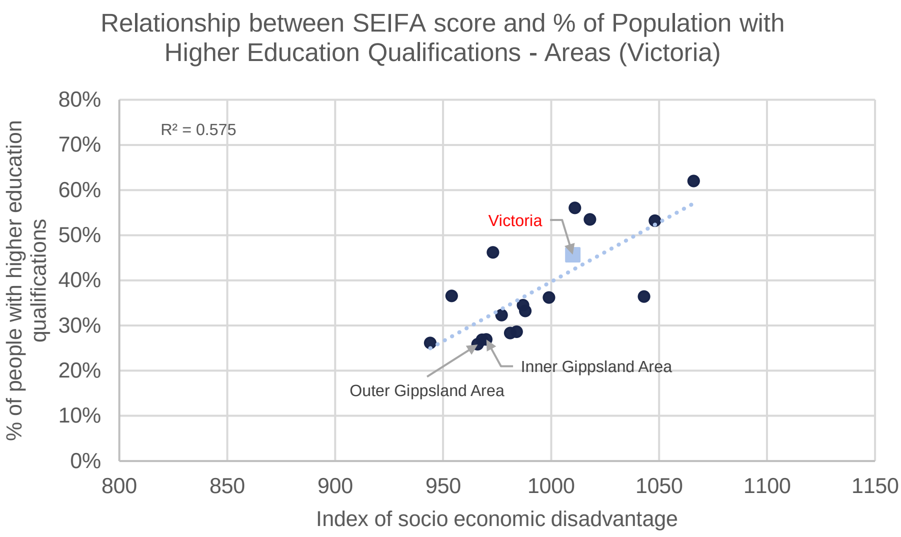

Figure 11: SEIFA score *and* Gippsland

It is estimated that university graduates have a lifetime earnings dividend of 37% as result of their of university education. In undiscounted terms this equates to around $674,000. These private benefits deliver society wide benefits (public benefits), which are valued over a lifetime of $891,000 for the average worker with a bachelor's degree, relative to a person with no post-school qualifications (Deloitte Acess Economics, 2020).

All of Gippsland's LGAs also have lower levels of people under 19 years of age who have completed year 12 compared to the Victorian average, as well as low levels of the population who have not completed year 12, well below Victorian averages.

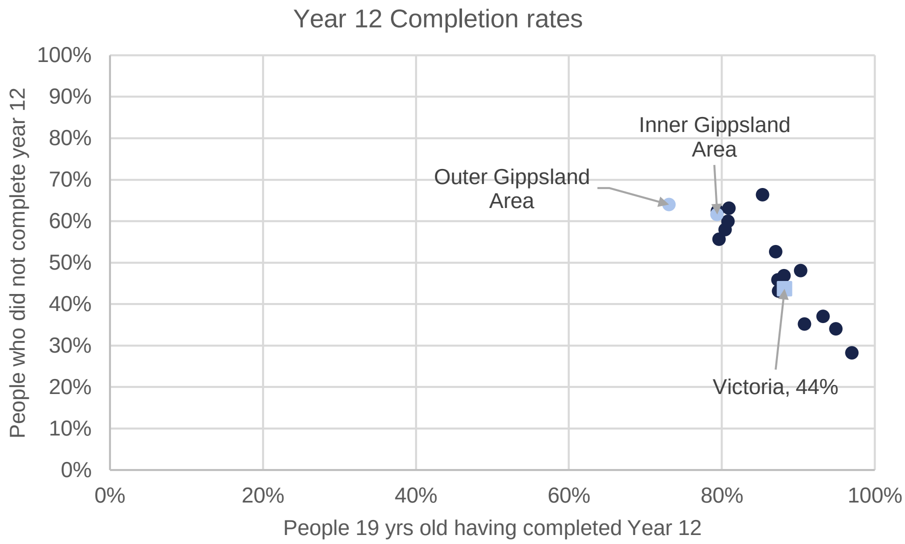

Figure 12: Year 12 completion *rates*, Gippsland

The cost of failing to address the real economic and social impacts of exclusion from the workforce can have significant detriments over the course of an individual's lifetime. Defining "early leavers" as a person who does not complete year 12, the lifetime (19-62 years of age) financial cost of disengagement is $334,000, while the social cost for that same person is $616,200 based on the impacts of lower tax revenues, higher dependence on public health and higher costs on crime and law enforcement systems (Lamb & Huo, 2017).

Higher education and vocational training generate positive social impacts by increasing the skill levels of Victorians, leading to more and better opportunities for participation in the workforce while reducing the chances of disengagement from education and work.

6.5 Environmental impacts

This project directly provides large and significant environmental outcomes, supporting the Victorian renewable energy target of net zero emissions by 2050.

6.6 Site capacity requirements

The Tertiary Education Facilities Management Association (TEFMA) maintains a range of facilities and facilities management benchmark data. TEFMA has a rule of thumb benchmark of 14-15m^2 gross floor area (GFA) / equivalent full time student load (EFTSL) for higher education.

With planned student numbers of, 30 in total in year one, each with 16 contact hours, using the more conservative metric and 50% of these at Gippsland, around 225m^2 will be needed to support the initial intake. If total enrolments are 150 (expected maximum in this business case), with an estimated 50% (75) of these at Gippsland, then total GFA needed will be in the order of 1,350m^2.

In addition, partnership / industry staff will need to be located, requiring around (2 x 12.5m^2) another 25m^2. Administration can be completed from existing sites, and both Churchill and MIC have meeting rooms, facilities, etc. that would also be needed to support teaching, student activities and industry engagement. Locating the GRETC at either the existing Churchill campus or the MIC would further leverage these assets.

Federation academic staff have advised that lab space can double as teaching space. There will need to be some allowance for infrastructure work and connected classrooms to be established.

A separate computer laboratory will be needed, capable of supporting between 15 students, allowing for another 50m^2.

Total estimated space requirements based on 50 enrolments modelled.

Function	M^2
Teaching and lab	1,350
Computer lab	50
Partnership /industry collaboration	25
Total	**1,425M^2**

Figure 13: Estimated space requirements

This model would generate utilisation of around 60% (84% x 80%), around double that of the average utilisation of university facilities, which is 30%.

These requirements mean that in the short – medium term, depending on the final configuration of the intake, students can be accommodated at the existing MIC facility, as well as Churchill, meaning both sites can be assessed as potential location options. Once student numbers at Gippsland exceed 75, further capacity will be required. Locating at Churchill will not present capacity issues; however, it is foreseeable that capacity constraints will arise at MIC, particularly if there remains high demand from industry to locate at the site.

Over the medium term, the proposal is to develop separate lab and teaching space, with the lab being co-located at TAFE Gippsland, making best use of available space at this facility, and leveraging common infrastructure.

6.6.1 Car Parking infrastructure

The MIC site can appear somewhat congested with the site becoming increasingly active. Car parking is limited with overflow areas generally in use. In the medium term, as further activation occurs, parking capacity will need to be addressed.

In a similar vein, increasing student use will require public transport and bus services to be considered and possibly recalibrated to accommodate additional users.

6.7 Integrated analysis and options ranking

To determine the suitability of potential sites, a multi-criteria model was developed using benefits and risk categories. The model identified the critical site and building attributes and weighted them in accordance with relative importance. The criteria and weighting are detailed in Table 17.

Scoring was provided out of 5 for each of the sites reviewed. Scoring was completed based on the framework set out in Table 17.

Attribute	Which means	Weighting
Building capability		
Amenity	General site amenity supports student attraction	5%
Site access	Access to industry, local activities play a role in site attractiveness	5%
Lab suitability	Lab is considered critical to program success. Site must be able to support lab and lab activities in unimpeded manner	10%
Teaching suitability	Facility must be able to cater for teaching requirements including technology and connected classrooms	10%
Student attraction	Student attraction, particularly local, is considered important to program success. Facilities, infrastructure, academics, amenity, location and access all have a role to play in student attraction	10%
Facilitates pathways	Facilitates pathways into and from courses as well as with industry	10%
Attracting academics	Academic attraction is considered important to program success. Facilities, amenity and infrastructure have a role to play in academic attraction	10%
Ability to support growth	Capacity to grow the capability within the facility	10%
Industry attractiveness and engagement	Presenting an attractive option to industry to utilise the facility is important. Scoring is skewed towards facilitating ease of access to industry for research and development	15%
Leverage existing assets	Site utilises existing assets rather than requiring new ones to be built or accessed	15%
Risk considerations		
Opex costs	The comparative costs of operation will be an important consideration.	30%
Capex costs	The comparative costs of establishment will be an important consideration.	20%
Admin & complexity	Complexity of program model including ongoing management	10%

Control over assets	Program needs to be able access assets and facilities in unimpeded manner.	40%

Table 17 – MCA scoring model

The MCA analysis conducted on the two identified sites is outlined in Table 18.

Building capability	Churchill	Precinct	Weighting	Churchill	MIC
Amenity	2	4	5%	0.10	0.20
Site access	1	4	5%	0.05	0.20
Lab suitability	4	3	10%	0.40	0.30
Teaching suitability	3	3	10%	0.30	0.30
Student attraction	2	4	10%	0.20	0.40
Facilitates pathways	2	4	10%	0.20	0.40
Attracting academics	3	4	10%	0.30	0.40
Ability to support growth	4	2	10%	0.40	0.20
Industry attractiveness and engagement	3	4	15%	0.45	0.60
Leverage existing assets	4	3	15%	0.60	0.45
Benefits score	**28**	**35**	**100%**	**3.00**	**3.45**
Benefits weighting	**78%**	**80%**		**2.33**	**2.74**
Risk considerations					
Opex costs	-4	-2	30%	-1.20	-0.60
Capex costs	-3	-2	20%	-0.60	-0.40
Admin & complexity	-1	-2	10%	-0.10	-0.20
Control over assets	0	-3	40%	0.00	-1.20
Risk score	**-8**	**-9**	**100%**	**-1.90**	**-2.40**
Risk weighting	**22%**	**20%**		**-0.42**	**-0.49**
Risk adjusted score				**1.91**	**2.25**
Benefit / risk ratio				**5.53**	**5.59**

Table 18 – MCA Analysis

6.8 Recommended location

The results indicate that both sites would be suitable, with the MIC precinct scoring slightly higher on both the risk adjusted and benefit to risk ratio. Although the MIC has greater risk, it provides a higher benefit level.

PART 2 -THE DELIVERY CASE

7. Project solution

At a national level there are five problems related to skills shortages in the RE sector (Shah & Syed, 2022):

1. Insufficient numbers of people taking up studies in the relevant technical fields
2. The time commitment and energy investment to complete the programs
3. Training programs not fully meeting skill or workforce needs
4. Evaluating the success of RE education needs
5. Significant lags between identification of industry needs and updates to training packages

The proposed alignment of the proposed solution to the Federation vision and detailed education plan seeks to address these issues and the delivery the benefits to the region outlined above.

7.1 Federation development opportunities

The development of the GCRE provides several critical development opportunities for Federation consistent with the growth in its capabilities in the renewable energy sector. Federation has several planks to its renewable energy offering which can play a major role in the development of the renewable energy sector workforce:

- **Centre for New Energy Transition Research (CNETR)** - Launched in 2022, the new CNETR responds to the pressing need for research, training and skills development in new energy. This need is particularly urgent in regional Victoria, where legacy modes of power generation are being joined by multi-modal and widely distributed forms of new energy generation, transmission and storage.
- **Centre for Smart Analytics (CSA)** - Smart living and education for the citizens of tomorrow. Also launched in 2022, CSA aims to meet the grand challenges of developing smart and resilient cities, regions and industries. CSA brings together expertise from across Federation and partner organisations to harness digital technology, develop new knowledge and enable the development of secured, sustained and growth-focused socio-economic systems
- **C4NET** - In 2017 the Victorian Government provided $5.4 million in seed funding over four years to establish the Centre for New Energy Technologies (C4NET). C4NET seeks to deliver innovative solutions to complex challenges within the energy sector. The centre is designed to bridge the gap between research, industry and government, solving problems through practical, data-driven collaborations. Federation is a foundation member.
- **APRETC –** Federation has developed APRETC to provide training and workforce development for the renewable energy sector. It provides accredited training in the following: Certificate III Engineering (Composites), Manual Handling, Working at Heights, Confined Spaces, Working with fire extinguishers and First Aid. Non-accredited training includes Global Wind Organisation Basic Safety training (BST), Global Wind Organisation Basic Refresher training (BRT) and BZEE Turbine Technician training (BTT). Enrolments in 2023 represent students using the existing APRETC stage one tower and total 190 students. APRETC stage two is expected to support an additional 440 students per annum.
- **Future Regions Research Centre (FRRC) –** Aims to create new knowledge and innovative solutions to the grand challenges that impact both our natural and constructed environments. Mine rehabilitation social licence and regional transition are major components of the research agenda.

7.2 The Cooperative model

The Federation University cooperative model includes industry-informed and co-designed curricula authentic assessment and work integrated learning opportunities for all students. The intention is also to offer a unique course which provides graduates with the right mix of theoretical and practical skills and to provide certainty to industry, who will be employing graduates. The key features of the education plan are built around the following elements:

- Multiple entry and exit points
- Strong integration with TAFE and TAFE pathways
- Links to the Tech School
- Recognition of prior learning (specifically for existing workforce)

- Workplace integrated learning / physical placements
- Providing access to industry qualification so graduates are “work ready”
- Industry partnership approach to co-design/create the course to ensure the course meets employer needs
- Providing industry opportunities for co-delivery aspects of the program
- Flexible delivery models (virtual, connected classrooms, block mode)
- Integration of digital skills across all programs
- Integrate critical work skills across the program platform (interpersonal, innovation, digital literacy, problem solving, leadership)
- Quality academics, with national and international credibility
- Use of 3rd party providers to deliver aspects of the course, likely industry training components

There is no other program in Australia offering of this blend of skills, qualifications, and work experience. This opportunity presents the necessary competitive differentiation to underpin the courses’ success.

Importantly, the stage one courses are well advanced in their development and can be rolled out quickly in response to market demand.

Key features of the cooperative model include:

- Resourcing during start up and ongoing of *industry partnerships function* whose key role will be working with the demand side of the market ensuring industry needs are reflected in course content, coordinating physical placements for students, growing opportunities for graduate placements and working with potential suppliers who provide components of the program such as industry qualifications
- Builds on *existing capability* in engineering and renewable energy
- *Physical work placements*, which are favoured by industry, meet industry needs. AEMO currently has a graduate placement model that has been identified as potentially suitable for replication. Initial opportunities have been identified in the large engineering consultancies who provide many of the services that will be used in the RE projects design, construction and commissioning
- *End to end pipeline* of students with awareness of the career opportunities in RE extending into secondary schools, and particularly through the active engagement of the Morwell Tech School

Educational and learning aspects are detailed below in 7.3.

7.3 Education plan

The HE education plan is built around two stages. The courses in the first stage are Bachelor of Engineering Technology (Renewable Energy), Bachelor of Engineering (Renewable Energy) and Associate Degree in Design Drafting and Construction Management program. These course offerings and program structure have been developed.

The programs have been developed with attributes that respond to (1) industry needs and expectations and (2) local (regional) needs, including being able to meet the needs of current energy and mining workforces.

The skills need identified by industry are for stage two, but where course offerings have not yet been developed, they are associated with mine rehabilitation and community engagement / social planning.

These courses align to the FRRC where mine rehabilitation is an established research stream and the community social planning fits under the existing society and heritage study stream.

The Cooperative Research Centre for Transformations in Mining Economies (CRC-TiME) are interested in developing or supporting curriculum materials in mine rehabilitation, economic transition, new enterprise (e.g. renewable energy) and social license developed and shared at a national level. The CRC has eight hubs across Australia – with the Latrobe Valley being one of them.

Also identified is an opportunity to build a broader course offering in renewable engineering, as opposed to renewable energy engineering. This course would be a defined stream of the engineering program with a common first year with other Bachelor of Engineering courses. The course will require further curriculum to be developed but will be able to utilise some of the materials from the proposed stage one Bachelor of Engineering (Renewable Energy).

7.3.1 Bachelor of Engineering (Renewable Energy)

The first pathway to be established under the GRETC is to expand Federation's existing Bachelor of Engineering programmes to include a major in renewable energy in Gippsland. This programme will incorporate aspects of the existing engineering programme as well as elements of the existing Master of Engineering Technology (Renewable Energy and Electrical Power Systems) programme. Because the proposed programme incorporates those existing elements, the development of the programme is well advanced, requiring only the year 4 curriculum to be finalised. This can be completed over the course of the 2023 year by existing academic staff. The costs to develop the curriculum are therefore expected to be relatively low. The programme will integrate with the proposed hybrid Bachelor of engineering practice in renewable energy.

Estimated student numbers for a 2024-year commencement are 10-15 with a doubling to 20-30 commencements in the short to medium term. The programme will be offered through Ballarat, Gippsland and online pathways. Commencement in 2024 will also provide sufficient time to undertake marketing efforts to increase awareness of the programme amongst existing secondary students.

Program structure based on the existing Bachelor of Engineering (Electrical and Information Engineering)

Year 1

- Professional engineering
- Engineering physics
- Materials in engineering
- Modelling and change (introductory level)
- Engineering design and drafting
- Engineering mechanics
- Engineering computer modelling
- Linear algebra and applications

Year 2

- Professional practice
- Signals and systems
- Digital logic and electronic systems
- Big data and analytics
- Modelling continuous change
- Engineering project management and sustainable design
- Principles of renewable energy sources
- Electrical and electronic drives and actuators
- Modelling and change (advanced level)

Year 3

- Power electronics
- Power systems analysis
- Engineering computer applications and interactive modelling
- System dynamics in control
- Engineering research methodology and management
- Power system protection
- Digital communication principles
- Digital imaging and artificial intelligence

Year 4 to be developed from the following courses in the Master of Engineering Technology (Renewable Energy and Electrical Power Systems)

- Power electronics
- Power systems analysis
- Sensors and artificial perception
- Engineering project management theory
- Principles of renewable energy sources
- Research and quantitative methods
- IOT in smart energy systems
- Advanced control systems engineering
- Electrical Power Distribution engineering
- Advanced engineering project 1
- Microgrid and energy storage systems
- Power electronic application to renewable energy systems
- Advanced engineering project 2
- Electrical demand forecast and management

7.3.2 Bachelor of Engineering Technology (Renewable Energy)

The second pathway is through a true hybrid structure that builds on a AGF5 first year largely delivered by TAFE (Diploma of Applied Technologies). An overview of the structure, key entry, exit and employment positions for the BEng (RE) course is shown in Figure 14. Entry points are available in years 1 & 2 and exit points, with recognised qualification leading to in-demand careers, are available at the end of year 1,2 and 3.

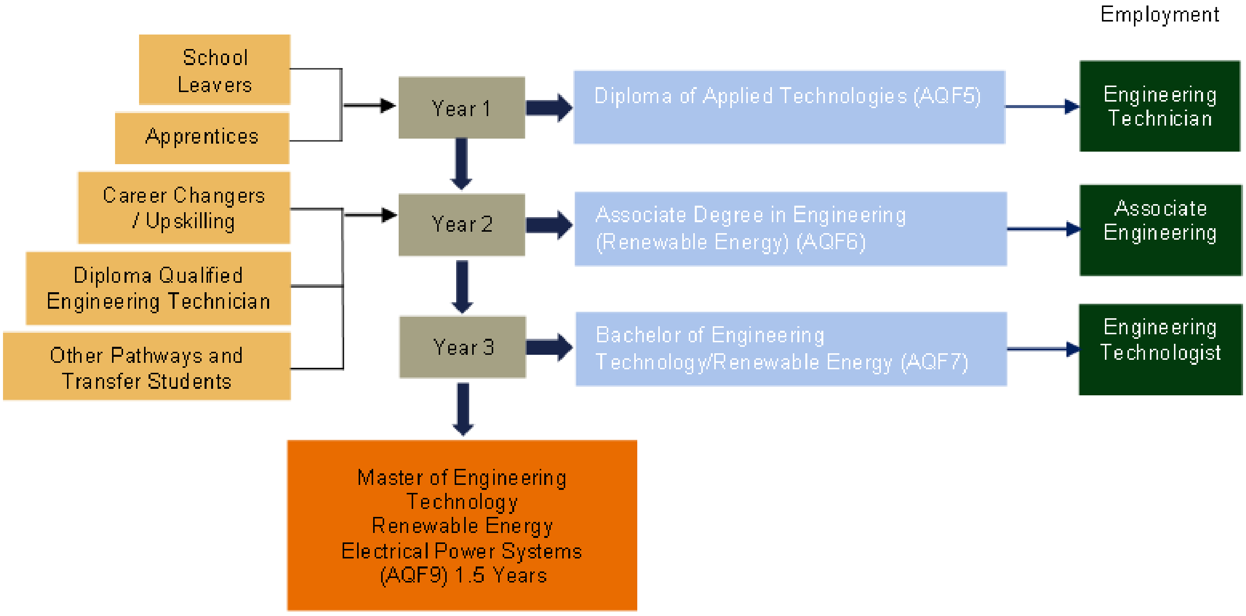

Figure 14: Proposed Bachelor of Engineering Practice (Renewable Energy)

The year one structure (Figure 15) shows the highly integrated TAFE aspects, with six of the eight units integrated to TAFE and the exit option of a Diploma of Applied Technology.

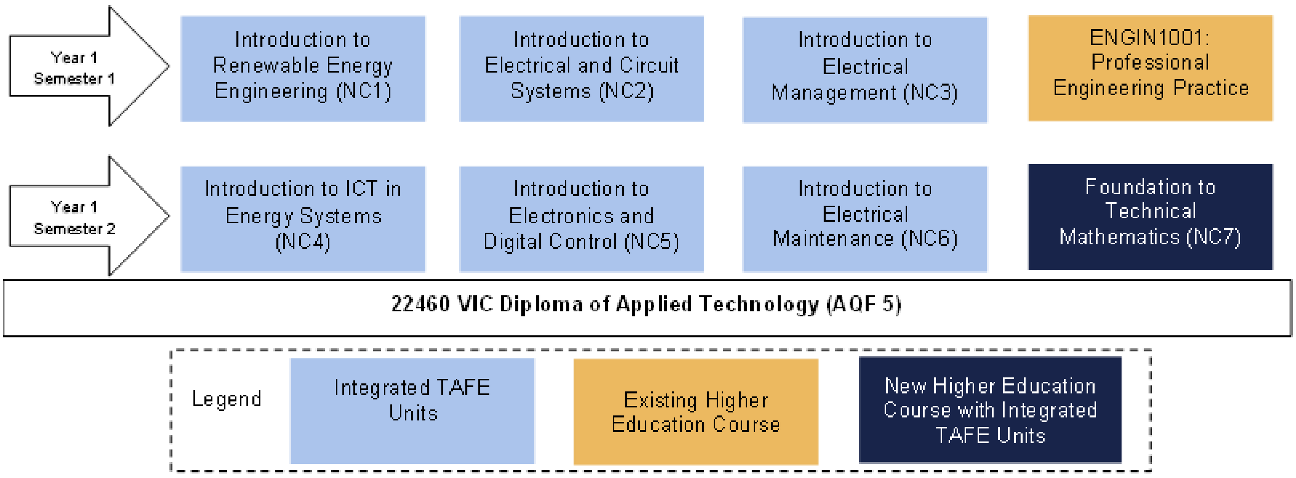

Figure 15: Proposed structure of year 1 of the new Bachelor of Engineering Practice (RE)

The second year (Figure 16) highlights the extent of course development, with an exit with an Associate Degree in Engineering (Renewable Engineering).

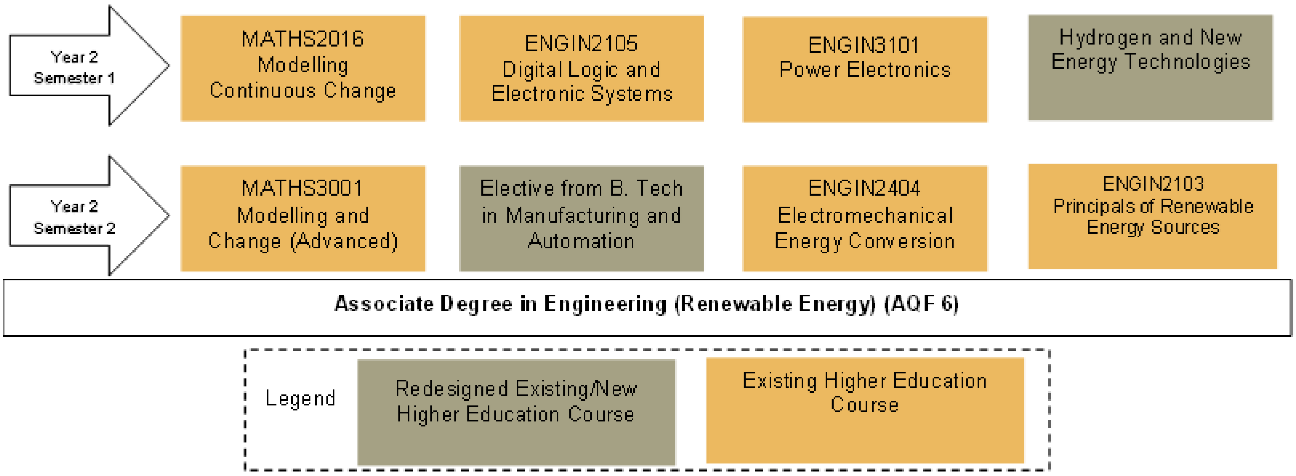

Figure 16: Proposed second-year structure of the new Bachelor of Engineering Practice (RE)

Figure 17 shows the third-year program, with six of the eight units being sourced from existing higher education courses. The exit point is the Bachelor of Engineering Practice (Renewable Engineering Program). Continuation leads to the existing Master of Engineering Technology Renewable Energy Electrical Power Systems (AQF9), requiring a further 1.5 years.

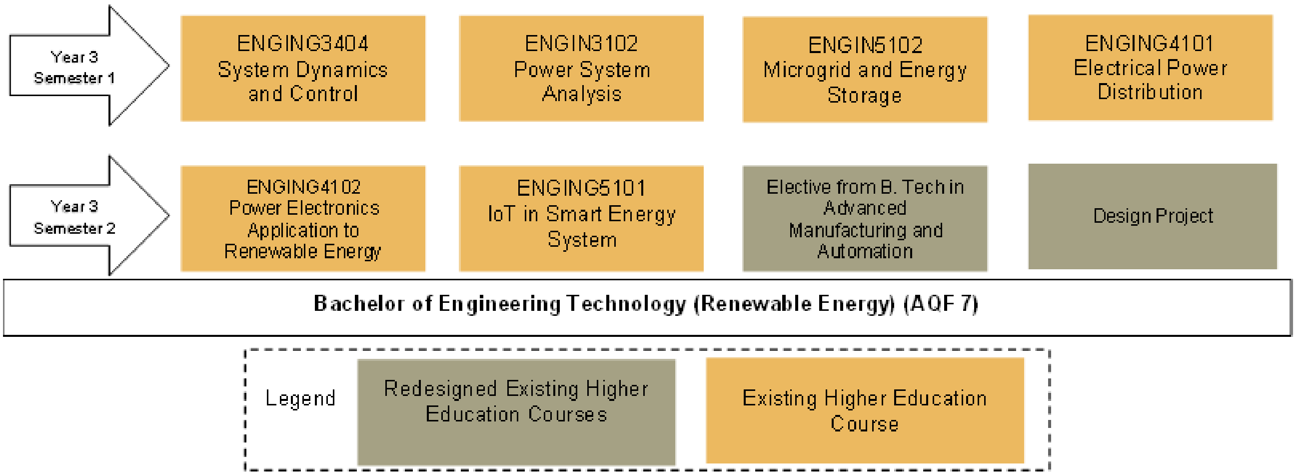

Figure 17: Proposed third-year structure of the new Bachelor of Engineering Practice (RE)

7.3.3 Work skill integration

Critical work skills will be integrated into the program as follows:

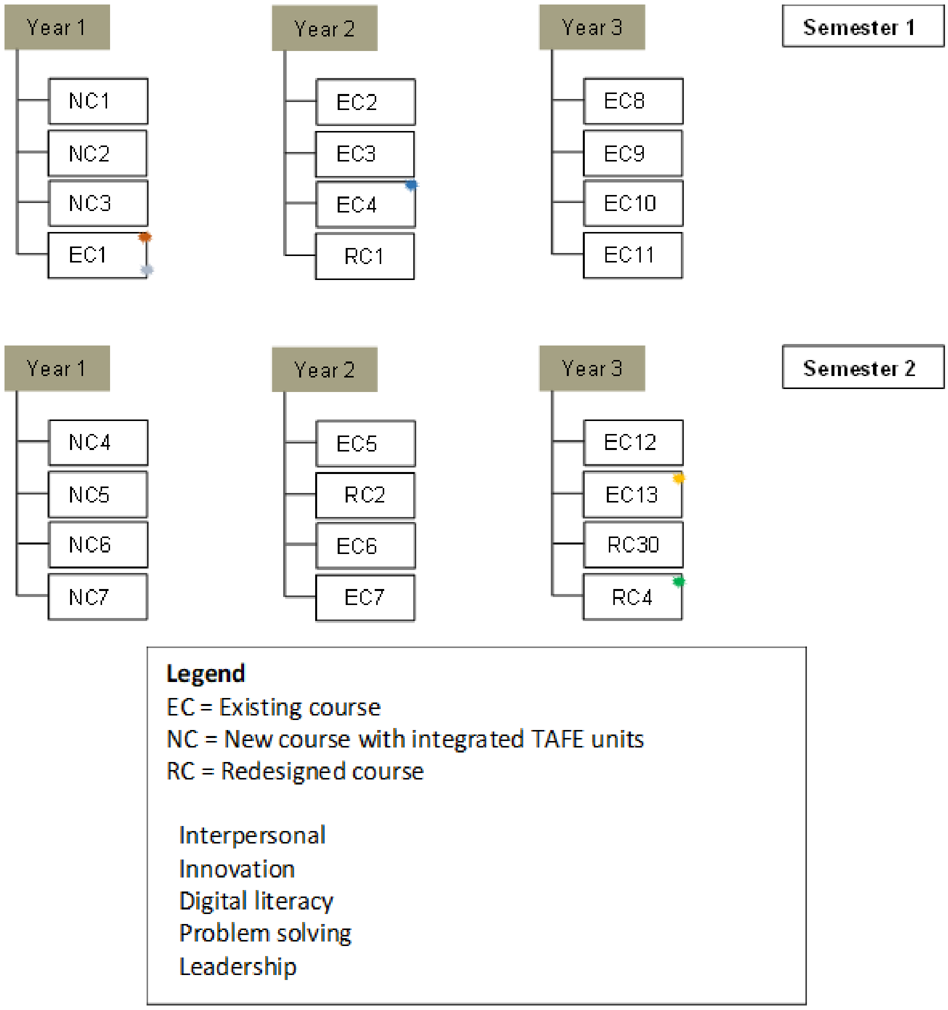

Figure 18: - Work skills Integration

7.3.4 Associate Degree in Design Drafting and Construction Management program

An overview of the structure, key entry, exit and employment positions for the Associate Degree in Design and Drafting, and Construction Management course, is shown in Figure 19. Entry points are available in years 1 & 2 and exit points, with recognised qualification leading to in-demand careers, are available at the end of year 1,2 and on to Bachelor Engineering (Civil).

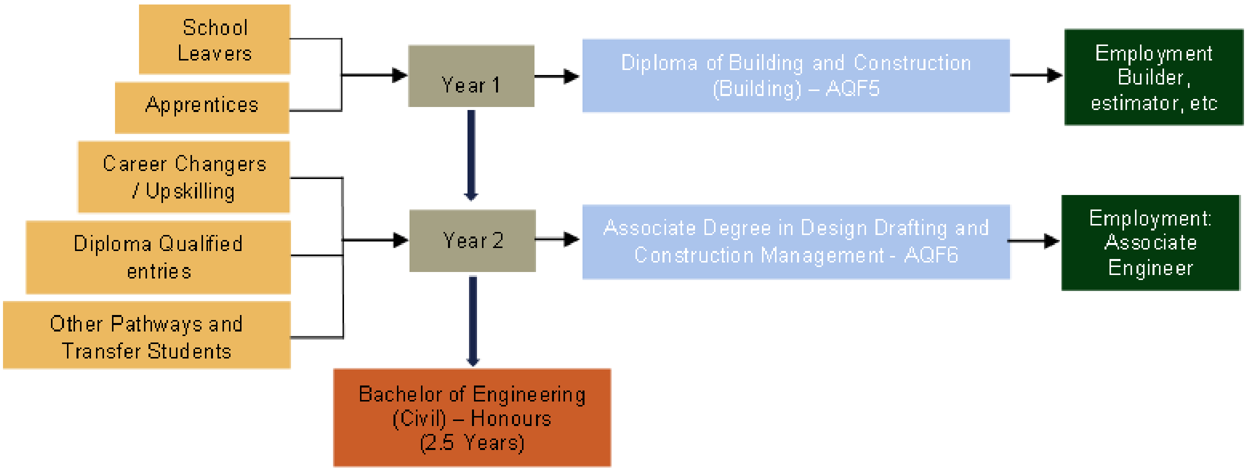

Figure 19: Proposed qualification development and pathway for the new Associate Degree in Design Drafting and Construction Management program

The year one structure (Figure 15) shows the highly integrated TAFE (Diploma of Building and Construction (Building) into the degree. Six of the eight units needed are TAFE units, and two are existing HE courses.

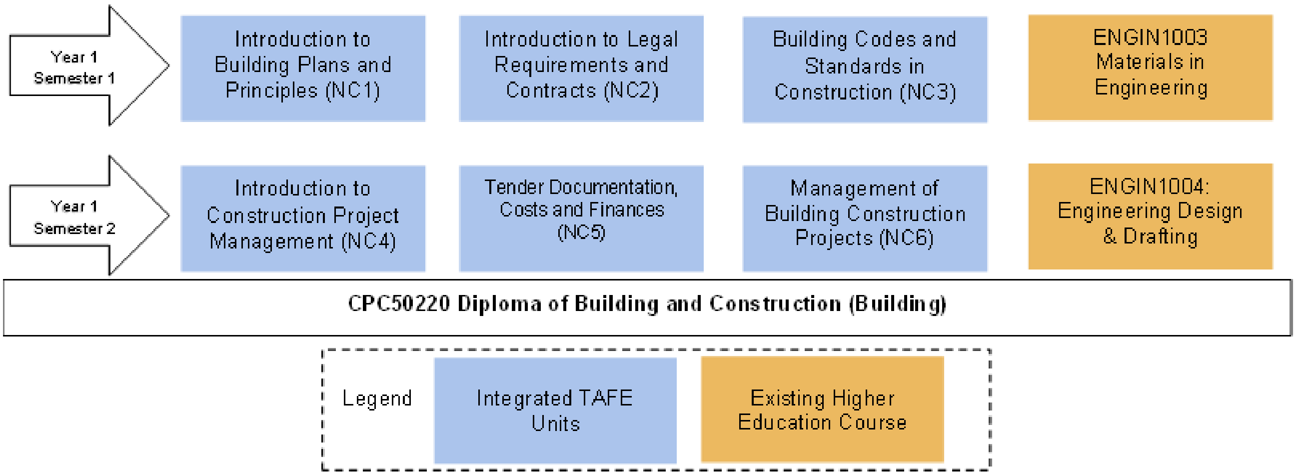

Figure 20: Proposed structure of year 1 of the new Associate Degree in Design Drafting and Construction Management program

The second year (Figure 21) highlights the extent of course development, with an exit with an Associate Degree in Design and Construction Management. There are four existing units, and a requirement to design three new units.

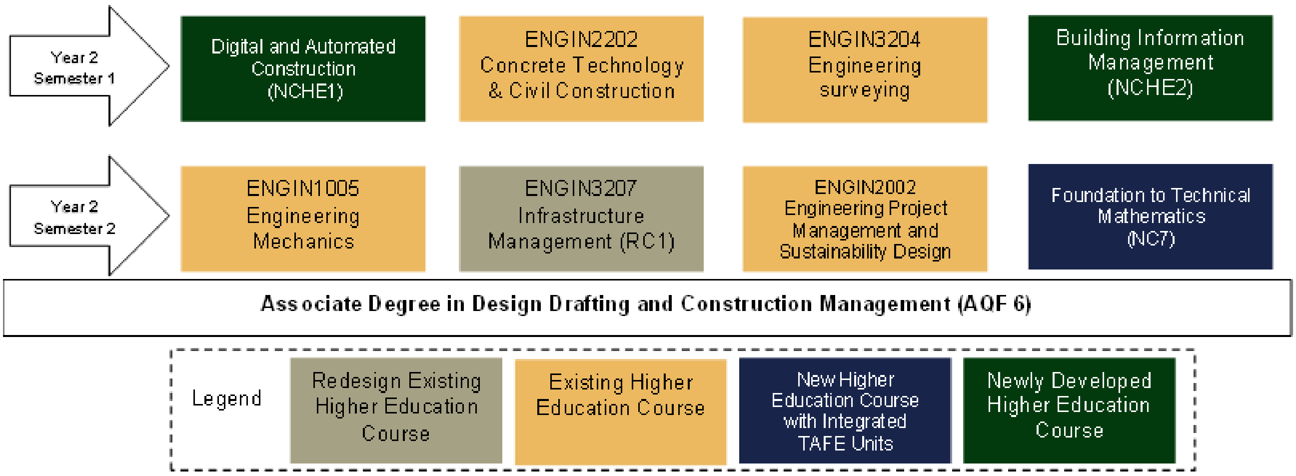

Figure 21: Proposed structure of year 2 of the new Associate Degree in Design Drafting and Construction Management Program

7.3.5 Industry qualifications

There are a range of industry qualifications that will need to be embedded in the course, including:

Course	Current RTO’	Location
GWO – Basic Safety Training (BST)	Altec Australia Pty Ltd, Canberra Institute, of Technology, Federation University, Fire, and Safety Australia, Skylar Safety, Thomson Bridge Pty Ltd, Vestas Wind, Technology Australia, Wright Training	Melbourne, Canberra, Adelaide, Sydney, Mt Helen
GWO Technical Training	Federation, APRETC	Mt Helen
Basic Offshore Safety Induction and Emergency Training (BOSIET)	ERGT	Perth, Darwin, Melbourne
Helicopter Underwater Escape Training (HUET)	ERGT, Life Flight Training Academy, Ace Training Centre	Melbourne, Darwin, Perth, Sydney, Queensland (various locations)
AMSA Integrated rating of Proficiency	Australian Maritime College, South Metro TAFE, TAFE NSW, Newcastle	Hobart, Fremantle, Newcastle

Table 19: Industry qualifications

7.4 Alignment to Campus Vision

This business case aligns to Federation’s key strategic documents. The following points are noted from the Campus Vision:

Element of Campus Vision	How this project meets objective
<u>For Students</u>	
Courses and program offerings increasingly focussed on areas of jobs growth	Evidence of strong and ongoing demand in RE sector
Co-design programs with industry to ensure they are relevant and practical	Industry involved in program design and features
Aim to have every Fed student involved in workplace learning throughout their studies	Built into proposed delivery model
Students will graduate with a core set of skills developed with industry that will make them job ready and will future proof their careers	Curriculum designed to meet industry needs
Fed experience unique within Australia's higher education sector	Proposed offer is a unique combination of core skills and industry-based training and qualifications
Better use of digital technology	Embedded in course
Blending face to face learning with immersive online forums	Connected classroom model and virtual options offered
Connected classrooms bringing together staff and students from across the campus network	Connected classroom key feature
Classes taught simultaneously in person and online in a highly interactive digital experience that will overcome physical distance	Embedded in course design
<u>For community</u>	
Almost 70% of graduates live and work in regions	Target is young people in Gippsland
We have a key role in driving economic growth and jobs in our regions, providing skilled graduates to local employers and boosting productivity through research and innovation	Program supports unique industry development opportunities for Gippsland and regional Victoria
<u>For our partners</u>	
Our industry partnerships help us drive economic growth in our regions	Partnerships model and engagement built into business case
Our industry partnerships will increase as we shift towards workplace learning and program offerings driven by jobs growth and demand	Workplace learning key feature of the proposed program
We will expand our Tech Park model to welcome aligned enterprises into our ecosystem	Recommended location in existing Tech Park portfolio
Workforce skills will be a key driver of economic growth over future years	Project links specifically to workforce skills growth and future demand
We plan for our campuses to become regional employment and skills hubs that will be linked to providing better services to our regional communities	Location at MIC emphases link between employment and skills

Table 20: Alignment to campus vision

7.5 Financial analysis

The capital and financial costs of establishing the GRETC at the MIC are detailed in this section.

7.5.1 Project cost estimates

Building configuration

Building works at either site will be minimal, with possible reconfiguration works.

Total $50,000

Curriculum establishment

While most of the curriculum has been developed, there is a need to develop curriculum for all proposed HE courses.

- Bachelor Engineering Practice (RE) requires one new and four redesigned units together with the TAFE program
- Ass Deg Drafting and Construction Management requires three new and one redesigned course
- Bachelor of Engineering (RE) needs year four to be developed

Allow estimated cost of development / purchase

Total $700,000

Teaching requirements

Teaching and facility set up for teaching is minimal:

- Connected classroom technology, provide for $100,000
- Classroom infrastructure, say $10,000

Total $110,000

Laboratory requirements

A detailed laboratory and plant and equipment listing has been provided by Federation academic staff. Total estimated costs are $1,098,000, of which $612,000 is quoted. The remaining $486,000 is awaiting quotation with estimated pricing. Allow an additional 10% to cover total contingency, for lab plant and equipment

Total $1,207,800

Hardware and computers

Include an allowance for 15 x $3,000 including set up and configuration.

Total $45,000

Industry partnerships

Provide an allowance for the establishment of partnership aspects of the program of, say, $300,000. This would cover initial employment of staff, partnership engagement, accreditation and project support. This will be quite an intense start-up phase that will require resourcing for the courses to commence in late 2023.

Provide for additional $600,000 over 3 years for marketing and brand building, with $300,000 in year one, $200,000 and $100,000 in year three.

Establishment and set up

Provide an allowance of $100,000 for set up, administration, commencement, marketing, web site, etc.

7.5.2 Total program costs

Total project commencement costs are estimated to be $3,000,000 ex GST.

Program component	$ (ex GST)
Infrastructure and capital	
Building works	50,000
Teaching infrastructure	110,000
Lab plant and equipment	1,207,800
Hardware, computers	45,000
Total capital costs	**$1,302,000**
Operational expenditure	
Curriculum	700,000
Industry partnerships / cooperative model	900,000
Program set up and establishment	100,000
Total operational expenditure	**$1,700,000**
Total set up and establishment	**$3,002,000**
Say	**$3,000,000**

Table 21: Project funding requirements

7.5.3 Ongoing operating model

Once established the centre will require a teaching model and industry engagement resourcing. The following ongoing operating costs are estimated:

Academic and teaching resourcing

- Academic staff required to commence the program from year one, 1 x Level A,B,C and E, with a combined staff salary cost of $548,000 + 30% on costs
- Based on ratio 1:20 student, @ average of $175,000 per staff + 30% on costs
- 0.5 – 1.0 administration and general support staff @ $70,000 per staff + 30% on costs
- Teaching support / supplies - $250 per student per annum
- Annual maintenance / building cost contribution 1% of equipment needs
- Head office and support recovery costs per annum - $20,000

Industry engagement and partnership resourcing

- 1.5 x industry engagement staff to support industry partnerships / work placements and related party suppliers @ $130,000 per staff + 30% on costs
- Provision of $50,000 for annual industry engagement and supplier activities, including $24,000 per annum for guest lecturers

Revenues per course

Revenue per student is based on government contributions under the Commonwealth Grant Scheme and maximum student contribution amounts for a student place (ESFTL) for 2023 of $8,301 student contribution and $16,969 Commonwealth contribution, a total of $25,270.

Bachelor of RE program and the Associate Degree, two years (Bachelor of RE year one is delivered by TAFE) and Bachelor of Engineering is three years

Completion rate of 75% forecast

7.5.4 Course enrolments

Expected commencements are outlined as follows. At this point all commencements are considered domestic enrolments.

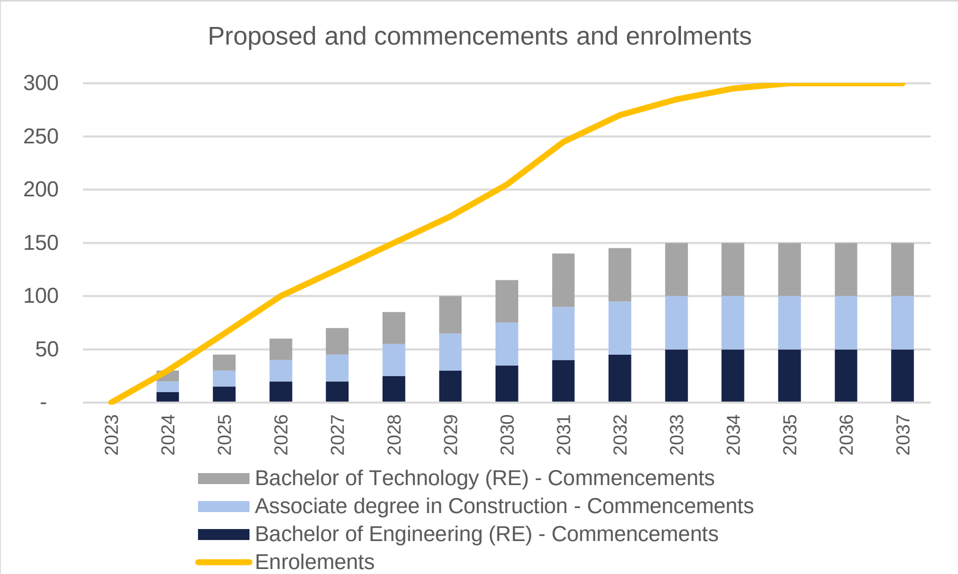

Figure 22 Student commencements and total enrolments:

In terms of context, there are just over 8,500 domestic EFSTL commencements in 2020 in Bachelor Engineering degrees across Australia (Department of Education Skills and Employment, 2022), which is down from the peak in 2014 of 8,900.

The Federation demand of 150 EFSTL commencements represents 1.8% of national annual engineering enrolments indicating that there is sufficient demand in the national market to support this program.

7.6 Financial and economic results – Federation

Based on these assumptions, the financial model for the program over 15 years is as follows:

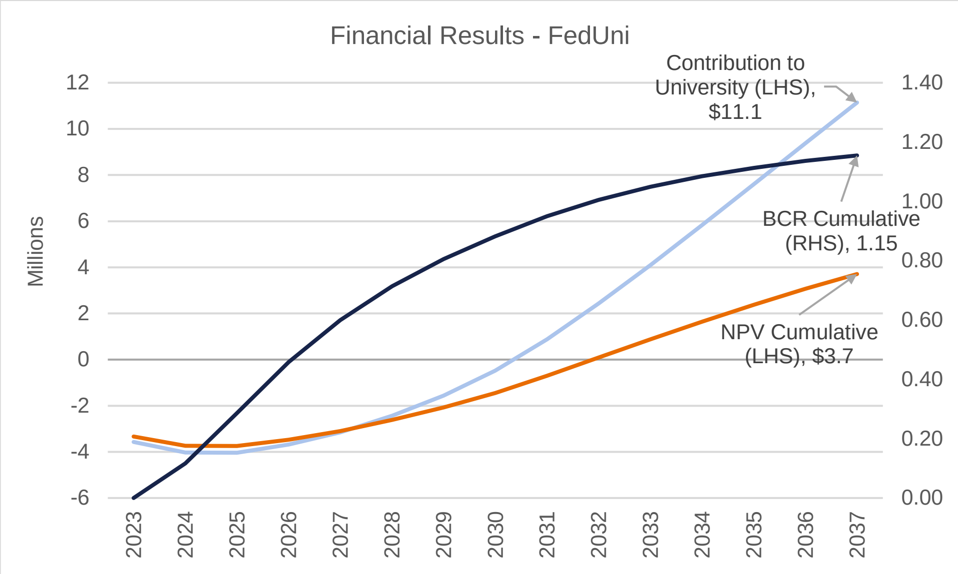

Figure 23: Financial results

The contribution to Federation over 15 years is forecast to be around $11.1M, with an NPV @7% of $3.7m. There is a BCR of 1.15, IRR of 15.8% and MIRR of 12.2%. Payback occurs around year 7 (proposed 2030/2031).

7.7 Uncertainties

The major uncertainty relates to the response of other education providers. The growth in the renewable energy industry will be significant over the coming decades. Competition will increase from private and public providers of RE courses. This business case identifies an opportunity for Federation to develop a suite of courses that meet the immediate and identifiable demand in Gippsland (and more broadly) for RE skills. How other providers respond has the potential to impact this business case.

7.8 Commercial & Procurement

7.8.1 Procurement strategy

The project will be subject to Federation's procurement policy.

7.8.2 Commercial and procurement risk assessment

The primary risks from the project and their mitigation strategies are detailed as follows:

Risk	Risk Level	Mitigation
Budget overrun There are some items of the budget that may increase and remain unquoted.	Medium	• Contingency included to cover expected upside of risk • Indicative quotations for lab equipment provided by experts
Access to equipment	Low	• Federation owned and managed via appropriate access agreements
Capacity at MIC	Medium	• Overflow through TAFE and labs • Precinct structure and governance arrangements
Student attraction	Medium	• Significant marketing budget proposed • Utilise Tech School on precinct • Pathways and integration
Industry partnerships	Medium	• Working group established • Industry consultation for project • Project framed around industry needs and cooperative model
Speed to market	Medium	• Course materials largely developed for Y1 and Y2 entry • Planned 2023 commencement – second half of year

Table 22: Commercial and procurement risk assessment

7.8.3 Planning, environment and heritage culture considerations

There are no material planning, heritage and cultural considerations.

7.8.4 Project budget

A project budget is provided at $3.0M. Details of expected lab requirements $1.3m are provided in Appendix A.

7.9 Governance framework

The project will be overseen by Head of Campus – Gippsland which has responsibilities for the operations of the MIC. The critical academic appointment will be Dr Rakib Shah, currently employed the Centre for New Energy Transition Research (CNETR). Rakib has worked and consulted with industry as part of the planning for this project.

An ongoing industry skills taskforce (Gippsland new energy skills taskforce) has been established to oversee the skills development and acquisition needed for offshore wind projects. This will be the primary reference group for the project and represent ongoing industry consultation.

The project will fit into the existing Federation governance model, including: the Vice-Chancellor's Senior Team and Governance and Strategy Committee.

The project will also have reference to the Gippsland High Tech Precinct Governance arrangements.

Once operational, the project will be established under the Institute of Innovation, Science and Sustainability (IISS).

7.9.1 Stakeholder and communications plan

Ongoing engagement will be with following stakeholders:

- Minister for Training and Skills and Minister for Higher education, the Hon. Gayle Tierney MP
- Minister for Energy, Environment and Climate Change, the Hon Lily D'Ambrosio
- Latrobe City – Community stakeholder

- Morwell Tech School – careers and aware of opportunities
- Local secondary schools – careers and aware of opportunities
- TAFE Gippsland – pathways into program and integration
- Industry & industry taskforce – employers, key partners

Federation will finalise the communications plan once the implementation begins. Responsibility for stakeholder engagement and communication will be through Federation's communications unit, Head of Campus and the program partnership function.

7.9.2 Readiness and next steps

The university is ready to take the next steps:

- Funding announcement – December 2022
- Project commencement – January 2023
- Curriculum development

Appendix A – Lab Requirements

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Hydrogen and Fuel Cell Research (H2-FC) Facility

Location: Federation University Australia, Gippsland Campus - Churchill

Context: The proposed ($1.37M) facility lies within the Federation University's Centre for New Energy Transition Research - CfNETR ($2.4M). Advancing this initiative, and focussing on Future Fuels and Hydrogen Economy, H2FC will bring the much-required H2-based research facilities to Latrobe valley. H2FC will address the following:

- **All-under-1-roof** - H2 production, Fuel Cell testing, material/component development, characterisation and systems engineering
- **Drive research and innovation -** developing new TRL 3-4 technologies
- **Working with industry at established TRL 5-6 levels**
- **Bridge the skills and training gap** via **tailored upskilling/reskilling programmes**
    - Training in materials/components, component assembly for H2 technologies
    - Lab-based training for UG/PG degree programmes at Federation Univ. starting in 2023 & 2024
    - Support apprenticeships, facilitate industry placements
- **Tap-into the region's energy-based ecosystem** (carbon and metal industry) - facilitate **transition into H2 supply-chain ecosystem – enter global H2 supply chain market**
- Serve as a platform – facilitate international H2 industry and local industry collaborations
- **Sustainable transition towards net-zero** - Spread public-awareness about H2 technologies and safety, generate interest among the next-generation and future workforce
- **Enabling the region to deliver as the Clean Hydrogen Industrial Hub**

Scope

The facility will house state-of-the-art polymer electrolyte membrane electrolysers and fuel cell (PEMFC) test-stations for single-cell and stack testing, essential for studying life-cycle analysis, end of life and balance of plant research. It will also include tests-stations for direct methanol fuel cells (DMFC), potentiostats for electrochemical studies, other peripheral equipment to support wet chemistry and powder processing, and material characterisation facilities (XRD, Raman spectroscopy, BET - complementing existing facilities at Carbon Technology Research Lab - CTRL, $2.3M, focussed on upcycling carbon waste into medium/high-value carbons, electrodes). Working with the CTRL, the new H2-FC facility will enable the advancement into component development **for next-gen H2 and FC technologies**. The H2FC facility will enable in-house development, characterisation and testing of novel materials/hybrids and components for hydrogen (H2) -storage, electrocatalyst development (HER, OER, ORR, HOR), proton conduction, gas distribution within FCs and electrolysers. The R&D scope of this facility includes:

- **Addressing existing challenges for PEM electrolysis** - for sustainable H2 production, enhancing efficiency, removing cost-barriers
- **Addressing key challenges faced by PEMFCs and DMFCs -** at the material, component, single-cell, stack and system level. Optimization for specialized transport, portable, stationary applications
- **Driving innovation -** utilizing CfNETR's computational expertise blended with lab-based research to develop TRL 3-4 technologies while simultaneously working with industry (TRL 5-6) for H2 production, storage, transportation and other applications
- **Providing end-to-end training** (Doctoral, UG/PG) - component development (electrocatalyst, membrane, GDL, BPP geometries), characterisation/testing, MEA assembly, single-cell and stack testing
    - Exploring novel nanostructured 2D and 3D hybrids (graphene, nanocarbon, metal, biopolymers)

- Developing tailored component designs/ hybrid components to maximise efficiency
- Using composite and multilayered membranes, nanostructured aerogels/foams, in combination with synthetic biology, biopolymers, other hybrid approaches for H2 storage, purification (blue H2 sources), methanol and ammonia as H2 carrier
- Cost-effective, corrosion-protective coatings and efficient fluid flow designs for bipolar plates
- Systems engineering - combining computational and lab-based research

- **Integrating FC-PV hybrid systems into micro-grids,** edge-of-the-grid hybrid systems (H2-FC-PV and thermal storage) - capacity and optimisation using simulation and prototypes
- **Examining socio-economic aspects** of H2 tech- public perception, routes to early adoption, feasibility of H2 storage in domestic and business settings
- Evaluating approaches for **H2 integration into energy-supply mix**

National Significance

As Australia transitions into a green economy, 60% of the estimated 6000 new jobs to be created within Victoria will lie in regional Victoria. Thus, R&D facilities in the regional Hydrogen Hubs are a necessity.

Latrobe valley, identified under the Clean Hydrogen Industrial Hubs programme, has an established status of the **energy-powerhouse of Victoria**. It is geographically and strategically well-placed to further this position by playing a leading role in the growing H2 economy. Successful completion of projects - Hydrogen Energy Supply Chain (HESC –2022, Kawasaki and partners), presence of consortiums - Gippsland Circular Economy Precinct, and AusNet's plans of setting up a 10 GW renewable energy zone demonstrate the continued interest of H2 industry in the region. With more green energy projects in the offing, skilled workforce is a prerequisite.

The H2FC facility will bring the research and training, vital for sustaining H2 industry, to the heart of regional Victoria. It will provide a platform for new technologies to develop and grow beyond the big cities, **enabling Australia to address the UN-SDGs - 7, 8, 9 and 11** while **empowering regional Australia with essential H2 R&D facilities** as it evolves into a H2 Economy.

Through these, H2FC facility endeavours to **bridge the significant skills-gap**. Currently, there are **limited training programmes in the Hydrogen** domain**,** incl. applications and connected technologies (Skill Victoria). "H2 technology-relevant" materials/components/systems training will **empower Latrobe Valley's existing energy-based ecosystem -** workers and businesses (carbon industry, steel, suppliers, metal recycling, moulding and fabrication, engineering consultancy) **to enter the expanding international H2 supply-chain market**, and support new spin-offs. This will enable global players to establish regional/Australian R&D presence.

Benefits for Partner Organizations

- Access to the H2FC facilities and knowledge base of Federation Univ and Partner universities via collaborative research projects
- Access to the specially designed teaching materials modules/training courses, tools developed at H2FC
- Developing tailored training programmes for up-skilling and reskilling your workforce (Industry only)
- Leading new research projects based on immediate industry research requirements
- Conducting feasibility studies (blue sky research) with Federation Univ. and participating organisations
- Undertake pilot studies, testing new materials/components (catalysts, membranes, BPP geometries)
- Local access to electrolyser and FC material testing and characterization
- Participate in establishing Australian standards for H2 technologies
- Participate in active industry-academia initiatives and national/international consortiums

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