A TAFE ENERGY CENTRE OF EXCELLENCE

Scoping Study & Preliminary Business Case

NOVEMBER 2023

INSTITUTE FOR REGIONAL FUTURES

This report was prepared on Awabakal and Worimi Land for the Hunter Jobs Alliance by the Institute for Regional Futures. Modelled costings in Section 3.4 provided by Turbo – The Business Case Company.

The University of Newcastle acknowledges the traditional custodians of the lands within our footprint areas: Awabakal, Darkinjung, Biripai, Worimi, Wonnarua, and Eora Nations.

We also pay respect to the wisdom of our Elders past, present and emerging and acknowledge the traditional custodians of all lands referred to in this report.

Cover Image: Newcastle TAFE Campus, Tighes Hill

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About the Hunter Jobs Alliance – The Hunter Jobs Alliance is a locally-based union and community environment group formed in 2020. The Alliance is committed to delivering a safe, prosperous future for the Hunter – one in which workers, their families, and the environment thrive.

CONTENTS

EXECUTIVE SUMMARY.

Professor Peter Dawkins, the Acting Jobs and Skills Australia (JSA) Commissioner, described the challenge of providing skilled workers to support Australia's energy transformation in the landmark Clean Energy Capacity Study, released in October 2023:

> *The clean energy workforce is at the intersection of two major transformations. A transformation of how we generate, use and export energy in order to decarbonise our economy, and a transformation of how we deliver skills through higher education, VET, migration and on-the-job training to grow our workforce.*
>
> *Australia has a once in a generation opportunity to reshape our economy through a rejuvenated, harmonised approach to skilling... The clean energy workforce could be a unique testbed to explore innovative models of education and training and should be used to the fullest.*

Success in this endeavour is a critical priority for the nation. Failing to meet this workforce challenge leaves economic prosperity on the table, foregoes opportunities for people in our regions, and poses multiple risks to our energy system and environment.

The challenge is particularly acute in New South Wales, as the state with the largest forecast demand for workers to build and operate new energy generation and storage. As Australia's most populated state, NSW will also constitute the largest share of workers required to move from previous energy uses to the emerging revolution in electric vehicles, home electrification, industrial decarbonisation, and the use of hydrogen.

This is not a challenge that will resolve itself. Thousands of tradespeople and other vocationally trained workers are required over the next decade, on top of strong existing demand from other growing industries. Some will be in new, specialised occupations, but most jobs required for clean energy are the same critical roles that already build our towns and cities, run our energy grid, construct our roads, wire our homes and weld our steel.

The vocational training system, including our cherished public TAFE system, is straining at the seams to meet current demand across our economy, let alone meet the needs of a set of clean energy industries whose growth is critical for the state's future.

Fortunately, there are known models, industry appetite, and new policy from the New South Wales and Australian Governments that can help deliver the workforce required. In October 2023 over a billion additional dollars were allocated to NSW through the new National Skills Agreement to address unmet challenges in training our workforces. A portion of these funds have been earmarked for addressing the net zero transformation, in particular through the establishment of TAFE 'Centres of Excellence'.

Centres of Excellence type model – collaborative bricks and mortar training facilities funded to provide pathways for students and workers, and meet the needs of industry, in specific sectors – have been or are being established in Victoria and Queensland for wind, solar, hydrogen, and energy efficient construction industries. The state and federal governments have set the policy foundations, and the workforce demand is acute and accelerating. It is now time for New South Wales to catch up.

This paper reviews the data on clean energy workforce demand in NSW. Incorporating the results of engagement with a range of industry, training provider, and expert stakeholders, it then assesses the capacity of the existing training system to meet projected clean energy workforce demand and establishes a set of design principles for a TAFE Energy Centre of Excellence to meet this demand.

This study then evaluates the Hunter Region as the home for a 'hub and spoke' training centre to meet statewide demand, including modelling the costs for establishing an Energy Centre of Excellence at refurbished facilities at Tighes Hill TAFE Campus in Newcastle to train 450 workers a year.

KEY FINDINGS.

The case for a TAFE Energy Centre of Excellence in NSW is strong. The structural shortage of skilled workers has been identified as a substantial risk to the pace of the clean energy build out. In a renewable energy development environment now impacted by investment, transmission infrastructure, cost inflation, supply chain, planning approval and social licence risks, labour supply crunches present an additional, significant risk – but one that can be addressed through proactive and targeted public investment.

The case for basing the Centre of Excellence in the Hunter, and specifically at Tighes Hill TAFE campus, is also strong. A key challenge for training workers to meet clean energy needs is balancing the need and aspiration for training workers in the regions of Western NSW where most initial labour demand is required, while acknowledging the hard limits on the available labour force in those regions. A training approach that meets needs in those places, while providing access to the large student and labour pool in NSW's coastal areas, is required. In addition, an energy training facility must lay the foundations for training workers to enable the growth of new sectors, like offshore wind and hydrogen, and to meet the needs of urban areas where uptake of electrification and new technologies will grow rapidly.

Tighes Hill provides an ideal location to balance these needs. The campus already hosts renewable energy, electrotechnology, mechanical engineering and other key trades. As a legacy of its key role in training Newcastle and New South Wales' 20th Century industrial workforce, there are significant underutilised building assets set in a campus environment that is ripe for evolution to the high amenity, high quality learning environment that is essential for attracting students.

Newcastle is accessible to both the New England (NE) and Central West Orana (CWO) Renewable Energy Zones (REZ), with good road and air access, and is the state's core location for the emerging offshore wind, hydrogen, and battery manufacturing industries. It is also integrated with the Sydney urban area where demand for electrification of homes, businesses and transport will be concentrated. The Hunter is also identified by state and federal policy as a priority area for supporting workers in traditional industries to retrain into growth industries.

Sector business case specialists Turbo have modelled preliminary costings for a hub and spoke Centre of Excellence at Tighes Hill servicing statewide needs, inclusive of facility refurbishment, investment in mobile training, and five-year operational and training budgets. This would train a minimum of 450 students on site annually, with additional numbers trained through off-site or 'spoke' delivery. The cost of establishing and operating a Hunter TAFE Energy Centre of Excellence in refurbished facilities at Tighes Hill is competitive with similar interstate projects and recent NSW investments for other sectors, with a base case costing comprising of a five-year operational budget of $22 million, a mobile delivery cost including mobile training units at $3.5m over five years, and a facility refurbishment cost of $41m including substantial space for future expansion.

Given existing facilities and course delivery onsite, there are options for rapid commencement, in line with recent Australian Government announcements intending to establish a net zero TAFE Centre of Excellence in 2024. Existing delivery of electrotechnology, renewable and engineering trades also facilitates a progressive approach to investment – for example a fast start implementation, followed by more substantive infrastructure investments. Utilising and refurbishing an existing facility is also a priority, given the urgency of training needs to meet projected NSW energy workforce demand peaks in the back half of the 2020s. The Tighes Hill campus also provides space to expand facilities in future, for example to meet training needs for the marine environment in offshore wind.

In addition, there is live opportunity and active appetite to integrate a TAFE Energy Centre with industry and tertiary investments in the Hunter region, including the proposed Hunter TAFE Manufacturing Centre of Excellence and the New Energy Skills Centre being developed by the University of Newcastle that will provide cutting edge, open access research and training equipment to service tertiary, industry, research and vocational needs. This integration is consistent with the Australian Government's proposals for TAFE Centres of Excellence.

RECOMMENDATIONS.

#1 The Australian and NSW Governments, with TAFE NSW, urgently assess the establishment of a Tighes Hill Energy Centre of Excellence as a candidate to meet the 'rapid establishment' of a Centre of Excellence for net zero in 2024, as prioritised under the National Skills Agreement, to meet state wide demand for training in clean energy and related industries.

#2 The NSW Government immediately instructs and funds TAFE NSW to undertake a Strategic and Final Business Case, for significant infrastructure and operational investment to establish a TAFE Energy Centre of Excellence at Tighes Hill, including active participation of the Australian Government and potential industry and tertiary partners.

#3 The Strategic and Final Business Case should incorporate the following:

- **a.** Assess the establishment of an Energy Centre of Excellence based at Tighes Hill for at least 450 students annually.
- **b.** State-wide delivery, including utilisation of other TAFE facilities, mobile training, and industry participation.
- **c.** Dissemination of best practice clean energy training across the statewide TAFE network.
- **d.** Partnership options with industry, tertiary and private training providers, including utilisation of industry technology, utilisation of partner facilities, and vocational-tertiary articulation.
- **e.** Co-location and integration with the Hunter Manufacturing Centre of Excellence planned by the NSW Government.
- **f.** A high amenity student experience.
- **g.** A significant outreach component to facilitate uptake of clean energy training pathways for young people and workers in transition affected sectors.
- **h.** Funding for ongoing industry engagement to identify evolving training needs.
- **i.** Operational training costs over a multi-year period, for example five years.
- **j.** Assess options for a) facility refurbishment and b) new build facilities.
- **k.** Assess timeline options for a) rapid course investment followed by progressive facility establishment b) course establishment following facility refurbishment or new build.
- **l.** Identify priority sectoral and course training and equipment needs for near term delivery.
- **m.** Identify likely future expansion needs by sector and course types, including offshore wind marine environment training and for the hydrogen sector.
- **n.** Compliance with any guidelines or requirements for funding under the National Skills Agreement Centres of Excellence program.

1 | CLEAN ENERGY INDUSTRIES & WORKFORCE SKILLS IN NSW.

1.1 | ENERGY TRANSITION & WORKFORCE DEMAND

The rapidly accelerating transition in New South Wales' energy system requires building 12 gigawatts of renewable energy between now and the end of 2029 – around four times the capacity of the Eraring coal fired power station.[1]

In addition, and accelerating rapidly from the late 2020s, there will be a radical transformation in the ***use*** of energy. This includes widespread uptake of electric vehicles, the electrification of household appliances, the increasing use of renewable energy for large industrial loads, and the production and use of hydrogen.[2]

These changes ***will*** occur, but the challenge is ensuring these shifts happen with minimal delay and disruption, in a way that maximises economic, energy security, and environmental benefits. Critically, this requires an adequate supply of skilled workers to develop, build, and operate clean energy technologies.

Recently released analysis from Jobs and Skills Australia has assessed the clean energy workforce demands ***in addition*** to the skilled labour required across other sectors of the economy.

JSA's analysis incorporates a broad set of clean energy industries, including electricity construction and generation, as well as sectors that will transition from fossil fuel use (for example household electrification). This capacity study forecasts potential shortages of tens of thousands of workers for specific skilled occupations, such as electricians, by the end of the decade.[3]

At state level, New South Wales has a higher workforce demand for renewable energy deployment than any other jurisdiction in the country.

Recent analysis for the Australian Energy Market Operator (AEMO) projects annual employment demand for building and running renewables in NSW rising from around 9000 in 2023 to 13,000 in 2027 under the 'Step Change' renewables deployment scenario considered 'most likely' by the energy industry.[4]

This is followed by a significant and sustained increase from the mid-2030s, rising from around 13,000 workers, to 20,000 by the mid-2040s. While operational and maintenance roles increase significantly over time, more than half of all jobs are in construction until around 2035. Alternative scenarios – for example, where NSW fulfils ambitions to become a substantial supplier of hydrogen to domestic and international markets – add demand for around 5,000 additional roles.[5]

A critical issue for meeting the required pace of renewable energy build out, and for planning investments in workforce development, is identifying peaks in labour demand. Based on current projections, over the next fifteen years, there are critical peaks in 2028 and 2035. This lends significant urgency to workforce development. For example, a 2023 Year 12 graduate doing a four-year trade will have just enough time to become a qualified tradesperson before the renewables job demand peak hits.[6]

The urgency of ensuring appropriately skilled workers is also highlighted by rapidly emerging demand for workers to build transmission infrastructure. The AEMO step change scenario projections has demand for workers to build transmission lines ranging between 1500 and 2000 workers from now until 2032, but with a sharp, immediate peak to just under 3500 workers in 2025 when multiple projects need to be under construction.[7]

This demand profile comes on top of a NSW labour market straining at the seams. Demand for skilled electrical tradespeople, engineers, infrastructure construction workers, and project managers – the same workers required for the clean energy sector – is showing up a structural shortage of skilled labour for existing sectors. These shortages reflect underlying structural challenges in training enough skilled workers to meet demand.

1.2 | DEMAND BY INDUSTRY, OCCUPATION & REGION

Industry consultation for this study unveiled frustration that 'clean energy jobs' are often spoken about as a whole new category of employment. Like any set of new technologies, specialised skills must be developed. However, in the main, renewables jobs are similar if not identical to existing occupations.

Developing a wind farm is similar to civil construction. Building and maintaining a transmission line for a renewable energy zone is the same as transmissions lines for coal fired power-station. Building and servicing offshore wind turbines requires many of the same marine skills as the offshore oil and gas sector. Project managing a pumped hydro project requires the same skills as the construction of a freeway or coal mine. Installing household batteries requires skills familiar to domestic electricians.

This has important implications in a growing economy where these trade and professional skills are already in short supply. For example, modelling undertaken for the Australian Industry Energy Transitions Initiative – a collaboration between CSIRO, major Australian manufacturing and mining companies, and university research centre ClimateWorks – found the following challenge in meeting projected labour demand in solar, wind, transmission, storage and hydrogen:

> *About **51% of the workers** required by 2030 (43,200 workers) are in occupations already facing a **national shortage**, with the skills needs particularly acute across **electricians** and **engineering professionals**.*[8]

Previous efforts to plan and invest in training capacity to meet demand requirements for the clean energy workforce have to some extent been constrained by data gaps. Key challenges have included assessing the number of workers required in what timeframes, in what locations, and in what occupations. Notably, trying to assess how many additional workers are required over and above demand in other industries – industries that are themselves evolving over time and under unobservable future economic conditions – is a challenging issue, albeit one common to all skills forecasting exercises.

Considerable work has now been undertaken at state and national levels that provides a substantial level of detail to answer these questions.[9] Ongoing work is required in matching skills forecasting to real world conditions against a shifting backdrop of development timeframes, immigration, economic conditions and changing demand profiles in other sectors. These common challenges notwithstanding, however, the ability now exists to identify 'where the jobs are' to a level of detail that makes specific investments in the education and training system both possible and essential.

So, what do these jobs look like in practice? JSA's recently released clean energy capacity study ***The Clean Energy Generation - Workforce needs for a net zero economy*** provides a detailed breakdown of required skills.[10] Ultimately, these demands span a need for increased investment in training workers for traditional roles required by clean energy industries, and in sector specific skills.

JSA comprehensively defines the Australian clean energy workforce. Broadly, this definition includes workers:

- Designing, building and operating energy generation, transmission and storage assets (such as utility and residential solar, onshore and offshore wind, pumped hydro, and batteries)
- Reducing or managing energy demand (for example energy efficiency retrofits of housing, or software services for energy reduction) and
- Installing and maintaining technology that uses clean energy rather than fossil fuels (for example electric vehicles, heat pumps or hydrogen production).

JSA identifies 38 existing occupations that are deemed 'critical' to the clean energy transition. This assessment is based on occupations with long training periods, requirements for at least some specialist clean energy skills, and where clean energy is likely to take a large proportion of the existing workforce.

This 'critical occupations' list is dominated by trades and technical workers across a range of fields, including electrical trades, electrical engineering, fitters, welders, industrial engineers, building surveyors, motor mechanics and auto electricians.

JSA describes electricians as the 'leading example' of critical occupation gaps. The supply of electricians is forecast to grow slowly, due to an older demographic profile and flat rates of trade completion. Combined with high rates of demand growth for electricians across a wide range of clean energy sectors, JSA's 'central' modelling scenario projects an additional 32,000 electricians are projected as required nationally, over and above current rates of training, by 2030.

At NSW level, projections for AEMO covering the construction and operation of domestic renewable energy generation – onshore wind, utility and roof-top solar, hydro and pumped hydro, and transmission – suggest significant annual requirements for 'in-demand occupations' (Figure 1).[11]

Renewable-specific demand for electricians is forecast to rise from around 1650 this year, with another thousand required by 2029, for a total of 2700. This demand is sustained and increases to over 3000 in the late 2030s. This is allied with consistent annual demand for at least 600 electrical trade assistants.

Construction managers and electrical engineers show similar numbers and demand trajectories over the next two decades, with demand for each rising from 4 – 500 hundred in 2023 and peaking at 7-800 in 2027/28. This is dominated substantially by onshore wind and transmission build out, as well as utility scale solar for construction managers. Demand for both is then retained at around 300 – 500 workers annually over the following decade.

Mechanical trades and technicians demonstrate a different demand profile over time, rising from around 400 in 2023 to 900 in 2029. Demand then stabilises through to 2035 before increasing to 1200 by the end of that decade. Notably, these numbers are heavily dominated by the wind

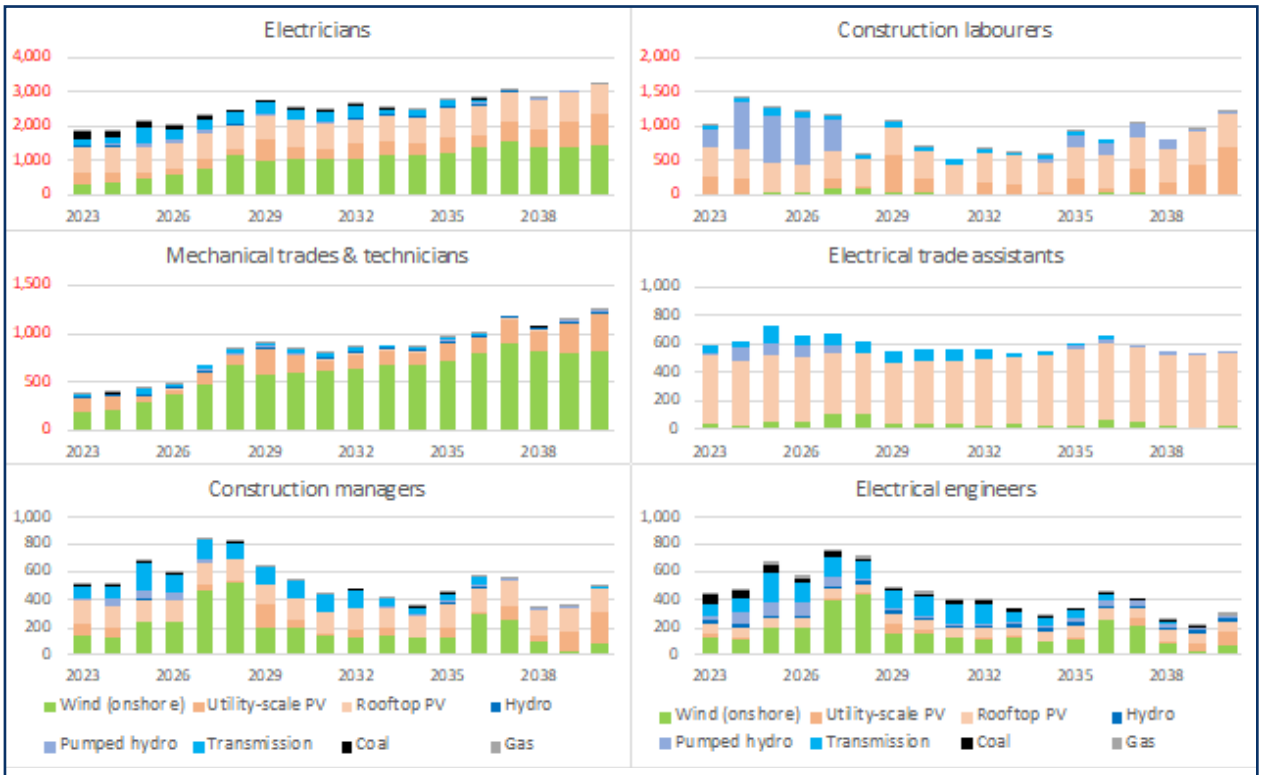


FIGURE 1: NSW, IN-DEMAND OCCUPATIONS BY TECHNOLOGY, STEP CHANGE SCENARIO. SOURCE: RACE 2030 (2023) ELECTRICITY SECTOR WORKFORCE PROJECTIONS FOR 2022 ISP: FOCUS ON NEW SOUTH WALES. REVISION 1. FINAL REPORT.

industry, as the balance of jobs shifts from construction to operations, reflecting the greater operational labour demand for wind compared to solar, pumped hydro and transmission infrastructure.

While there is limited data on the regional distribution of occupational demand for clean energy in NSW, projections for AEMO's central step change scenario show workforce demand for utility scale generation and storage (wind, solar, batteries and pumped hydro) to be overwhelmingly concentrated in the New England and Central West Orana Renewable Energy Zones. Each zone sees an annual average workforce demand of around 3000 jobs in each over the period 2023 – 2050. This compares to 400 in South West (SW) NSW and 100 in the Hunter. In the NE and CWO REZs, these annual averages translate to a rapid ramp up from 2023 to the 2027/28 construction peak. This is followed by slight decline in the 2030s, before consistent growth through to the 2040s as the operational jobs component increases with industry scale, particularly for wind.

This high concentration of skills demand in two regions creates a significant challenge for both satisfying labour demand, and the design and location of investments in training. These areas of regional NSW have small population bases and thin labour markets – in scale, skills base, and consistently low unemployment rates. They are also older on average than other areas of the state, putting additional limitations on the availability of a new generation of workers that can be trained.

Regionalised analysis of key occupations required for clean energy development[12] suggests that demand in a four-year peak period from 2027 to 2031 in the NE REZ exceeds the entire available labour force, including requiring twice as many skilled workers as are projected to exist in some years. These occupations comprise electricians, construction managers, construction labourers, mechanical trades, truck drivers, and electrical engineers (Figure 2). In addition, ongoing demand for these workers comprises about half the available workforce. At a smaller scale, the SW REZ experiences a similar situation. While the figures are less acute in the CWO REZ, peaks occur in the next 2-4 years at about half the available skilled workforce (Figure 3).

Extensive industry feedback on REZ workforce availability reinforces these projections. Electricians in particular are noted as a 'massive problem' with shortages also noted for 'wind farm maintenance personnel, transmission lineworkers, fitters, carpenters, engineers and site supervisors that can train staff on the job and pass on knowledge' as well as other key occupations such as labourers, project managers and mechanical and engineering workers.[13]

The scale of workforce demand compared to thin regional labour markets has significant

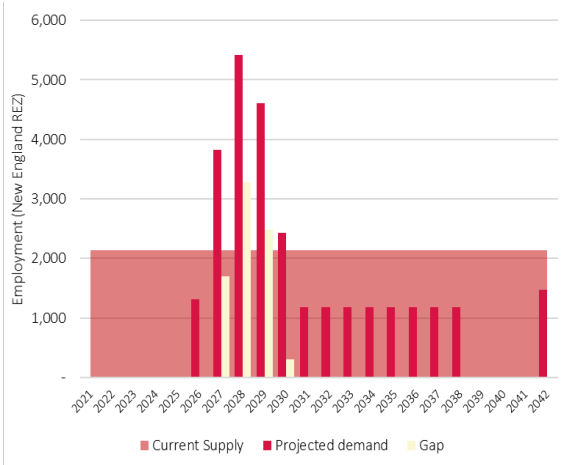


FIGURE 2: KEY RENEWABLES OCCUPATIONS - SUPPLY VS DEMAND, NE REZ

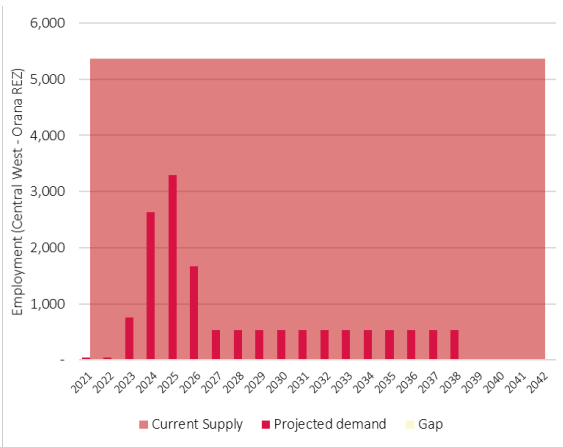


FIGURE 3: KEY RENEWABLES OCCUPATIONS - SUPPLY VS DEMAND, CWO REZ

implications for the location of investments in training capacity. On one hand, policies and investments need to prioritise approaches that maximise ***in region*** opportunities and aspirations for local training to maximise the benefits of once-in-a-generation capital inflows.

At the same time, however, there are hard numerical limits to this approach, given the scale of demand and the need for specialised skills. Given the serious consequences of any energy generation development delays based on labour shortages, responses to workforce demand must account for these realities of regional labour market size.

It is also important to account for the needs of other local industries that have historical and ongoing demand for occupations with shared demand with the energy sector, whether that be truck drivers, electricians, labourers or mechanical trades.

Meeting aspirations for local employment, concurrently with providing sufficient skilled labour to meet the scale of the energy transition, requires investments that delivers training both ***inside*** renewable energy zones, ***and*** trains sufficient labour in larger population centres that can migrate to regions and also meet temporary peaks in demand.

1.3 | HIGH GROWTH SCENARIOS

In addition to onshore renewable energy generation, there are several other clean energy industries that are likely to stimulate additional labour demand over the coming decade. Several of these industries are subject to intense overseas competition – for example export hydrogen production, renewable component manufacturing, and to some extent capital and equipment competition in offshore wind.

Highly skilled workers are one of Australia's few clear advantages over other jurisdictions with similar renewable resources, stronger industrial ecosystems, larger pools of public investment, cost advantages, and better market access. Industry feedback suggests the absence of skilled labour is already constraining the ability of businesses in NSW to value add to clean energy supply chains.[14]

A failure to create ***sufficient availability*** of high skilled workers will negatively affect prospects of attracting highly mobile capital and securing market share for the limited number of clean energy export industries. Moreover, a lack of skilled workers will constrain the pace of rollout for pivotal emissions reduction sectors such as energy efficiency in homes and industrial use of green hydrogen.

> Offshore Wind

The Australian Government is progressing the licencing of offshore wind farms in the Hunter and Illawarra regions. While development times are substantial, government estimates put the number of jobs in the Hunter at 3000 for construction, with 1560 ongoing roles, and Illawarra at 2500 and 1250 jobs respectively.[15, 16]

The Victorian government recently funded the *Star of the South Offshore wind jobs guide*, a collaboration between TAFE Victoria, Federation University, Star of the South and other energy companies, and skills agencies.[17] The guide identifies over 50 occupations required for the development, construction and operations/ maintenance of offshore wind. While there is some crossover with onshore skills, such as professional roles, and turbine and blade repair technicians, many of the required occupations are specific to the marine environment.

Given the large workforce requirements, paucity of full marine training operations in Australia (housed primarily at the Australian Maritime College in Launceston and TAFE WA in Fremantle)[18, 19], and lack of dedicated offshore wind training facilities, delivering these projects requires significant training investments in general marine roles, and those specific to offshore wind.

> Hydrogen

NSW workforce projections undertaken for AEMO explicitly model a 'Hydrogen Superpower' scenario. This assumes strong global action on emissions, 'significant technological breakthroughs, and a near quadrupling of NEM energy consumption to support a hydrogen export industry.'

On average, this scenario requires an additional 5,000 workers per year between now and 2050. There is a large early peak in the late 2020s, requiring 29,000 workers – 7,000 more than the central step change scenario – to establish a foothold in the hydrogen production and export market. After levelling out in the 2030s, the labour requirement for hydrogen production then peaks again, requiring 6-8,000 workers more than the central scenario from the late 2030s.

New South Wales is home to several designated hydrogen hubs. Recent capital investments and precinct developments, such as on Kooragang Island in Newcastle, are demonstrating early progress. However, as noted in strategies such as the Hunter Hydrogen Roadmap, 'the development of the hydrogen sector will require the development of new skill and capabilities across the hydrogen value chain through formal training and applied learning'.[20]

Energy Efficiency

Industry consultation conducted for this study identified 'energy efficiency' as a sector expected to experience accelerating demand for skilled workers.

The most comprehensive sector study to date defined these workers as those using, installing and operating energy efficient building materials, lighting and appliances, heating and cooling equipment, and water consumption products. Occupations include air conditioning and fridge mechanics, builders and construction managers, electricians, and mechanical engineers.[21]

While estimating the share of workers actively engaged in decreasing energy use and increasing energy efficiency is difficult, research suggests that 'the workforce and job potential in the energy efficiency sector is likely to be higher than in the renewable energy sector'.[22] For example, Jobs and Skills Australia estimates 15-20% of construction workers and 5-8% of transport workers are engaged in work related to energy efficiency, with this set to expand significantly.[23]

There is significant scope for Australia to improve energy efficiency and increase electrification in residential, commercial, industrial and transport applications, with a National Energy Performance Strategy in development to accelerate uptake. In turn, this expansion will stimulate demand for both traditional tradespeople and those with specific skills, including in new vocational courses currently under development by industry.[24]

Equipment Manufacturing

A 2022 study conducted for the NSW Renewable Energy Sector Board on employment opportunities and demand for delivering the ***NSW Energy Infrastructure Roadmap*** noted the lack of data but assessed that the 'local content up and down the supply chain in mineral processing, manufacturing and offsite maintenance is widely agreed to be low.'

However, given the large scale, long timeframe, and coordinated renewable energy development strategy in NSW, the study identified opportunities for increasing jobs in resource processing, manufacturing, servicing of supply chains, and end-of-life recycling and reuse. Specific opportunities include battery pack assembly, battery cell manufacturing, construction of wind towers and provision of local steel, assembly of wind turbine components, solar mounting and racking, solar panel recycling, and transmission tower manufacturing.[25]

Notably, a survey of supply chain businesses identified skills shortage as the 'number one barrier... to realise opportunities created by the Roadmap and the REZs.' This was related to wider labour market pressures such as shortages in electricians and other key occupations, to renewable sector dynamics including uncertainty around project timing, and to fundamental issues in training provision:

> *Challenges with the provision of training include structural issues with the vocational education and training (VET) sector and a lack of training market capacity in renewable energy, especially in the context of thin markets in regional areas where demand has not been sufficient to underpin investment.*[26]

The pre-existing commitment of the NSW Government to a Manufacturing Centre of Excellence in the Hunter also provides an opportunity to integrate energy and manufacturing training facilities, given the crossover in supply chain and skills demand in the manufacturing and clean energy sectors.

Land Restoration

There is considerable policy impetus for expanded efforts to address issues of emissions reduction through land restoration, and related initiatives to deliver environmental benefits. Modelling undertaken regarding employment from specific public clean energy investment plans suggests the potential for an additional 2,200 ecosystem restoration jobs in NSW[27] and studies assessing additional conservation investments as part of mining land rehabilitation in the Hunter Region suggest the creation of around 670 ongoing jobs.[28] The expected growth in both public and private investment in land restoration is also likely to provide a future, additional source of skilled labour demand concentrated in regional areas.

1.4 | POLICY ENVIRONMENT

Federal Policy Context

In April 2023, the Australian Government announced a new National Skills Agreement (NSA) with the states and territories. The agreement provides the states and territories with access to additional Commonwealth funding of $4.1 billion over five years, beginning from January 2024. This funding comprises $3.7 billion in direct Commonwealth investment and $400 million to support an extra 300,000 TAFE and vocational education and training (VET) fee-free places.[29]

NSA funds are allocated to priority reform areas. This includes partnerships with industry, TAFE, universities and governments to address critical challenges. The transformation to a net zero economy is a specified priority.[30]

The September 2023 ***Working Future*** employment white paper identifies the funding of TAFE Centres of Excellence in specific areas such as wind, solar, smart energy systems and hydrogen as a priority investment to address the net zero transformation. This includes explicit reference to sharing opportunities 'across regions and all cohorts in society'.[31]

In October 2023 the Australian Government provided further information on the design and funding of TAFE Centres of Excellence:

> *The Australian Government is investing up to $325 million over five years to establish and operate up to 20 TAFE Centres of Excellence. States and territories will make a matched contribution.*
>
> *The Australian Government will work with states and territories in consultation with stakeholders to agree on design and implementation arrangements to deliver the initiative. The first TAFE Centres of Excellence are expected to commence operation in 2024.*
>
> *Up to 6 TAFE Centres of Excellence will be turbocharged for rapid establishment in the areas of net zero, the care and support sector, and digital skills with around $32 million committed through the Working Future White Paper and in addition to the National Skills Agreement.*

The Australian Government has also prioritised the development of responses to clean energy workforce demand through JSA's clean energy

ELECTROGROUP RENEWABLE ENERGY TRAINING CENTRE PINKENBA

capacity study that links satisfying critical clean energy workforce demand with the need for training sector reform.[32]

In addition, July 2023 saw a Net Zero Economy Agency established as a precursor to a legislated Net Zero Authority. These agencies are focused on 'ensuring that Australia, its regions and workers realise and share the benefits of the next zero economy', including supporting 'workers in emissions-intensive sectors to access new employment, skills and support as the net zero transformation continues'.[33,34]

State Policy Context

While NSW is a national leader in renewable energy development, there is a notable lag in skills and training investments compared to other states.

For example, Victoria recently established a $50 million TAFE Clean Energy Fund, following previous state investment in facilities such as the Asia Pacific Renewable Energy Training Centre (APRETEC) at Federation TAFE in Ballarat, commenced in 2016. Similarly, Queensland has a dedicated $50 million fund, including recent investment in regional TAFE centres of excellence and a $17m contribution to an industry-led renewable energy training centre in Brisbane.

The New South Wales Government has committed to the development of three TAFE 'manufacturing centres of excellence' to boost trade skills and apprenticeships. Each centre aims to retrain and upskill at least 300 apprentices and workers in 'traditional and advanced manufacturing techniques and technologies each year, with free courses to be offered including mechanical engineering and electrical fitting.'[35] These specific course types, and the centre of excellence model, have significant crossover with identified demands for the energy sector and are likely to offer opportunities to integrate training across manufacturing and clean energy industries. In total, $43 million was committed to help upgrade three centres in the Hunter, Illawarra and Western Sydney.[36]

In October 2023 the Australian and New South Wales Government announced details of the National Skills Agreement. An additional $1 billion in funding has been allocated to NSW to 'complete significant reform to the skills and training sector' including commitments to 'investing and rebuilding TAFE NSW and the broader skills sector' and specifying investments in TAFE Centres of Excellence.

Notably, the announcement of the NSW agreement earmarked an additional $2.4 billion nationally in 'flexible funding to support state and territory skills sectors with capacity to deliver skills for critical and emerging industries' including 'clean energy and Net Zero transformation of the economy'.[37]

At a regional level, JSA also identifies the NSW Government's Royalties for Rejuvenation Fund as a state-based policy initiative relevant to workforce training for the future.[38] Under this fund, the NSW Government sets aside $25 million per year from mining royalties to help support coal communities, including through targeted investments in workforce development programs and establishing new industries and employment opportunities. The Hunter is one of four regions covered by the Fund.[39]

ASIA PACIFIC RENEWABLE ENERGY TRAINING CENTRE - FEDERATION UNIVERSITY, MT. HELEN CAMPUS, BALLARAT

2 | MEETING **WORKFORCE DEMAND**

2.1 | SECTOR CONDITIONS

Industry and expert consultation suggest New South Wales is at significant risk of a skills shortage that would compromise the delivery of essential electricity generation, storage and transmission infrastructure. Moreover, a lack of skilled workers was viewed as an active threat to developing and attracting industries such as hydrogen and supply chain manufacturing that rely on NSW having a competitive skills advantage.

Industry feedback suggests a complex set of factors are contributing to the challenge of planning for and meeting demand in clean energy sectors. Broadly, these can be summarised in four areas: economy wide skilled labour demand; the large scale of clean energy demand; the existing capacity of the training system; and a set of factors specific to clean energy.

The shape of the first two challenges is relatively easy to identify. Australia has structural challenges in the provision of skilled workers. This includes the tradespeople required both by the clean energy sector and by established industries such as construction, infrastructure and mining. This will be a persistent issue, and the large workforce demand for clean energy will increasingly add to this pressure.

Sector-specific challenges in developing an adequate clean energy workforce are more complex.

The location of onshore renewable energy resources in areas with thin labour markets and low populations creates practical constraints in securing workers and investing in local training.

In addition, while there is interest from younger people and mid-career workers, there is limited visibility of what occupations are available in clean energy. This is partly a function of geography – with projects not visible to those in coastal population centres, and of time – the scale of renewables has a rapid ramp up, and as a new sector there is little existing experience of opportunities amongst key influences such as parents and peers. Industry feedback also suggested NSW has a gap in clarifying and promoting the skills and pathways into clean energy.

Uncertainty of industry growth, both real and perceived, was also viewed as a barrier to those considering training for a clean energy career, and for government or industry investments in training. In particular, the growing gap between required deployment rates of clean energy, and the projects that are successfully navigating planning approvals and financial investment decisions, was disrupting efforts at forecasting and investing in meeting training demand. Ultimately, however, and notwithstanding some uncertainty, a surge of workforce demand was identified as occurring sooner rather than later, and a failure to invest in and prepare a suitable skills base will result in additional delays and lost economic opportunity.

Lastly, industry structure was repeatedly identified as constraining the ability to identify and invest in a trained workforce. Renewable energy is capital and construction intensive, with onshore development having relatively short project construction timelines. Although there are large developers with comprehensive portfolios, there is also dispersed ownership. Transfers of ownership between prospecting, development, construction and operational phases are also endemic in the sector, and there is widespread utilisation of contracting.

This fragmented industry structure was seen as creating quite different training conditions and incentives than for previous iterations of industry expansion, for example in mining or

manufacturing. Project developers and operators have significant labour demand, but do not take on apprentices, engage in course and unit development, provide training equipment to vocational providers, promote careers to young people, or stimulate the development of a specialised vocational training ecosystem at the same rate as previous growth industries. In response to these conditions, public investments and efforts at coordination, particularly between companies, industry bodies, government and training providers were noted as requiring more attention than in other sectors.

2.2 | TRAINING CAPACITY

Industry and expert feedback identified the capacity of the training system to meet demand for training in clean energy sectors as a key challenge.

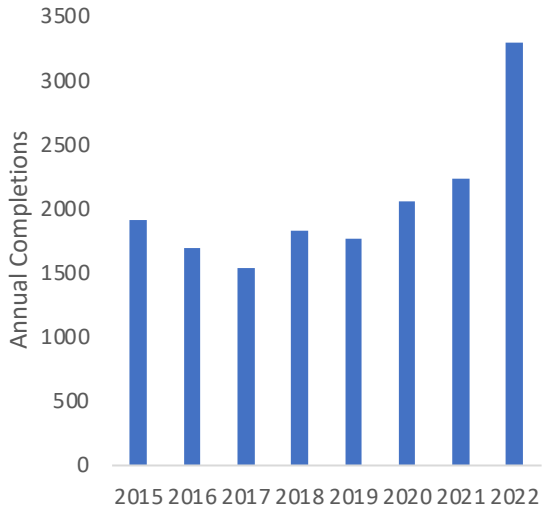
Industry stakeholders viewed the vocational training system in NSW as already under significant strain in meeting demand in trades for current industries. Investments in additional capacity for clean energy industries were suggested as essential. As one vocational sector veteran engaging directly with the clean energy and manufacturing sectors noted:

> *The capacity of the training sector to deal with this is at breaking point already.*

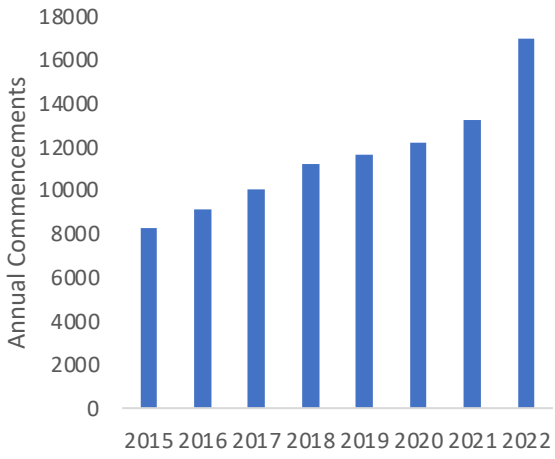
Electricians, as a key occupation consistently highlighted by industry and in technical workforce assessments as at risk of shortages in relation to clean energy, provides an illustrative case study of current trends.

On one hand, there has been a significant positive upward trend in apprenticeship completion and commencement numbers (Figure 4). This has been driven by consistent economy wide demand and is also reflected across other relevant trades. This expansion provides evidence that the vocational training system has been able to respond to increased demand.

On the other hand, however, the vocational training system appears close to hitting a hard ceiling of available capacity, in the absence of additional investment across a range of areas. While the demand driven vocational training system attaches funding to course enrolments, providing a measure of flexibility, interviews with industry informants suggested a range of visible stresses and practical constraints across public, private and group training providers.



Electricians - Annual Course Completions, New South Wales



Electricians - Annual Course Enrolments, New South Wales

FIGURE 4: ELECTRICIAN COURSE COMPLETIONS AND ENROLMENTS, NSW: SOURCE: VOCSTATS 2023[40]

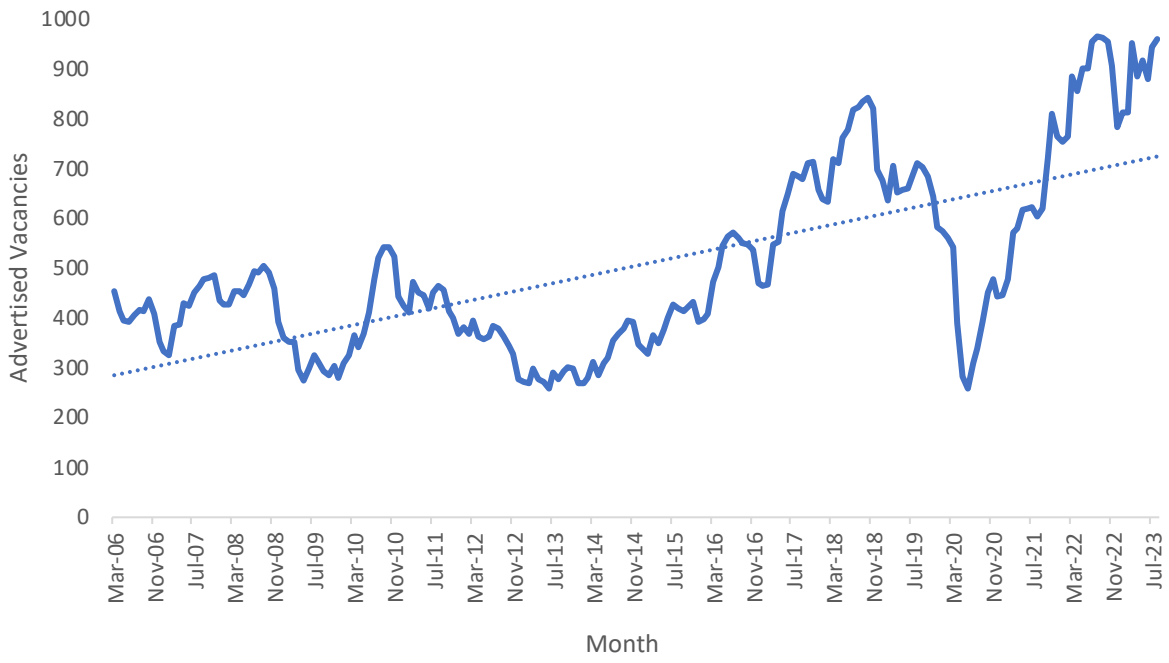


FIGURE 5: ELECTRICIAN VACANCIES, NSW, 2006 - 2023. SOURCE: INTERNET VACANCY INDEX

These included long waitlists, in some cases 12 months, for students and apprentices in key trades, difficulty accessing training in locations with high levels of demand, and challenges in recruiting qualified trainers. The latter was identified in the Australian Government's recent Employment White Paper as a specific challenge for teachers of new energy qualifications, with pay rates, an ageing workforce, and the challenges in securing additional training requirements for new sectors and technologies.[41]

In addition to industry observations about training capacity limits, other data sources suggest ongoing trends of increasing economy wide demand for training in key occupations. To return to the electricians' example, advertised vacancies in NSW continue to demonstrate a strong demand growth trajectory, notwithstanding disruption during the pandemic. Monthly vacancies have been consistently in the 900 – 1000 range for the past 18 months, with trends tracking upward (Figure 5).

Significantly, this straining at the seams of existing capacity is ***in advance*** of the rapid projected growth in skills demand for renewables and other clean energy sectors. While projecting economy wide demand and training growth compared to sector specific demands is challenging, the chart in Figure 6 incorporates some basic assumptions, generating a plausible scenario that illustrates the potential gap between training capacity and renewable energy demand for electricians in NSW.

The scenario creates a timeline that utilises actual electrician trades completion data from 2015-2022, and projections for electricians required to deliver the most likely ***AEMO Integrated System Plan*** step change scenario for renewable energy, transmission and storage in NSW out to 2040.[42]

The scenario makes the conservative assumption that the renewable energy demand for electricians in 2023 was satisfied by the number of electricians either newly trained or already in the labour market[43] at the end of 2022. The number of training completions is assumed to be held constant at 2022 figures, as is the existing number of electricians in the labour force. While this is a non-conservative assumption given recent rises in completions, it has been selected as the simplest option for illustrative purposes, and reasonable given the aforementioned conservative assumption, and projected economy-

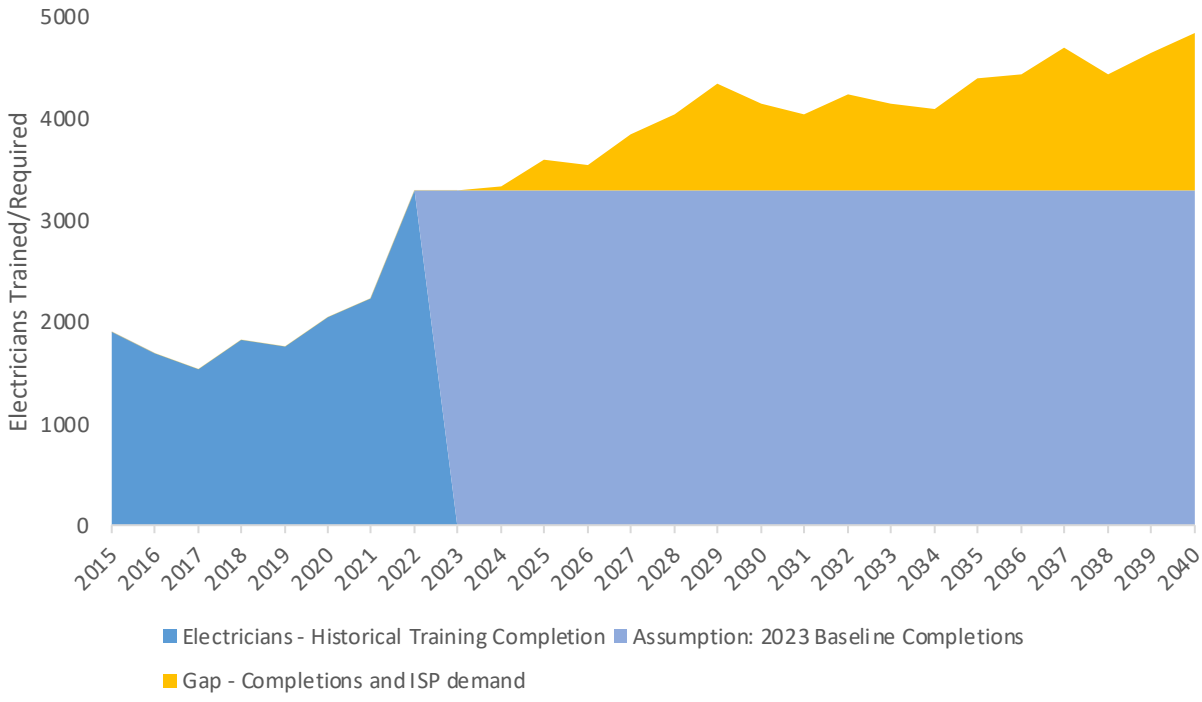


FIGURE 6: ELECTRICIAN COMPLETIONS VS. PROJECTED DEMAND. SOURCES: VOCSTATS[44]; RACE 2030 (2023) ISP FORECASTS NSW.[45]

wide demand growth for electricians.

The gap between the ISP forecast and the 2022 completions baseline is equal to the demand for electricians in renewable energy ***over and above current labour supply plus the assumed stable supply of new electricians.*** Represented in Figure 6 by the orange section, this scenario suggests annual shortages of electricians to deliver renewable energy deployment and operations rising rapidly to 550 in 2027, then to 1050 in 2029. This moderates slightly to around 750 in the early 2030s as the first construction peak passes, followed by rises to 1100 and above from 2035.

While we stress this scenario is illustrative only, it provides a plausible example of the potential scale of the gap between training provision capacity and the accelerating demand for critical occupations required for the clean energy transition.

Ultimately, the picture emerging from industry feedback, comprehensive studies, and recent data coalesces around the need for capacity investments to ensure clean energy training needs are met.

For example, a comprehensive skills and training analysis conducted for the NSW Renewable Energy Sector Board in late 2022 makes a recommendation to 'dedicate funding to increase training system capacity for clean energy workforce development'. This recommendation incorporates a range of measures including training market development, industry partnerships, development of new qualifications, mobile training delivery methods, skillset and microcredential development, and investigating the development of training hubs with TAFE NSW and other RTOs.[46] Other recent skills audits in NSW emphasise the urgent nature of responding to these needs, noting major risks of a skills crisis, serious consequences for the state's energy transition including potential delays and cost blowouts, and the importance of building clean energy training capacity and pathways.

Fortunately, however, recent policy developments, including the National Skills Agreement between the Australian and NSW Governments, and the comprehensive work of Jobs and Skills Australia, have created a strong platform – and specific options – to address these urgent needs.

2.3 | POLICY RESPONSES: CENTRES OF EXCELLENCE

The evidence suggests there are significant structural challenges in meeting the clear and increasingly urgent demand for clean energy workers in NSW.

Geographic, information, time, and institutional market failures that are particular to the clean energy industry disrupt some of the traditional mechanisms for industry and market lead responses to meet training demand. The demand for skilled workers in clean energy comes on top of persistent and growing demand for the same workers for other growth industries.

While there are encouraging responses from the vocational training sector in increasing training in response to demand over recent years, and in innovating to respond to demands in the renewables sector, it is widely recognised by public and private sector trainers that the capacity of the industry is already under serious stress.

Given the structural challenges, there is an essential role for both the New South Wales and Australian Governments to undertake targeted investments to boost capacity to train students and workers in traditional trades and skills where clean energy is making substantial additional demands, and in specialised courses where training markets are immature and are at risk of constraining development.

Effective actions to deliver these training and skills needs to meet fundamental energy security, economic development, and emissions reductions aims is clearly an urgent matter of public policy interest – as reflected in the recent commitments under the National Skills Agreement.

In particular, the recently released detail on commitments to TAFE Centres of Excellence describes investments that tightly align to those needs:

> *Through the National Skills Agreement, the Australian Government will partner with states and territories to establish nationally networked TAFE Centres of Excellence which will help deliver a skilled workforce for strategically important industries to meet national challenges.*
>
> *They will increase collaboration between TAFEs, through partnerships with industry and universities and deliver the skills people need for good, secure work and careers.*

Providing 'high quality and responsive skills training for critical and emerging industries, including the transformation to a net zero economy' is an explicit priority for the establishment of a Centre of Excellence. Developing practical solutions to skills needs, and to disseminate best practice across TAFE networks, are also identified as key functions.[47]

In addition, Jobs and Skills Australia provides guidance on the implementation of TAFE Clean Energy Centres of Excellence, emphasising collaboration with industry and universities, and regulatory innovation and a faster pace of course development to respond to industry growth and technology change.[48]

BOHLE HYDROGEN RENEWABLE ENERGY TRAINING CENTRE - TOWNSVILLE, DESIGN

2.4 | TRAINING CENTRE EXAMPLES

There are a number of interstate examples of 'Centre of excellence' type facilities, and other TAFE and industry-led vocational training facilities, that have or are being established to meet clean energy skills demands.

The pioneering example is Federation University's Asia Pacific Renewable Energy Training Centre in Victoria, established in 2016. The centre was established through proactive efforts by Federation, as a regionally focused dual tertiary-vocational institution. APRETEC emerged from analysis conducted by Federation staff on economic opportunities and training needs in Western Victoria. Federation identified a significant pipeline of local renewable energy development and built relationships with renewable energy developers to understand skills needs.

This was followed by the development of a business case to the Victorian Government that identified specific training gaps in relation to international standard safety, technical, and blade technician training for wind as the dominant growth industry, and quantified the economic benefits to the local economy based on the substitution of imported labour.[4950] After partnering with four major renewable energy developers and manufacturers - Vestas, Acciona, Global Power Group and Tilt Renewables - Federation secured investment in the Centre's first stage, involving the construction of a $1.8 million wind turbine training tower to allow for the training of workers at heights in a simulated wind turbine environment.[5152]

In late 2022, and in response to a Stage 2 business case developed by Federation[53], the Victorian Government pledged $6 million to support the expansion of APRETEC as part of its $50 million TAFE Clean Energy Fund to deliver a new classroom, workshop and training equipment.[54] Federation University expects to eventually train over 600 people a year.[55]

The Victorian TAFE Clean Energy Fund also includes funding for new training centres across the state, as well as funding to develop a business case for a revived State Electricity Commission (SEC) that will play a key role in coordinating and accrediting courses for apprentices. Funding for new training centres will include $5 million for TAFE Gippsland to invest in a Clean Energy Centre in Morwell, $5 million for South West TAFE to deliver a Building Innovation and Design Centre in Warrnambool, and $10 million for a Hydrogen Energy Worker Training Centre.[56]

In relation to the Morwell facility, industry engagement identified a focus of this centre is building visibility of pathways for locals to access offshore wind and other clean energy employment, including through government-resourced collaboration between TAFE, Federation, and offshore wind developers to identify and develop specific courses and training offerings.

In Queensland, construction has commenced on a $17.2 million expansion of TAFE Queensland's Bohle campus in Townsville, comprising a Hydrogen and Renewable Energy Training Facility and an Advanced Manufacturing Skills Lab. This expansion will enable TAFE to offer 20-plus new Skill Sets, Certificate and Diploma qualifications across renewable and advanced manufacturing industries.[57]

The Queensland Government has also invested $17 million into the $23 million Renewable Energy Training Facility at Pinkenba in Brisbane, operated by industry owned not for profit Electrogroup Training. The facility offers qualifications in renewable energy, training for apprentices, and upskilling to licenced electricians to install, operate and manage solar and other renewable energy equipment, and is expected to provide training to around 750 apprentices a year.[5859]

The $20 million Hydrogen Centre of Excellence at Beenleigh was similarly established by the Queensland Government in partnership with the Plumbing Industry Climate Action Centre. Upon its opening in 2022, the Centre of Excellence was anticipated to increase training capacity from 700 to 1,100 apprenticeships and trades per year in the areas of fire protection, fire control, plumbing and hydrogen.[60]

2.5 | VOCATIONAL, INDUSTRY & TERTIARY PARTNERSHIPS

Industry, expert and training provider feedback received to inform this study repeatedly identified the importance of collaborations across different actors to meet the complex and urgent demands of delivering a clean energy workforce.

A common issue raised was the fragmented industry structure in clean energy industries. As an industry with large numbers of projects, developers and new entrants, there is not the same critical mass of ownership concentration that has facilitated large volume training in other growth industries in the past, such as at Newcastle's BHP steelworks or in the mining industry.

This was seen as hindering the ability to allocate resources to properly identify skill, course, and training investment requirements. This essentially constitutes a type of market failure where a lack of coordination results in sub-optimal and more costly efforts to satisfying demand, such as importing labour or competing with other sectors for a very limited pool of skilled workers.[61]

Stakeholders identified projects such as the Victorian Government funded collaboration between TAFE Gippsland, Federation University and Star of the South to identify specific occupational demand and training requirements for offshore wind as critical investments in addressing this failure. Feedback from TAFE NSW similarly identified the importance of coordinated training provider and industry platforms to properly assess detailed training provision needs.

The geographically dispersed and 'peaky', construction intensive nature of renewable energy developments was also raised as a coordination issue, exacerbated by uncertainty regarding approvals and investment decisions. These issues were particularly relevant in relation to providing a stable pipeline of work that could support apprenticeships and other longer term training needs. Collaborations between project developers, contractors, group training organisations, and public vocational training providers were identified as required to smooth out geographic and temporal challenges.

Responses to changing technology were also identified as a key area of collaboration. In particular, having integration between training providers, project developers, and end product or original equipment manufacturers was seen as critical to ensure workers are trained on equipment that meant they were job ready. This aligns with industry feedback in other NSW studies that identified capital expenditure on new technology as a barrier to training[62], and recommendations from Jobs and Skills Australia on the importance of dedicated government funding for capital equipment.[63]

Efforts to more effectively articulate vocational and tertiary training were also seen by stakeholders as important. While there was some scepticism expressed about the ability to integrate differently assessed training structures, and institutional challenges in establishing between vocational and tertiary partners, significant practical benefits were identified.

For example, in providing hands on qualifications for engineering degree holders entering the workforce, or alternatively for vocationally trained electrical engineers to receive credit to develop complementary skills in managing energy grids. Feedback indicated that dual tertiary-vocational providers, formalised centre-based partnerships, and specific funding for integrated models were more likely to succeed than ad-hoc collaborations.

The practical issues raised in this feedback echoes the opportunity – and the entreaty – highlighted by the Jobs and skills Australia Commissioner in the recent clean energy capacity study:

> *Australia has a once in a generation opportunity to reshape our economy through a rejuvenated, harmonised approach to skilling. This means moving beyond coordination and collaboration and instead pursuing genuine partnerships within and among systems. The clean energy workforce could be a unique testbed to explore innovative models of education and training and should be used to the fullest.*[64]

The Australian Government's ***Working Future*** employment white paper proposes two mechanisms for vocational-tertiary-industry-government collaboration to address net zero training needs – dual sector tertiary providers, and TAFE Centres of Excellence funded under the National Skills Agreement:

> *Centres of Excellence could develop deep expertise in wind, solar, smart energy systems or hydrogen, and build partnerships with industry to develop innovative training courses. The pace of the transformation means new models of course design and new types of qualifications should be prioritised.*[65]

2.6 | HUB AND SPOKE DELIVERY

A major issue raised by experts and industry stakeholders are practical realities in matching training delivery with the location of labour demand, and of labour supply.

It is in the interests of both project developers and locals to be able to develop skills in the regional labour market. In some cases, notably the development of Federation's APRETEC facility in Ballarat, local training provision was central to the business case for investments in equipment, facilities and training courses, with significant retained benefits in income going to local rather than imported workers.[66]

However, course delivery in regional areas is challenged by 'thin' training markets. There are significant costs in course development, equipment and facilities, trainer recruitment and retention, and course delivery. Where the population does not support sufficient enrolments, there is reluctance to invest in training capacity, or delivery can prove unsustainable. Industry feedback suggests this can be exacerbated by other issues, such as reluctance to invest in training equipment, or reluctance by employers to invest in training, when there are uncertainties in project timelines.[67]

This market failure is challenging and requires specific interventions. One suggestion includes subsidies for group training organisations to deliver apprenticeships and traineeships in locations that would otherwise be unsustainable through standard training subsidies and industry payments.[68] This is a useful suggestion that can meet some demand but has limitations in terms of the breadth of course offerings and locations that can be serviced, as well as access to evolving equipment and technology.

A second option in meeting training needs across different regional markets requires the effective implementation of a 'hub and spoke' model. This aligns with the Centres of Excellence approach in developing hubs to disseminate best practice training, Hub and spoke models were recommended by Jobs and Skills Australia as a response to 'servicing thin markets in higher education and VET to ensure training provision in areas critical to the clean energy transition'.[69] Similarly, work for the Renewable Energy Sector Board recommended investigation of training and innovation hubs with TAFE NSW and private training organisations and the development of new delivery methods to service thin markets, including mobile training units.[70]

In broad terms, hub and spoke refers to a model where a core training facility provides a set of centralised training services which are then also delivered in other locations.

The 'hub' will generally provide substantial course delivery, host block training, house key training equipment, include staff with course development and industry engagement functions, and be a central point for organisation and administration. 'Spokes' can take various forms, but in a TAFE Centre of Excellence context would include course delivery at other TAFE campuses; delivery at Connected Learning Centres, in-field locations and with training partners with Mobile Training Units (MTUs); online delivery, and other forms of outreach such as schools and TVET.

While the terminology is relatively recent, TAFE NSW has historically utilised knowledge, course development, industry engagement and block training capacity based out of specific locations to deliver state wide needs for some industries.

More recently, TAFE NSW has sought to utilise its network of campuses, improved digital delivery, and innovations such as MTUs to provide course delivery across regional and rural areas.[71]

As well as addressing thin regional training markets, hub and spoke approaches provide a mechanism to address the other major challenges for providing skilled labour in regional areas – that is, the training and recruitment of workers from largely population centres. As the projections data shows, there are simply not enough workers in regional areas to meet the demand in clean energy. In addition, many of the growth areas for clean energy are attached to population centres, such as domestic solar and battery installation, or energy efficiency and electrification installations.

Clearly, in defining the design of a hub and spoke model, the location of the hub is a key decision.

Feedback from industry and training practitioners for this study identified that a establishing a hub (or hubs) in large population centres that can support enrolments was the logical and financially sustainable approach. This capacity can then be leveraged with appropriate designed and resourced spoke delivery to deliver training in less populated regional locations.

Critically, implementing an effective hub and spoke model requires substantial administrative capacity, capital and equipment, industry expertise and trainer knowledge, access to sites and/or mobile delivery capacity, a track record of effective partnerships, and sufficient investment in a core hub to develop, coordinate and deliver training. The statewide capacity of TAFE, and the clear alignment with the Centres of Excellence model, suggests they are the logical choice for implementing the hub and spoke model that appears essential to meeting clean energy workforce needs in NSW.

Centres of Excellence could develop deep expertise in wind, solar, smart energy systems or hydrogen, and build partnerships with industry to develop innovative training courses. The pace of the transformation means new models of course design and new types of qualifications should be prioritised.

– Australian Government, *Working Future Employment White Paper*

3 | A TAFE ENERGY CENTRE OF EXCELLENCE FOR NSW.

3.1 | DESIGN PRINCIPLES

There is a clear need for additional investments in training and training capacity to enable the development of the clean energy sector in NSW. The Centres of Excellence model being established through the National Skills Agreement and endorsed by both the Australian and New South Wales Governments, provides a direct pathway to securing investment and delivering the scale and innovation required.

As recent foundational research, and the industry and practitioner feedback secured for this paper make clear, considering the appropriate design and location for a training facility to service statewide demand requires balancing several criteria.

Satisfying workforce demand and local aspirations for accessible training in regional areas where the immediate onshore renewables boom is concentrated is an important consideration. Ensuring training is accessible to workers experiencing mid-career transitions in traditional energy industries based in regional NSW is similarly critical.

Conversely, however, the thin labour and training markets in parts of NSW where new electricity production is concentrated mean provision of training is required to the larger volume of recruits needed from coastal population centres. Moreover, most of the expansion in domestic clean energy and energy efficiency provision will occur in NSW's urban areas, and likely growth industries such as offshore wind and hydrogen production are similarly located adjacent to coastal population centres.

Establishment time is also a critical concern. Workforce development is urgent for some sectors, and of uncertain scale for others. This requires the ability to rapidly commence centre establishment – leaning on existing training capacity and facilities – while laying sustainable physical and institutional foundations to respond to emerging needs.

Realising the opportunities associated with integrated training models – particularly between vocational, industry and tertiary actors – also requires strong collaboration frameworks or demonstrated capacity and appetite to develop the required levels of integration. Practical needs include adequate institutional capacity to collaborate on course development and industry engagement, and willingness to apply shared-use approaches to technology and training equipment investment.

One additional consideration that emerged strongly from a number of stakeholders with experience of the current training landscape and student preferences was the importance of high amenity locations, and high-quality physical surroundings and equipment in training facilities. This was viewed as creating a stand out student experience that encourages course uptake and creates visibility of a clean energy sector that has struggled for definition in career and training pathways.

Reflecting the needs outlined above, and other feedback and data assessed for this study, suggests a particular set of 'design principles' that should be considered in the implementation of a TAFE Energy Centre of Excellence for NSW. These principles are outlined below and have been deployed to inform the proposed Centre of Excellence model described in the following section.

- **Model Meets Statewide Demand.** Given the diverse and geographically distributed nature of clean energy and related sectors a Centre must meet state-wide skills demand. This means capacity to deliver hub-and-spoke training, for example through block training, mobile training units, remote delivery, onsite with industry, and potentially more than one core facility.

- **Adds To Training System Capacity.** Most skills required for clean energy sector are the same or similar to those in demand by other sectors. The vocational training system is struggling to meet needs across all these sectors. Public investments to meet clean energy needs are an opportunity to boost the scale of training in key trades and occupations suffering shortages, as well as specialised clean energy skills.

- **Priorities Industry Participation.** This means sufficient resourcing of teaching and industry engagement staff; adequate space and flexibility to accommodate different industry needs; and a focus on course design and deliver modes that integrate with industry needs and equipment, whether at the Centre or other industry locations.

- **Enables Collaboration Across Education and Training Institutions.** There are significant opportunities for sharing equipment, meeting industry skills needs across public and private training organisations, and improving articulation between vocational and tertiary pathways. Any Centre of Excellence must be capable of integrating across regional, state-wide, and interstate collaborations.

- **Sustainable Operational Funding.** Appropriate physical infrastructure is a key requirement for meeting skills demand. However, adequate and recurring operational funding is required to ensure financial sustainability, delivery quality, and industry engagement capacity. Opex needs including teaching staff and recruitment, and course delivery, development and coordination costs.

- **Dedicated Investment in Equipment.** Ensuring adequate training and student experience means judicious investment in training equipment, both for core training and responding to evolving technology. Any Centre model should also incentivise industry and education and training organisations to utilise shared equipment.

- **Targeted at Short-Medium Term Skills Demands**. A training centre must prioritise courses in sectors with urgent demand, for example electrotechnology.

- **Minimises Establishment Period.** There is an urgent pipeline of demand in some clean energy sectors. The selection of location and operational model must minimize start up time.

- **Capacity to Adjust Delivery to Future Skill Demands**. The physical space and operational model of any Centre must have the capacity to flexibly develop and deliver courses to meet emerging needs, accommodate new technology and investments in new sectors, and accommodate enrolment growth.

- **Location is Accessible.** Location must be accessible to large population centres (to access a pool of potential students); with good transport links to the distributed set of locations with clean energy labour demands (airports and road); have available accommodation for block training; and be in proximity to industry and tertiary locations for integrated training.

- **Prioritises Pathway Visibility and Student Amenity.** The geographically distributed and diverse type of skill requirements for the sector creates challenges for visible pathways, particularly for younger students. A physical location must be attractive, with high amenity, to encourage participants. A centre should also incorporate an outreach component, for example to students.

3.2 | EVALUATION: A TIGHES HILL CENTRE OF EXCELLENCE

After reviewing recent research of clean energy skills demand, industry feedback, and available detail on the Centre of Excellence model described in the National Skills Agreement, Newcastle's Tighes Hill TAFE Campus has been assessed as an ideal location to host a TAFE Energy Centre of Excellence for NSW.

Tighes Hill TAFE was originally developed in the 1930s. It has been a key training hub for manufacturing including the BHP Steelworks, for electrotechnology, and for a wide range of other trades and vocational sectors. Located in the gentrifying inner suburbs of Newcastle, close to industrial facilities, the Port of Newcastle, and passenger rail, Tighes Hill occupies a large site with multiple facilities. The campus is well attended and offers a high amenity experience with a site layout and architecture similar to tertiary facilities.

FIGURE 7: TIGHES HILL CAMPUS

> Location

In relation to location, Tighes Hill has significant advantages that allow it to service multiple training markets.

Firstly, Newcastle is located in relative proximity to the New England and Central-West Orana Renewable Energy Zones where the overwhelming majority of onshore renewable energy development is concentrated (Figure 4). Given the noted population, labour and training market constraints in those regions, the Hunter provides the closest large population centre, and has strong road and air links with the NW and CWO REZ areas. We note the critical importance of an appropriate delivery model to service regional needs, with a 'hub and spoke' model leveraging TAFE's regional locations and networks the central component.

Secondly, the Hunter region is a key focus of industry, investor, Australian, and NSW Government efforts to establish key clean energy sectors, including offshore wind, hydrogen production and export, and battery technologies. Statewide workforce demand – and the imperative to demonstrate training capacity and skilled labour availability to attract investment – in these industries will be significantly concentrated in this area.

Thirdly, as an urban area integrated with Greater Sydney, the Hunter is in an ideal position to provide training to service the largest component of clean energy demand – that is, installation of domestic and commercial solar and batteries, electrification of households, energy efficiency, uptake of electric vehicles, and so on.

Finally, the Hunter is home to significant numbers of workers in traditional energy producing industries that are the focus of efforts to provide training and career transition support.

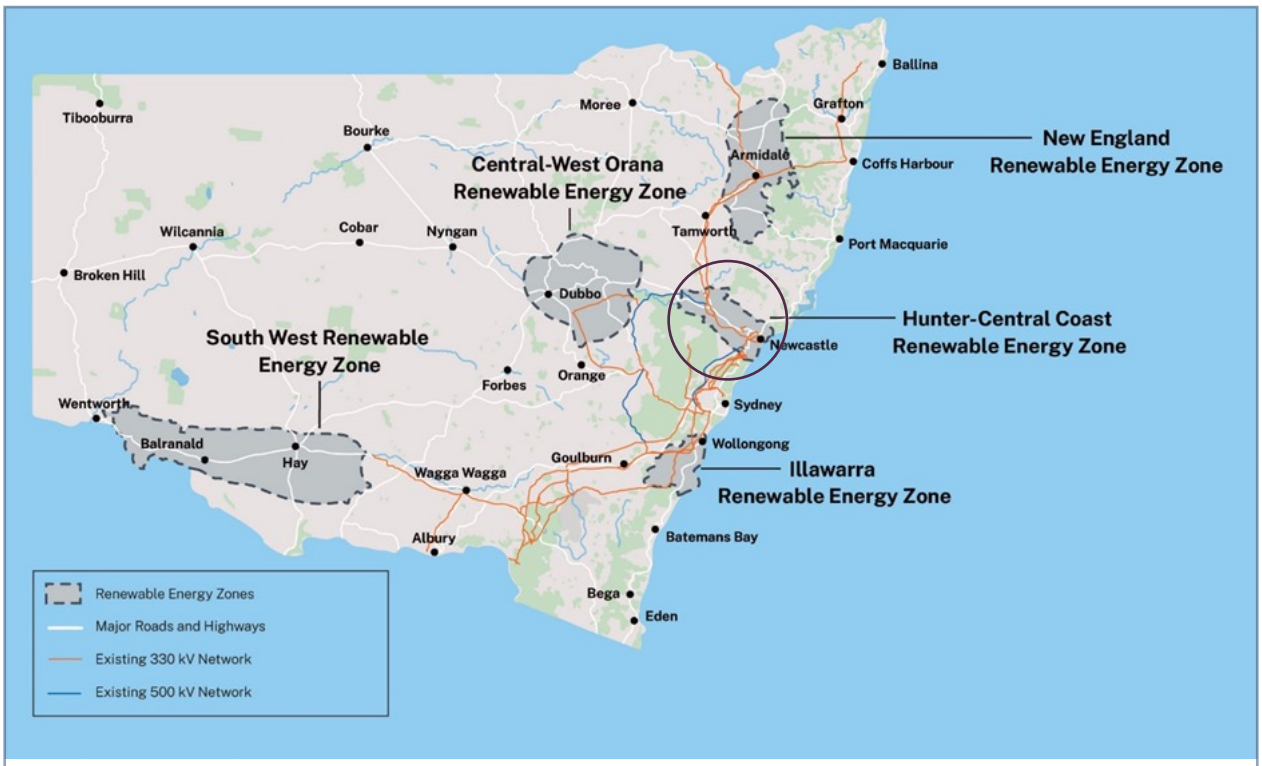


FIGURE 8: THE LOCATION OF RENEWABLE ENERGY ZONES (REZS) IN NSW. SOURCE: ENERGYCO 2023.

Existing Course Delivery Expertise

Tighes Hill also has significant advantages due to its existing course delivery offerings that align significantly with clean energy occupational demands. This includes electrotechnology, mechanical engineering, energy storage technology, air conditioning and refrigeration mechanics, and building design.

Tighes Hill is also one of only two sites, and the only regional location, to offer the recently developed Diploma and Undergraduate Certificate of Renewable Engineering. There are some course delivery approaches being applied out of the campus to renewable energy that provide the foundations of a hub and spoke approach, for example online delivery of short courses in renewable energy and energy storage systems.

In addition, the campus has had recent success in the implementation of new industry-specific training and the establishment of new capital technology and facilities, with the establishment of mechanical and avionics apprenticeship courses at the purpose-built Aviation Delivery Hub.

Physical Assets and Centre Start-up Time

The built assets and space available at Tighes Hill also situate it favourably for the development of an Energy Centre of Excellence. For example, J Block (Figs. 10, 15, 16) is a large, three-story facility of around 9,000 square metres where electrotechnology courses are delivered. There is significant scope for expanding utilisation of this facility, including additional equipment, and refurbishment, rebuild, and/or addition of adjacent new facilities. There are also a range of other facilities that could be deployed for related uses, for example mechanical and engineering workshops.

Importantly, Tighes Hill offers multiple options for establishing a Centre of Excellence in a phased manner. The ability to 'turbocharge' the establishment of a centre, utilising existing physical capacity and expertise, aligns with the clear urgency in boosting training identified through renewable energy labour projections and industry feedback. This capacity also aligns with the National Skills Agreement intention to rapidly establish six Centres of Excellence, including for net zero industries, in 2024. Industry feedback

identifies serious concerns about the required training times for key occupations such as electricians before demand peaks in 2028/29, with advocacy for early investment in training to boost supply an urgent need.[72]

The recent experience of repurposing of facilities at Tighes Hill for the establishment of the Aviation Delivery Hub also indicates the potential for future expansion to meet emerging clean energy needs over time.

Student Amenity & Centre Visibility

Tighes Hill Campus is ideally located and designed to facilitate a high amenity student experience. Recent investments in TAFE facilities in Sydney, such as the Meadowbank Institute of Applied Technology, demonstrate the potential for augmenting traditional TAFE facilities to substantially improve campus attractiveness and student amenity.

Tighes Hill, as a campus benefiting from significant historical investments and careful design, could deliver a similar experience at a much lower cost. The site is leafy, with open space, and well-designed buildings and layout. It is located on a highly visible main road in a thriving and sophisticated inner suburb with the benefit of industrial and port industries nearby.

FIGURE 9: TIGHES HILL CAMPUS

It is also well serviced by public transport and in close proximity to key recreational amenities in Newcastle including beaches, entertainment and major sports facilities. Stakeholder feedback identified these amenity values as being important considerations for local students, staff attraction and retention, and for visiting students.

Notably, training industry feedback also placed high importance on the development of a 'landmark', high visibility, high quality facility that 'tells a story' about the pathways and opportunities available in traditional trades and clean energy, as a student attraction strategy. With appropriate investment, Tighes Hill has all of the key elements to deliver this visibility and amenity.

Industry & Education Partnerships

There is significant local progress in the Hunter regarding the development of integrated industry, vocational and tertiary partnerships.

Importantly, the Hunter Region has a significant history of collaboration, with TAFE NSW and the University of Newcastle having a thirty-year partnership in education delivery.[73] Notably, Tighes Hill TAFE was the original location of the University of Newcastle when it was established as a university college in the 1950s.[74] This partnership has continued with recent examples, for example both institutions partnering with industry to deliver integrated aviation engineering training to address skills shortages.[75]

This history of collaboration extends to responses to clean energy training demand, with the University of Newcastle's Institute for Energy and Resources (NIER) in the process of developing a $16 million federally funded New Energy Precinct Skills Hub.

The Skills Hub will provide cutting edge training equipment for clean energy industries through a cooperative, open access partnership model with industry, TAFE, and other key stakeholders. The facility is planned to incorporate hydrogen, wind, solar, microgrid, battery, fuel cell and biofuel training equipment, and options for physical co-location with industry and vocational partners are currently being assessed.

As noted by Jobs and Skills Australia 'the current environment of supply chain lags and high inflation... has left some TAFE institutes with a shortfall in the purchase of equipment and building fit out.' Increased collaboration with industry and across providers to access new technology and available training infrastructure, and to cost share 'purchases of common training materials and equipment', was seen as a practical response to maximise the value of investments.[76]

This potential to share equipment, and indeed to deliver value for money through integrated course development and delivery, and coordination and administration, also extends to the implementation of NSW Government commitments for a Manufacturing Centre of Excellence to be based in the Hunter. This presents an opportunity for further integration across sectors and training needs.

The in-progress development of the New Energy Precinct Skills Hub, potential investment in a TAFE Centre of Excellence, and the demonstrated appetite of regional stakeholders to work together suggests the Hunter as a location with the right enabling conditions for effective partnerships. These conditions and partnerships will be critical in delivering the integrated training environment required to meet clean energy workforce needs.[77]

3.3 | TRAINING CENTRE DELIVERY MODEL & COSTING METHOD

> Method

There is a strong case for the establishment of an Energy Centre of Excellence at Tighes Hill. To provide additional detail for decision makers, training organisations and industry, the Institute for Regional Futures has developed an indicative delivery model design.

In order to develop this illustrative delivery model and associated costings, a set of scope and operational parameters were identified. Data from various sources, expert advice, and informed judgements were then used to define specific parameters. A specialist consultancy with sector experience in costing training centre models for vocational proponents (Turbo – The Business Case Specialists) was engaged to estimate costings using standard Net Present Value and sensitivity tested business case techniques.

The selected parameters were informed by:

+ Publicly available information on similar developments in NSW and interstate, for example in relation to build costs and course sizes.
+ Business cases undertaken for similar developments, such as APRETEC.
+ Publicly available information related to specific training costs, such as floor plans for Tighes Hill facilities, equipment for mobile training units, renewable energy training equipment, and trainer wage rates.
+ Testing of key assumptions with industry experts.
+ Research, sector knowledge and data and advice from Turbo - The Business Case Specialists.

> Parameters

The assumed annual number of students is 450. This is similar to the numbers identified for similar facilities, such as the Electrogroup's Pinkenba Renewable Energy Training Centre (Brisbane – 300)[78] and the NSW Government's commitments for Manufacturing Centres of Excellence (300 – 400 per facility).[79]

These student numbers were then broken down across trade, pre and post trade, diploma and short course delivery (Table 1). These student numbers were estimated to grow in line with the regional population (to 576 by 2052), noting that this is a conservative assumption and does not account for growth to respond to new growth sectors, such as offshore wind. While percentages were not specified, it is assumed that a proportion of onsite training consists of block, short course, and online training suitable for non-local students.

TABLE 1. **MODELLED COURSE BREAKDOWN**

Course Breakdown – Tighes Hill TAFE Energy Centre of Excellence Model Option	
Cert III (trade)	100
Cert IV/Diploma	75
Cert II (pre trade)	100
Cert II (post trade)	75
Short courses and micro credentials/skills	100
Total Students	450

Importantly, the model option does not specify training for particular occupations or clean energy sectors. While there is significant definition around occupational needs (for example electricians, engineering trades, wind farm technicians)[80] and sectoral demand (for example onshore wind, domestic and utility solar, battery installation, offshore wind, hydrogen, energy efficiency upgrades) identifying particular courses and key sectors requires detailed scoping and industry engagement conducted through a proponent-led business case.

Teaching staff numbers for onsite delivery were assumed at a ratio of 1 teacher per 17 students onsite on any one day, based on best practice ratios. These ratios were adopted in recognition of the importance of the student experience, and to provide sufficient opportunity for trainers to contribute to course development, industry engagement, and updating of skills.

Wages were assumed at the highest pay scale under the relevant award, with a 30% overhead. This accounts for the importance of competitive wages for teacher recruitment, and allowing for smoothing of rates to account for conversely, some teaching staff on lower rates, and others receiving overtime and other additional payments.

In keeping with industry feedback, a set of other operational costs have also been estimated, primarily IT, course materials, cleaning and related costs. Total operational costs across teaching, administration and other costs, were modelled over a five-year cycle, in keeping with industry feedback to ensure that operational costs, as well as capital costs, were incorporated in business case estimates.

In addition to onsite delivery, remote delivery costs were estimated for the provision of two mobile training units. Two separate models were identified as necessary for practical reasons. Truck-mounted units provide essential functionality for some course delivery – for example, rails for height training, confined space training, and larger training kits and equipment. However, they require a vehicle licence that is not held by all trainers, and the costs of hiring drivers are prohibitive. Other functions can be satisfied with lighter, trailer-mounted equipment – including compact, multi-technology clean energy training equipment. This includes trades and technical training, as well as other functions such as careers fairs and STEM training for schools.

Industry feedback suggests ensuring sustainable work and travel loads is an important consideration for mobile training staff. Given this, it is assumed two teaching staff are attached to each unit, and that the MTUs are in the field 50% of the time. This also provides for coordination and engagement capacity with staff. Costs associated with trainer accommodation, as well as unit operational and insurance costs, have also been estimated.

We also note that course enrolment numbers of MTU-delivered courses have not been estimated, given a lack of available data on class sizes and types. Given thin labour markets we would anticipate lower per teacher ratios than assumed for onsite and online delivery. These numbers would need to be defined by a training Centre proponent with access to current data on MTU delivery, but would result in considerable additional annual student numbers beyond the 450 enrolled at the Centre 'hub'.

Lastly, the most substantial influence on modelled costs relate to options for the physical facility to deliver and coordinate courses. The required minimum floor space capacity is based on

estimates of per student requirements for general classes, trade, and specialist trades spaces, as well as sufficient office space. This is estimated at around 2,600 square metres of study space and 1,000 square meters of non-study space at commencement. Operational maintenance costs are also incorporated.

One primary option has been modelled – refurbishment of Tighes Hill J Block, where electrotechnology courses are currently delivered (Figure 7). J Block provides significant advantages, as an existing facility that can be rapidly utilised, progressively refurbished, and with a very large floorspace capacity of 9,000 square metres that provides for significant facility expansion in future. An extensive set of refurbishment costs have been incorporated, including demolition and hazardous materials, comprehensive internal fit out, 7-star energy efficiency requirements, and solar panels and battery storage.

A second option – a new building, on an unspecified onsite location – has also been included, for illustrative purposes, with modelled costs for meeting minimum space requirements for 450 students at 3,600 square meters at Centre commencement, and 576 students in 2052, based on conservative regional population-based growth rates.

We also note that, due to the identification of specific course types and the exact clean energy sectors to be serviced not being assumed in this model, no costings are undertaken for capital equipment. This should be undertaken as part of a full business case including industry engagement and access to commercial data. However, the modelled costings are equivalent to proposed or in-progress facility investments in other states, and there are significant prospects for utilisation of shared open access training facilities in Newcastle through collaboration with tertiary and industry institutions, for example the NIER New Energy Skills Hub.

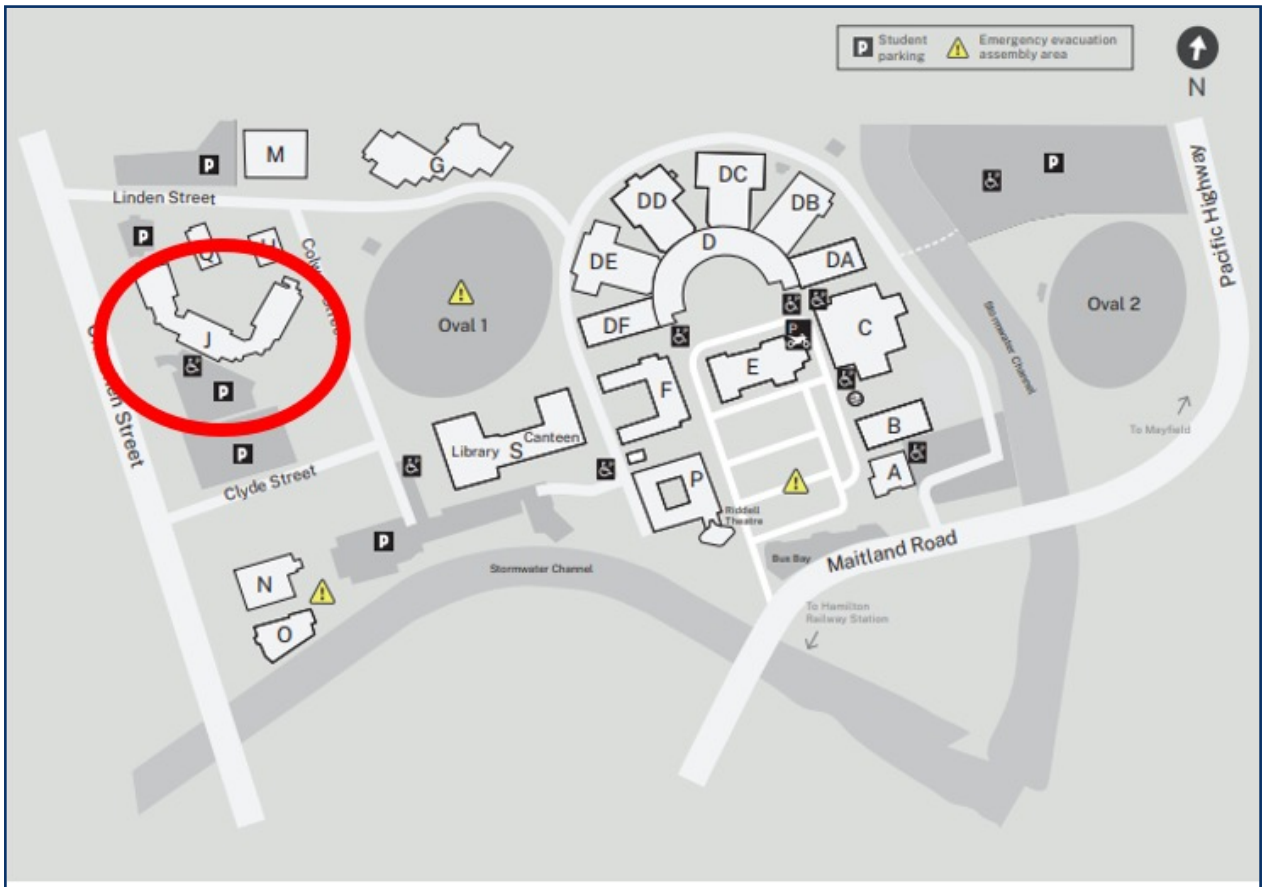


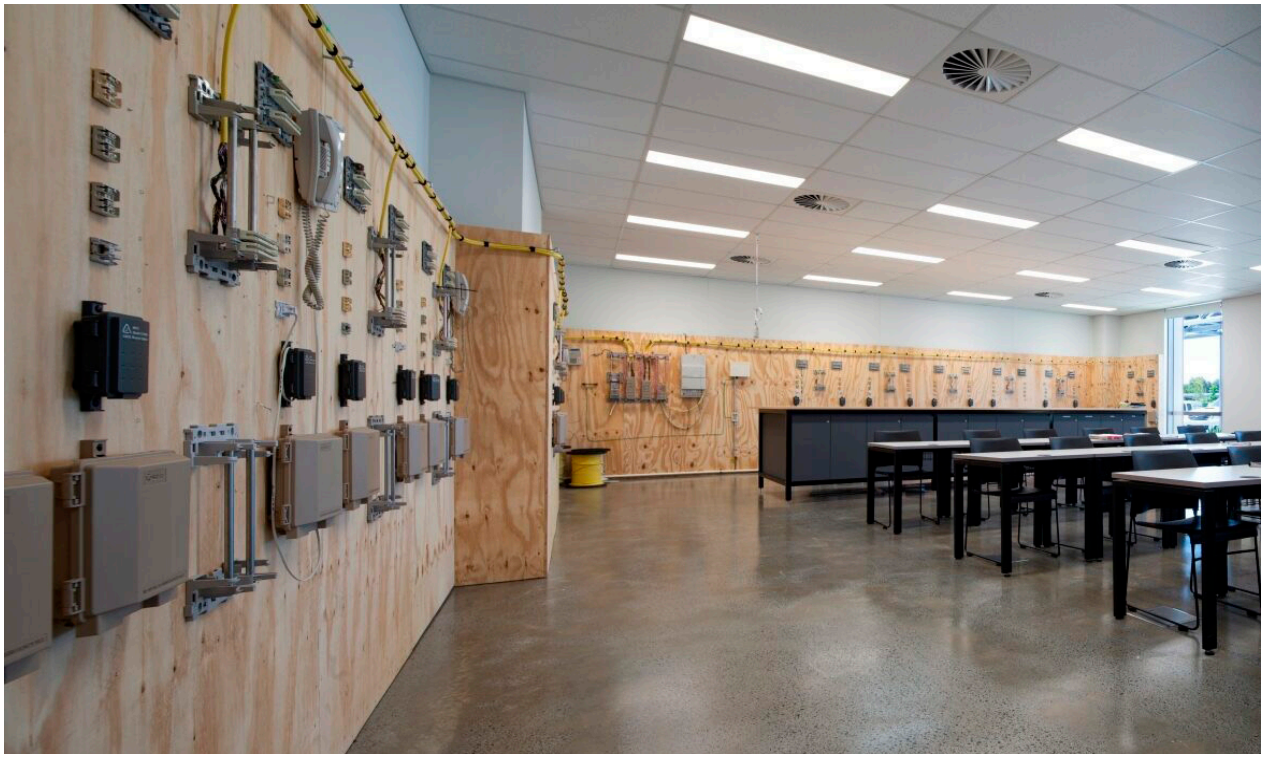
FIGURE 10: TIGHES HILL CAMPUS MAP - J BLOCK

Delivery Model Description

In sum, the option described here for the implementation of a TAFE Energy Centre of Excellence at Tighes Hill has the following parameters:

- Hub and spoke design.
- 450 students annually across trade, pre and post trade, diploma and short courses.
- Delivery includes block and online training courses suitable for remote delivery.
- Includes a major refurbishment of the electrotechnology J-Block, noting scope for phased development extending from use of existing facilities, to refurbishment or new build.
- Includes two mobile training units to deliver courses at other TAFE or industry facilities, and to conduct educational outreach.
- Includes sufficient teaching and administration staff to support course development, industry engagement, dissemination and coordinate training across the TAFE network.
- Includes operational funding, costed over a five-year cycle.
- Scope for rapid start up in line with national Centre of Excellence priorities and industry demand.
- Integration with industry and tertiary facilities and training, including shared use of equipment – for example NIER New Energy Precinct Skills Hub.
- Specific clean energy industry training areas and course types and equipment needs to be defined through a detailed business case, and industry and partner engagement.
- Site provides capacity for future expansion – for example, specialised offshore marine training facilities or wind turbine installations.

ELECTROGROUP RENEWABLE ENERGY TRAINING CENTRE PINKENBA - TRADES CLASSROOMS



3.4 | INDICATIVE COSTINGS

The following indicative costings have been provided to illustrate the potential scope of operations and costs, and to provide a starting point that should be of value to proponents and key stakeholders who may choose to progress an Energy Centre of Excellence for NSW. Costings necessarily incorporate assumptions, and we note risks and sensitivities.

We also note the importance of undertaking a full business case that considers multiple options, for example facility reuse, refurbishment, and new build options; options for progressive staging of development; utilises more detailed parameters on course type, specific clean energy sectors being serviced, and capital equipment; has access to more detailed commercial and operational data only available to proponents; and includes engagement with industry, tertiary, and other potential participating organisations.

> Training Centre Operational Costs

Given industry feedback on the importance of sufficient operational allocations for the running of training centres, and the potential for rapid Centre establishment using existing facilities, the costing model begins with operational training costs.

Teaching numbers for onsite delivery were estimated at 18.9 FTEs, assuming best practice teacher-student ratios (1:17) for daily student numbers (322). Admin and IT staff were estimated at ratios of 1:100 and 1:150, totalling 5.2 staff. Assuming the highest pay scale, annual wage costs are $3.4 million. IT and materials were estimated at $445,000, and cleaning and related costs were estimated at $1.45 million per annum.

In current year costs, annual opex is estimated at $5.3 million (Table 2, Figure 11). Assuming delivery growth rates of 0.5% per year, and excluding inflation, operational costs over five years are $21.8 million in net present value terms, at a standard 7% discount rate (Table 3).

TABLE 2. **ESTIMATED ANNUAL TRAINING CENTRE OPERATIONAL COSTS**

Annual Training Costs	2023
Staff	$3,380,413
Cleaning	$1,441,275
IT and Materials	$444,808
Total	$5,266,497

TABLE 3. **ESTIMATED FIVE YEARLY TRAINING CENTRE OPERATIONAL COSTS (NPV).**

Five Year Operational Cost Estimate		Standard Discount Rate	
Discount Rates	3%	**7%**	10%
5 Years	$23,018,074	**$21,795,032**	$20,144,855
10 Years	$41,499,970	**$37,719,489**	$32,963,129

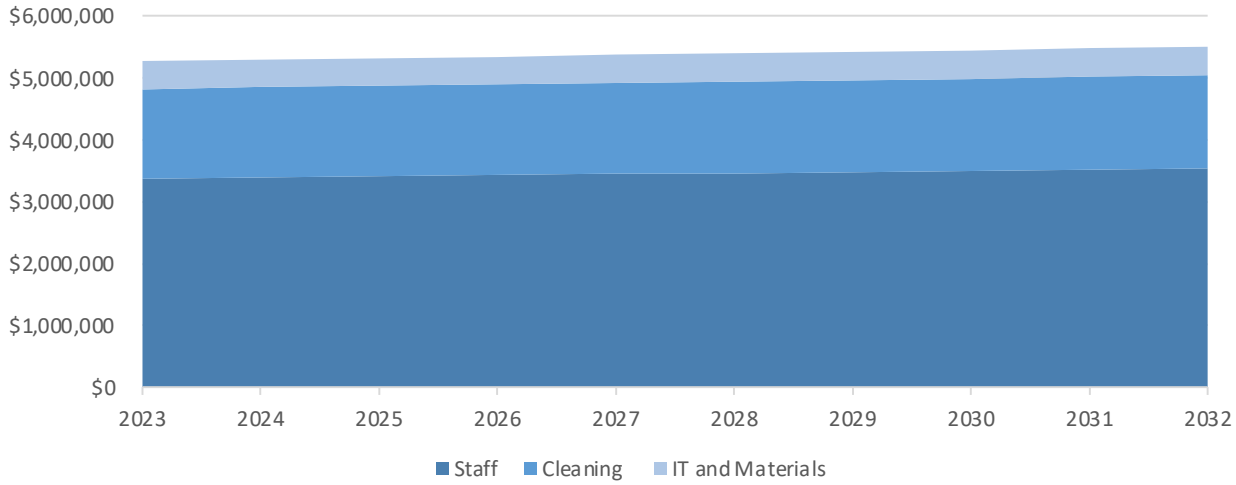


FIGURE 11: ESTIMATED ANNUAL TRAINING CENTRE OPERATIONAL COSTS (NPV).

Mobile Training Unit Capital and Operational Costs

The second key cost component are the mobile training units for spoke delivery. Key parameters include one truck (Figure 12) and one ute-and-trailer unit, with specialised clean energy mobile training equipment; two full time trainer staff per unit, and each unit being in the field for 50% of the time. Operational costs include accommodation and running costs.

Upfront capex on both units is estimated at $470,000 (Table 4). Annualised capital expenditure and running costs, including standard depreciation and capital return rates, are $421,000 in year one, largely comprising training staff and associated operational costs, and $3.6m over five years (NPV, 7% discount) (Table 5).

Facility Costs

The final, and largest, key cost component is facility refurbishment to create a modern and high-quality training environment. A building refurbishment and capex range was utilised based on broadly equivalent expenditure at similar recent TAFE and interstate training centre investments (Institute of Applied Technology and multi-trade centres at Kingswood and Meadowbank, Pinkenba Renewable Energy Training Centre, APRETEC Business Cases) and existing NSW Government commitments for

FIGURE 12: MTU TRUCK UNIT EXAMPLE

TABLE 4. MTU CAPEX ESTIMATES

Mobile Training Unit Upfront Capex Cost	
Truck Unit Isuzu N Series NLR 45-150, Trayback Shell and Fit Out, Clean Energy Training Kit, Advanced Solar Training Kit, Insurance and Registration.	$386,848
Ute Unit Dual Cab Hilux, Trailer, Clean Energy Training Kit, Insurance and Registration.	$82,710

TABLE 5. ESTIMATED FIVE YEARLY MOBILE TRAINING UNIT OPEX AND CAPEX (NPV).

Five Year Cost Estimate		Standard Discount Rate	
Discount Rates	3%	**7%**	10%
5 Years	$3,811,290	**$3,608,781**	$3,335,547
10 Years	$6,871,487	**$6,245,523**	$5,457,973

a similar Manufacturing Centre of Excellence. We note the present high-cost construction environment and risks in estimation.

The primary option assessed is the refurbishment of large and flexible existing electrotechnology facilities at Tighes Hill – the 3 storey, 9,000 square metre J Block (Figs. 10,13,14). Detailed assumptions on floor space requirements were based on expected student numbers, floor space requirements for different training environments, and publicly available floor plans and aerial mapping. As detailed in the method section, refurbishment estimates incorporate demolish and hazards, comprehensive fit out, 7-star rating, and solar and battery installation.

The base case refurbishment cost estimate for J Block is $41 million (Table 6). This compares favourably or equivalently to other recent facilities. For example, the TAFE Meadowbank multi-trades hub and digital Institute of Applied Technology (IAT) and the Kingswood Construction IAT were allocated $157m and $80 million respectively.[81] We note the Electrogroup Renewable Energy Training Centre in Brisbane was allocated $23 million for refurbishment and new build for 300 students in 2021, as an approximately equivalent expenditure, accounting for inflation and smaller scale.[82]

The NSW Government has also committed $43 million for TAFE upgrades to deliver three Manufacturing Centres of Excellence to support 1000 students annually.[83] At equivalent per student costs, this would suggest a cost of $19.4 million for 450 students, placing the J-Block refurbishment as a viable investment in the context of state-federal Centres of Excellence, assuming the joint contributions envisaged under the NSA.

In regard to sensitivities, we also note medium and high-cost environment scenarios add 30% and 69% cost premiums on base case refurbishment costs.

To illustrate alternative cost scenarios, a secondary new build option was also modelled (Table 7). This incorporates car park construction and landscaping costs. We note siting has not been specified, and this scenario assumes available open space, no demolition costs, or detailed design costs. While refurbishment costs have been modelled on the fixed area of the existing J building (9000 square metres), new build costs have been estimated under two floor sizes, reflecting year 1 enrolments, and

FIGURE 13: J BLOCK - EXTERNAL

FIGURE 14: J BLOCK - INTERNAL

to accommodate conservative population-based student growth rates over 30 years (to 570 students).

Under this scenario, new build facilities are initially cheaper, and offer other benefits such as longer operational life, and potential bespoke design. We also note unobserved costs and logistical issues in relation to siting, and medium and higher band sensitivity estimates of 24-33%, and 42-74% respectively.

These new build costings also provide insights to establishment costs on other sites, or the potential for investments on the Tighes Hill site that may be considered in future – for example specialised offshore wind marine training facilities.

However, new build facilities have similar or more expensive square metre costs and lack the flexibility of the larger J-Block refurbished facility to accommodate new training additions as clean energy industries continue to expand in future. We also note the policy intent expressed in relation to other Centre of Excellences focusing on facility upgrades.[84]

Ultimately, we believe the indicative operational, spoke delivery, and facility costings described here suggest a NSW Energy Centre of Excellence based at Tighes Hill Campus could provide a competitive and high value-for-money investment for the NSW and Australian Governments, and potentially other private and tertiary sector partners. While we note data and scope limitations in the analysis, these costings suggest a strong case for progressing to a full, proponent-led business case.

TABLE 6. **J BLOCK REFURBISHMENT COST ESTIMATE.**

Refurbishment Cost Estimate	Base Case
Total Refurbish Capital Cost	$41,017,568
Refurbish Capital per SQM $4,558	$4,558

TABLE 7. **NEW BUILD COST ESTIMATE.**

Refurbishment Cost Estimate	Base Case – Year 1 enrolments (450)	Base Case – Year 30 enrolments (572)
Total Refurbish Capital Cost	$15,044,805	**$25,638,996**
Refurbish Capital per SQM	$4,169	**$5,576**

4 | RECOMMENDATIONS.

4.1 | CONCLUSION: PROGRESSING A FULL BUSINESS CASE

The data and industry feedback assessed in this study show a pressing need for vocational investments in training the clean energy workforce.

Industry perspectives that describe the shortage of key trades like electricians as a 'massive problem' for renewable energy zone delivery,[85] refer to a 'skills crisis' and characterise the vocational training system as being 'at breaking point' demonstrate the urgency of the situation.

Fortunately, the increased sophistication of workforce analysis and the real time prioritisation in Australian and NSW Government training policy that offers prospects of a substantial public investment and policy response.

In particular, commitments to 'turbocharging' rapid development of TAFE Centres of Excellence, including in clean energy, offer a direct means to address complex issues of scaling up traditional trades, delivering new specialist skills, and addressing regional training needs.

Incorporating industry and expert engagement, the research in this paper has assessed the prospects of a NSW TAFE Energy Centre of Excellence to be based at Tighes Hill Campus in Newcastle. We believe this location is the best option for meeting and balancing the set of statewide needs. Moreover, based on indicative costings, Tighes Hill presents an affordable and value for money option.

Given the findings in this study, and the broader context, we recommend immediate actions to assess the rapid establishment of a Tighes Hill Energy Centre of Excellence, and to progress a Strategic and Final Business Case through TAFE NSW. We emphasise the importance of comprehensive assessments and strategic partnerships in delivering these actions, and provide some specific suggestions on key issues to be considered in the following recommendations.

We also welcome feedback on this study and look forward to engaging with interested parties on these critical issues for New South Wales.

4.2 | RECOMMENDATIONS

#1 The Australian and NSW Governments, with TAFE NSW, urgently assess the establishment of a Tighes Hill Energy Centre of Excellence as a candidate to meet the 'rapid establishment' of a Centre of Excellence for net zero in 2024, as prioritised under the National Skills Agreement, to meet state wide demand for training in clean energy and related industries.

#2 The NSW Government immediately instructs and funds TAFE NSW to undertake a Strategic and Final Business Case, for significant infrastructure and operational investment to establish a TAFE Energy Centre of Excellence at Tighes Hill, including active participation of the Australian Government and potential industry and tertiary partners.

#3 The Strategic and Final Business Case should incorporate the following:

- **a.** Assess the establishment of an Energy Centre of Excellence based at Tighes Hill for at least 450 students annually.
- **b.** State-wide delivery, including utilisation of other TAFE facilities, mobile training, and industry participation.
- **c.** Dissemination of best practice clean energy training across the statewide TAFE network.
- **d.** Partnership options with industry, tertiary and private training providers, including utilisation of industry technology, utilisation of partner facilities, and vocational-tertiary articulation.
- **e.** Co-location and integration with the Hunter Manufacturing Centre of Excellence planned by the NSW Government.
- **f.** A high amenity student experience.
- **g.** A significant outreach component to facilitate uptake of clean energy training pathways for young people and workers in transition affected sectors.
- **h.** Funding for ongoing industry engagement to identify evolving training needs.
- **i.** Operational training costs over a multi-year period, for example five years.
- **j.** Assess options for a) facility refurbishment and b) new build facilities.
- **k.** Assess timeline options for a) rapid course investment followed by progressive facility establishment b) course establishment following facility refurbishment or new build.
- **l.** Identify priority sectoral and course training and equipment needs for near term delivery.
- **m.** Identify likely future expansion needs by sector and course types, including offshore wind marine environment training and for the hydrogen sector.
- **n.** Compliance with any guidelines or requirements for funding under the National Skills Agreement Centres of Excellence program.

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