



Future Energy Skills for the North Coast

SNR FUTURE ENERGY SKILLS PROJECT





**Regional
Development**
Australia

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This project is funded by the Australian Government Department of Education, Employment and Workplace Relations (DEEWR) through the Local Employment Coordinator Flexible Funding Pool. The project was initiated and developed by the members of the Sustain Northern Rivers (SNR) Energy Working Group. As a member of SNR, the funding has been auspiced by Regional Development Australia – Northern Rivers (RDA-NR).

Sustain Northern Rivers and RDA–Northern Rivers would like to acknowledge the contributions of Sustain Northern Rivers Energy Working Group, DEEWR, the Local Employment Coordinator, the Institute of Sustainable Futures, University of Technology Sydney and J&S Learningwork.

Particular mention for project support and development are required to the Local Employment Co-ordinator, Terry Watson, Robyn Fitzroy and Kirsty Howton (former SNR Energy working group convenor) for securing the resourcing and Robyn Fitzroy for managing this project.

Citation:

Please cite this Report as: Ison, N., Mcgee, C., Tansley, S., Murta, J., Milne, G. and Harris, S. *Future Energy Skills for the North Coast, 2012*. Institute for Sustainable Futures, University of Technology Sydney prepared for Regional Development Australia – Northern Rivers on behalf of Sustain Northern Rivers.

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Sustain Northern Rivers

Member Organisations

Sustain Northern Rivers (SNR) is a collaboration of 26 peak regional organisations formed in 2008. These partner organisations are committed to communicate, consult and collaborate for action on climate change. The membership includes Councils, State Government Departments, University and TAFE, community organisations, including youth and natural resource agencies in the region.

To address the wicked problem of climate change Sustain Northern Rivers has developed a collaborative model based on distributed leadership. It acknowledges that no one organisation has the mandate or resources to deal with all of the interrelated issues involved. The approach is based on the premise that collaborative action is the most effective way to build this region's resilience to climate change. Four working groups devised a number of strategies to address climate change mitigation and adaptation, focused on the key areas of energy, transport, food and social innovation. A working Group is a self-governing, activity-based group, making its own decisions about how to maximise collaborative outcomes aligned to SNR.

SNR Collaborating Organisations

1. ACE Community Colleges
2. Ballina Shire Council
3. Byron Shire Council
4. Byron Region Community College
5. Clarence Valley Council
6. EnviTE Inc
7. Kyogle Council
8. Lismore City Council
9. Local Community Services Association - Far North Coast Regional Group
10. North Coast TAFE
11. North East Waste Forum
12. Northern NSW Local Health District
13. Northern Rivers Catchment Management Authority
14. Northern Rivers Social Development Council
15. Northern Star Pty Ltd
16. Northern Rivers Tourism Inc
17. Northern Rivers Youth Advisory Council
18. NSW Department of Education and Communities
19. NSW Department of Primary Industries
20. NSW Department of Trade and Investment
21. Regional Development Australia-Northern Rivers
22. Richmond Valley Council
23. Southern Cross University
24. Tweed Shire Council
25. University Centre for Rural Health-North Coast
26. Youth Environment Society

SNR Sustain Energy Working Group

SNR Sustain Energy has a goal *'to empower and enable the North Coast to reduce greenhouse gas emissions by 20% and increase the proportion of renewable energy sources to 20% by 2020'*. SNR has developed an action plan to reach this goal and recognises that in order to achieve significant and sustainable emissions reduction an integrated and targeted program is required that combines demand management, energy efficiency and distributed energy strategies with increased supply of renewable energy.

The SNR Sustain Energy Working Group has been responsible for the development of this project in collaboration with DEEWR and the Local Employment Co-ordinator.

Contributions to the SNR Sustain Energy Working Group come from SNR members as well as others from non SNR organisations. SNR Sustain Energy Working group members are responsible for:

- Implementing actions
- Attending Working Group meetings
- Collaborating actively on projects
- Proposing collective actions
- Recruiting other members
- Aligning projects with existing work plans.

Sustain Energy Working Group members include:

Kirsty Howton	Southern Cross University (former Convenor)
Craig Jenkins	NSW Department of Industry and Investment (current Convenor)
Alicia Bales	North Coast TAFE
Des Schroder	Clarence Valley Council
Paul Cruikshank	NSW Office of Environment and Heritage
Katrina Shields	Byron Region Community College
Kim Graham	Community Representative
Lynne De Weaver	Regional Development Australia-Northern Rivers
Max Boyd	Regional Development Australia-Northern Rivers
Derek Mackenzie	Richmond Valley Council
James Sturch	Si Clean Energy
Klara Marosszeky	North Coast TAFE
Natalie Myer	Local Community Services Association-Far North Coast Regional Group
Jeff Johnson	Ballina Shire Council
Suzie Coulston	NSW Department of Industry and Investment
Katrina Luckie	Regional Development Australia-Northern Rivers
Robyn Fitzroy	Regional Development Australia-Northern Rivers
Pieter Verasdonck	NSW Department of Industry and Investment
Mark Byrne	NSW Environmental Defenders Office (formerly)
Simon Clough	Community Member, Lismore City Council

Acronyms

BRCC – Byron Region Community College

CC – Community Colleges

CEC – Clean Energy Council

CPD – Continuing Professional Development

DEEWR – Department of Education, Employment and Workplace Relations

DE – Decentralised Energy

DG – Distributed Generation

DM – Demand Management

LCSA-FNC – Local Community Services Associate – Far North Coast

HSB – High Speed Broadband

HVAC – Heating, Ventilation and Air Conditioning

ISF – Institute for Sustainable Futures

MCE – Ministerial Council on Energy (now SCER – Standing Council on Energy and Resources)

MCTEE - Ministerial Council for Tertiary Education and Employment

NBN – National Broadband Network

NPV – Net Present Value

RDA – Regional Development Australia

RTO – Registered Training Organisation

SNR – Sustain Northern Rivers

Solar PV – Solar Photovoltaics

VET – Vocational Education and Training

EXECUTIVE SUMMARY

1. BACKGROUND

This research report has been commissioned to inform the development of the *Regional Skilling for Change Implementation Program* for the North Coast. The program will address the provision of current and future skills required to achieve a sustainable energy future, and is part of a broader *Energy Action Plan* developed by *Sustain Northern Rivers* (SNR) for the North Coast. SNR is a collaboration of peak government, educational, commercial and community bodies working together to improve the sustainability and resilience of the Northern Rivers Region.

This research project has been conducted by the *Institute for Sustainable Futures* (ISF) at the University of Technology, Sydney. The project is coordinated by *Regional Development Australia – Northern Rivers* (RDA-NR) on behalf of SNR and is funded by the *Department of Education, Employment and Workplace Relations* (DEEWR).

The research project addresses these key questions:

1. What skills are required, now and in the future, to transition to a sustainable energy future on the North Coast?
2. What skills gaps exist in the North Coast, relative to the skills needs defined above?
3. How can the various training providers on the North Coast best address these skills gaps?

In terms of project scope, the focus is on stationary energy generation and consumption, including all parts of the supply chain for related services and products with the exception of manufacturing (as most of this will occur outside the region). Transportation energy is not included in the scope. As requested by the project brief, we have considered the skills needed in the energy sector as it adapts to evolving issues such as carbon pricing, demand management and energy efficiency, a lower carbon economy, transition to renewable energy-based systems and the ‘smart’ energy systems enabled by the introduction of the high speed National Broadband Network (NBN).

1.1 Research Methodology

Given the ambitious scope of the project, an interview-based approach was chosen to provide the best outcomes for the available budget. This enabled us to draw on the expertise and experience of a diverse range of industry and training experts, many based in the North Coast, who engage with the questions of a sustainable energy future and skills development in their everyday practice. The project included the following steps:

- **Literature review** to define what is meant by a ‘sustainable energy skill’, scope the range of already identified skills gaps in Australia and provide a snapshot of relevant training available in the vocational education and training (VET) sector.
- **Interviews** with 18 stakeholders from relevant energy industry and training sectors, including national and local perspectives, to gain insights about skills needs, skills gaps and training opportunities in the North Coast.
- **Stakeholder workshop** with members of SNR to present the preliminary analysis of findings, test these findings and collaboratively develop recommendations for the *Regional Skilling for Change Implementation Program*.

1.2 North Coast Snapshot

The North Coast of NSW has many geographical and demographic features that support the development of a sustainable energy future, including good solar energy resources and a strong agricultural sector to support biomass. The region has a strong recent history in support for renewable energy, with a local company, Rainbow Power Company, being a pioneer in the field.

With the establishment of the SNR working group, a guiding aim was developed to “empower and enable the North Coast to reduce greenhouse gas emissions by 20% and increase the proportion of renewable energy sources to 20%, by 2020”.

On the North Coast there are four main avenues for tertiary and vocational education; North Coast TAFE, Community Colleges, private RTOs and Southern Cross University.

1.3 Energy trends

In the absence of a detailed energy strategy for the North Coast (this is yet to be developed by SNR), general energy sector trends and drivers in Australia were identified, including:

- Rising electricity prices
- Energy and peak demand projections
- Smart grid and NBN/HSB
- Decentralised energy
- Decarbonisation of the grid
- Community energy projects
- Zero carbon buildings

2. SKILLS FOR A SUSTAINABLE ENERGY FUTURE

For the purposes of this report, ‘skills for a sustainable energy future’ are defined as the technical skills, knowledge, values and attitudes needed in the workforce to develop and support a sustainable energy future in business, industry, the public sector and the community.

Skills for a sustainable energy future fall into three main categories:

- Traditional skills (skills already in the present in the labour market) put to use in a sustainable energy context, such as a sheet metal worker constructing wind turbine towers
- Traditional skills that are adapted to varying degrees to suit new technologies and approaches, such as an electrician wiring up a photovoltaic system
- A completely new set of skills, such as carbon footprint analysis

2.1 Skills gaps identified

For the purposes of this report, a ‘skills gap’ describes the deficit between available workforce skills and the skills that are required to achieve a sustainable energy future. The skills gaps identified in the research are summarised into 10 meta-areas as shown in the table below:

Skills Gap	National	North Coast
Energy option specific skills gaps		
Bioenergy	?	?
Building Energy Efficiency	?	?
Solar PV in buildings	?	?
HSB, Smart-grid and Demand Management	?	?
Large Wind	?	n/a
Cross-cutting skills gaps		
Energy assessors and auditors	?	?
Engineering	?	?
Grid connection for large renewables	?	?
Planning		
Business case for energy options	?	?
Soft-energy skills	?	?

These skills gaps, and recommendations for addressing them, are summarised in more detail below.

Bioenergy

Given the fertile land, high precipitation and associated agricultural industry in the North Coast, it is likely that a sustainable energy future will include a significant bioenergy sector. Already, two of NSW's largest bioenergy facilities are located on the North Coast.

The bioenergy sector encompasses a diverse range of potential technologies. Despite being prevalent in Europe and North America it is not yet a commercially mature sector in Australia. It can be considered as an amalgam of two existing skill sets – electricity generation and agriculture, though it can also cover the forestry, waste and wastewater sectors as well. To expand the fledgling bioenergy sector in the North Coast will require a concerted effort.

Recommendations:

- Develop a bioenergy strategy for the North Coast, bringing together a range of relevant stakeholders.
- Create bioenergy training programs at vocational and higher educational levels, which include placements in bioenergy facilities

Energy efficiency and solar technologies in buildings

Evidence from interviewees suggests that skills in energy efficiency and photovoltaic (PV) system design and installation already exist on the North Coast. However, these areas have been identified as skills gaps for three reasons:

- Retention of skills in the region is a challenge, with a number of PV installers migrating to Queensland where demand is higher (after the end of the NSW Solar Bonus Scheme)
- As energy efficiency and PV will play a significant role in a sustainable energy future for the North Coast, the current number of skilled professionals will not be sufficient
- These skills are mostly held by 'specialists' but are only slowly being embedded in the 'mainstream' building industry

Specific areas to be addressed through training include thermal performance in buildings, building services (e.g. lighting, HVAC), commercial-scale energy efficiency, solar PV systems and how the various building rating schemes work together.

Recommendations:

- Increase the availability of Clean Energy Council-accredited training for solar PV installation
- Increase the availability of specialist training in energy assessment/ energy auditing
- Develop short courses to address the gaps in energy efficiency skills
- Local agencies involved in energy programs could encourage the participation of local businesses and tradespeople as a means of retaining skills in the region

Note: Skills related to energy efficiency and solar technologies also need to be embedded into the base training for relevant professions such as builders, tradespeople, designers and facilities managers. Whilst at vocational education and training (VET) level this is the remit of the relevant Skills Councils, there could be an opportunity for SNR members to lend active support to this process.

HSB, Smart grid and demand management

NBN Co has developed a strategy to address the current lack of professionals available to install the NBN infrastructure. In the case of the installation of smart meters and electricity distribution infrastructure, Essential Energy is responsible for much of the training to meet demand.

Other skills requirements associated with a smart grid include:

- Installing smart appliances
- Design and installation of storage or battery systems at household and commercial scale
- Installation of vehicle home charging stations
- Developing and installing the control software to manage smart appliances, etc.
- Data management to monitor and control the smart grid
- Customer engagement in relation to the smart grid and how users interact with it

Recommendations:

- Develop a 'smart' energy strategy, bringing together a broad range of relevant stakeholders, and liaise with NBN Co to ensure the NBN roll out and skills strategy is complementary
- Introduce and expand smart grid training courses currently in development by EEOZ
- Establish a smart grid/ sustainable energy training centre to give learners hands-on access to smart appliances and other relevant technologies

Wind generation

Whilst large wind generation is unlikely to play a significant role in the North Coast's energy strategy due to poor local wind resources, there are skills gaps in this sector across Australia. There are some niche opportunities for small wind generation at household scale in the North Coast.

Recommendations:

- Provide local training in small wind site assessment, utilising existing course material developed by ISF and the Alternative Technology Association.

Energy assessors and auditors

For all sustainable energy options from domestic to large scale, energy site assessors and/ or energy auditors are essential. Energy auditors are specialist professionals who analyse options for reducing energy

use and costs in commercial and industrial premises. In many cases they are trained engineers with specialist knowledge in thermal energy and building services. Domestic assessors analyse energy use in households, and the required level of knowledge can vary. Energy site assessors are those professionals able to assess sites and buildings for the potential to capture renewable energy sources and integrate this with the requirements of the premises (e.g. strategies to reduce energy demand, energy storage, grid connection, etc.)

Nationally, demand for these skills is likely to increase with the introduction of mandatory disclosure of building energy performance. There is a lack of assessors that can provide a comprehensive service that covers multiple technologies across the spectrum of energy demand and supply options.

Recommendations:

- Expand the number of energy assessors in the North Coast who have a comprehensive skill set, by liaising with relevant skills councils to develop a new qualification that covers energy efficiency and a broad range of renewable energy technologies
- Target training to meet the needs (and demand) generated by the introduction of mandatory disclosure of building energy performance.

Grid connection for medium and large renewable energy sources

A significant skills gap inhibiting the wider uptake of renewable energy is grid connection for systems larger than 10kW. Specific skills required include:

- Knowledge of the likely voltage, stability and other electrical impacts of connecting a specific renewable energy system to the grid at a specific point
- Understanding and negotiating the regulatory framework
- Negotiating with the distribution company

Currently these are skills that reside within network businesses or with highly specialised consultants, but if renewable systems larger than 10kW are to become more prevalent these skills will need to be more widely available. Clearer guidelines and costs for grid connection will also be important.

Recommendations:

- Ensure at least one North Coast energy stakeholder (in addition to the network provider) has expertise in medium to large scale renewable energy grid connection

Engineering skills

Australia is experiencing an engineering skills shortage as yet no engineering degrees are offered in the North Coast (although Southern Cross University is planning to introduce a Civil Engineering degree). Engineering skills are essential for most sustainable energy options. Disciplines that are important include civil, electrical, mechanical, power, environmental and renewable energy.

Recommendations:

- Ensure the planned Civil Engineering degree includes content on sustainable construction
- Extend the range of engineering courses offered by SCU to include electrical engineering (with specialisation in power and renewable energy engineering), mechanical engineering, bioenergy engineering and information and communications technology (ICT) engineering
- The local availability of vocational engineering qualifications (e.g. diploma or advanced diploma) could help to address the engineering skills gap in a timely way

Strategic planning and development assessment

In the local government sector, skills gaps exist in strategic planning and development assessment. Skills that will be increasingly required in the transition to a sustainable energy future include:

- An appreciation of the appropriate energy options at a regional scale and how planning policies and instruments can support them
- An appreciation of the impacts of a sustainable energy future on job creation in the region
- The ability to assess development applications for their alignment with the goals of a sustainable energy future

Recommendations:

- Consider introduction of a planning qualification that incorporates the skills above at SCU and/or North Coast TAFE if appropriate
- Ensure CPD that provides skills in regional planning for a sustainable energy future and sustainable building is available to planners, perhaps delivered in-house at local Councils.

Business case and associated business management

The ability to construct business cases for different energy options and the associated financial management skills are often lacking in the relevant professions such as sustainability professions, accountancy, senior management and policy makers. Those with the knowledge about sustainable energy options need more business and financing skills, and conversely those with business skills need greater knowledge of the specifics of sustainable energy options and how to embed them.

Recommendations:

- Provide energy and carbon accounting CPD for accountants, managers and business students
- Embed energy management and costing in existing sustainability courses for business and accountancy students, where possible
- Provide business case CPD to sustainability and energy professionals
- Embed business case content in renewable energy courses, where possible

‘Soft skills’

Whilst the business case skills described above are essential for embedding sustainable energy, there is a complementary set of skills required to create a new sustainable energy business paradigm. This includes skills in energy literacy, leadership, social innovation, cross-disciplinary and meta-systems thinking, communications and behaviour and practice change. These skills gaps exist on the North Coast, despite higher levels of energy literacy compared to many other regional areas.

Recommendations:

- Bring existing social innovation and sustainability leadership programs to the North Coast
- Expand the reach of existing behaviour change and communications courses already taught by SCU, North Coast TAFE and Byron Community College

2.2 Sustainable energy job sector projections for the North Coast

A number of studies indicate that a sustainable energy pathway will generate a higher level of permanent employment than a fossil fuel based, centralised energy strategy. This is likely to be more pronounced in the North Coast, which has lost energy sector jobs in the last 30 -50 years as the electricity industry has become more centralised. Greenpeace International and ISF recently analysed the employment implications of a future global sustainable energy scenario, compared with a base case of centralised fossil fuel use. The sustainable energy scenario led to a projected 30% increase in energy sector jobs by 2030.

Whilst it is not possible to extrapolate this to a specific region, the distributional impacts of such a change would be likely to disproportionately favour a region such as the North Coast, due to its significant potential for energy efficiency, demand management and renewable energy. The employment benefits of energy efficiency programs have been apparent. For example, the recent Queensland Government *Climate Smart Home* program engaged over 150 electricians and other support staff in the rollout to over 300,000 homes.

3. TRAINING FOR A SUSTAINABLE ENERGY FUTURE

This research focuses on education and training leading to a vocational or higher education qualification, and continuing professional development (CPD). Sectors covered include the University sector and the Vocational Education and Training (VET) sector. The latter encompasses TAFE, Community Education providers and private Registered Training Organisations (RTOs).

3.1 Snapshot of training available on the North Coast

Following is an outline of the energy related training available on the North Coast that could help to address the skills gaps outlined above. At the moment, training in energy related skills has a mostly vocational focus on the North Coast.

North Coast TAFE

- **Diploma and Certificate Courses:** Diploma of Sustainability; Cert. II in Sustainable Energy; Cert. IV in Renewable Energy
- **Units of Competency, covering:** Stand alone grid-connected renewable energy systems; Power saving IT systems; Home energy assessment; Sustainable energy management; Thermally efficient and sustainable building; Carbon footprint; Education for sustainability; Solar hot water
- **Accredited Courses, covering:** Home sustainability assessment; Retrofitting to improve energy and water efficiency
- **Non-accredited training, covering:** Carbon accounting; Grid and stand alone PV systems

Southern Cross University

SCU does not currently have any courses specifically related to engineering and energy, however it will in the near future offer an undergraduate degree in Civil Engineering. SCU offers a range of degrees where relevant energy related skills could be embedded, including:

- **Undergraduate degrees:** Civil engineering (upcoming); Environmental Science; Forest Science and Management (for bioenergy); Education; Business; Information Technology; Technology Education; Psychological Science
- **Postgraduate degrees:** Environmental Science; Forest Science and Management; Education; Business; Accounting; Information Technology; Vocational Education and Training; Technology and Management

Byron Community College

- **Units of competency, covering:** Sustainable building design; Energy efficiency and sustainability in retail; Waste Management in building and construction; Education for sustainability
- Non-accredited training, covering: Energy efficient house design

Other available training

Renewable energy product training is provided by sustainable energy companies in the area, such as *Rainbow Power* and *SI Clean Energy*. Some non-local organisations provide training that can be delivered on the North Coast if there is demand, or in some cases accessed online. Examples include:

- Master Builders *Green Living* CPD course for housing industry builders and designers
- National Electrical and Communications Association (NECA)'s *Eco-Smart Electricians* CPD course for electricians
- NSW Office of Environment and Heritage's *Sustainability Advantage* program for businesses
- Online resources such as the Clean Energy Council's e-learning 'toolboxes'; Master Plumbers NSW's sustainable plumbing training; and the Dusseldorp Skills Foundation's *Trade Secrets – skills for the future* videos

4. TRAINING CHALLENGES AND OPPORTUNITIES

Through the research process a number of challenges and opportunities were identified. These are set out below, along with recommendations to address them.

4.1 The importance of demand

In many cases skills gaps are the result of a lack of demand for those skills. The appropriate training opportunities may exist, but uptake is low because the skills are not perceived as valuable or necessary to employment. There are examples of this in the North Coast, where training is available (e.g. the Cert IV in Renewable Energy) but demand is not sufficient to run the course.

A range of factors contribute to the lack of demand for sustainable energy-related skills, including:

- A general lack of energy literacy amongst the public and in the workforce
- A lack of understanding of career possibilities in sustainable energy
- Lack of incentive for builders and electricians as there's enough 'traditional' work
- The time-poor nature of small business, where training is unlikely to be a priority (a high proportion of the North Coast workforce is employed in small business)

Whilst Government policies can be helpful in creating demand, they can also create boom-bust cycles that impact negatively on the sustainable energy workforce and associated training providers. The NSW Solar Bonus Scheme is a recent example of where this occurred.

Recommendations:

- Develop a sustainable energy community engagement strategy to boost energy literacy
- Develop a training promotion strategy to increase workforce awareness of career paths, targeted to specific skills gaps

4.2 Trainer shortage

Exacerbating the sustainable energy skills gaps in the workforce is a lack of qualified trainers to teach these needed skills. This shortage is experienced on a national scale but is particularly prevalent in regional areas and in the VET sector. Factors leading to this include the typically lower pay (relative to industry positions) and the challenge of retaining up to date knowledge of the rapidly changing sustainable energy landscape.

Recommendations:

- Develop a strategy to address local trainer shortages in areas of key workforce skills gaps, as part of the *Skilling for Change Implementation Plan*

4.3 The need for a ‘roadmap’

A common theme emerging from the interviews and literature review was the need for a ‘roadmap’ or strategy to guide and coordinate training development. As a starting point, this requires a shared and holistic vision for a sustainable energy future on the North Coast (e.g. the *Energy Action Plan* proposed by SNR). This would need to encompass the range of industries that need to be involved across the entire supply chain, and include a clear vision for medium to long term skills needs. It would need to articulate outcomes in regional employment as well as energy-related outcomes.

An energy skills strategy for the North Coast would need to be informed by this sustainable energy vision and developed with input from a wide range of stakeholders including government, industry and local training providers. The strategy would need a particular focus on priority occupations where skills shortages have been highlighted.

Recommendations:

- Continue SNR’s collaborative approach, prioritise development of the *Energy Action Plan*
- Align development of the Energy Action Plan and the Skilling for Change Implementation Plan
- Build in opportunities for monitoring, evaluating and adapting both plans over time

4.4 Resourcing training

One of the key challenges facing training providers is resourcing. The need for better funding in the TAFE sector was raised in the interviews. Establishment costs for training that covers new technologies can be high, especially when demonstration equipment is required (as is often best practice, allowing learners a ‘hands on’ experience). Developing industry partnerships and creating placements can assist in some cases.

Recommendations:

- See the recommendations under ‘Flexible and applied learning’

4.5 Career pathways

Another issue raised by interviewees was the importance of clearly articulated career pathways that provide clear guidance about training options and enable learners to choose the path that best suits them. Whilst this happens to some extent, stronger collaboration between schools, the VET sector and the Higher Education sector would assist this process.

Recommendations:

- Ensure the *Skilling for Change Implementation Plan* facilitates collaboration between the different educational sectors on the North Coast to better articulate career pathways in the areas of key skills gaps

4.6 Accreditation and quality assurance of training

Well-recognised licensing and accreditation standards for emerging energy related technologies and processes are essential, and the learning outcomes of training should align with these requirements. Although there are some nationally accredited qualifications, such as the Clean Energy Council’s accreditation requirements for solar installation, these are not a well-established brand or well recognised by the public.

Besides reducing the risk of poor practice, the existence of such standards could provide incentive for practitioners to undertake training, thereby increasing demand for training. Ongoing continuing professional development (CPD) in appropriate energy-related skills could be made a requirement for renewal of accreditation and licenses to ensure practitioner skills remain current.

Recommendations:

- Promote existing licensing and accreditation standards to the public
- Advocate for robust accreditation and licensing structures for relevant energy-related skills, linked to requirements for ongoing CPD

4.7 Responsiveness to local industry needs

In the rapidly changing area of sustainable energy, training needs to be responsive to local industry needs. This can be a challenge given lead time in obtaining funding and setting up training, particularly for University and TAFE qualifications. This reinforces the need for a proactive skills ‘roadmap’ that includes a medium and long term view of skills needs. It also points to the important role of CPD (e.g. short courses or on-the-job training) to keep practitioners familiar with the latest developments.

Recommendations:

- See recommendations under ‘Need for a roadmap’

4.8 Flexible and applied learning

The format of training needs to suit the needs of the industry, particularly in the case of training targeted at those already in the workforce. Training options that suit the needs and preferred learning styles of different professions is crucial to maximising participation. Flexible learning options include on-the-job training and training that incorporates online learning, both useful in attracting time-poor small businesses (which account for a high proportion of employment on the North Coast).

A recent study by GHD found that on-the-job learning is generally the favoured professional development method for industry. To quality-assure this form of learning, programs need to be well designed with appropriate assessment. Online learning can help overcome trainer shortage in regional areas, but is generally best combined with face to face training. It assists learners to work at their own pace so that contact time can be used for discussion and reflection, and is particularly suited to the faster and more ‘user driven’ approach preferred by those already in the workforce.

Case studies and demonstration sites are also seen as important enablers of skills development, particularly for technology-related skills. This may require the establishment of training centres that allow ‘hands on’ learning.

Recommendations:

- Establish a sustainable and ‘smart’ energy training centre to give learners hands-on access to renewable, ‘smart’ and energy efficient technologies (this recommendation also occurs under ‘HSB, smart grid and demand management’ in the section on skills gaps (Section 6.1.3))
- Consider the use of flexible learning options in training design (this may be particularly important for CPD, where learners are already in the workforce)

4.9 Embedding sustainability

A common theme emerging from the interviews and literature review was the need to embed sustainability in core training for professions, rather than treating it as an ‘add-on’. For many sectors of industry, the new

‘skills’ required are overlays to existing skill sets. To explain the need to embed sustainability, several interviewees referred to the precedent of occupational health and safety (OH&S). This was once the job of one person on a construction site, whilst now it is the responsibility of all site workers and has become a skill set that is embedded across all professions and trades.

In the VET sector, sustainability is being embedded in existing Training Packages by the relevant Industry Skills Councils, as part of the Commonwealth Government’s Green Skills Agreement (GSA).

However strategies are required for the Higher Education sector, and also to ensure those already working in the industry are exposed to CPD that better integrates any relevant sustainable energy content with the core course content.

Recommendations:

- Southern Cross University is encouraged to review how sustainability content could be embedded across degrees (if this has not already been done)
- North Coast TAFE and Byron Community College are encouraged to do the same for any training content not covered under the GSA (if this has not already been done)
- North Coast TAFE and Byron Community College may wish to liaise with and support the relevant Industry Skills Councils with respect to the GSA.

5. RECOMMENDATIONS

5.1 Skilling for Change Implementation Plan

The recommendations in this report have been synthesised into the framework for a *Skilling for Change Implementation Plan* to be further developed by SNR. Each recommendation has been prioritised based on a ‘rapid analysis’ of:

- The likely effort it would take
- The extent to which the recommendation could address identified skills gaps
- The likely potential for new job creation
- The likely contribution to meeting SNR’s sustainable energy targets
- The likelihood of successful implementation (related to the level of control SNR has over delivery of the recommendation)

Recommendation	Priority
1. Bioenergy Strategy	Medium
2. Adapt existing training programs for bioenergy and create new bioenergy training programs and placements	Medium
3. Expanding the number of energy efficiency and solar PV professionals in the North Coast	High
4. Support the embedding of solar and energy efficiency content into training for relevant professions	High
5. Develop solar and energy efficiency CPD courses for relevant professions	High
6. Address specific energy efficiency and solar PV skills gaps	Medium
7. Retaining sustainable energy skills in the region	Medium
8. Create a Smart Meter, Smart Home, Smart Management Strategy	High

Recommendation	Priority
9. Liaise with the NBN and other HSB providers	Medium
10. Introduce existing smart grid training packages and expand	Medium
11. Creating a Smart Grid Training Centre	Medium
12. Provide training in small wind site assessment	Low/Medium
13. Help develop and introduce Building Energy Mandatory Disclosure Training	Medium
14. Expand the number of comprehensive energy assessors in the North Coast	High
15. Ensure at least one North Coast energy organisation has medium to large-scale renewable energy grid connection expertise	High
16. Extend the range of engineering courses in the North Coast	Medium
17. Ensure training options for planners include sustainable energy skills	Medium
18. Provide energy and carbon accounting courses for accountants, managers and business students	Medium
19. Provide business case courses to sustainability and energy professionals	Low/Medium
20. Bring social innovation and sustainability leadership programs to the North Coast	Medium/High
21. Expand existing behaviour change and communications courses	Medium
22. Develop a Sustainable Energy community engagement strategy	High
23. Develop a training promotion strategy	High
24. Develop a strategy to address trainer shortages	Medium
25. Continue with Sustain Northern Rivers' collaborative approach and Energy Action Plan	High
26. Articulate career pathways in the areas of key skills gaps	Medium
27. Advocate for more robust sustainable energy accreditation and licencing and for this to be linked to CPD requirements	Low
28. Consider the use of flexible learning options in training design	Low
29. Encourage Southern Cross University review how sustainability is embedded across degrees	Medium
30. Encourage North Coast TAFE and the Community Colleges in the area to review how sustainability is embedded across training content not covered under the Green Skills Agreement (GSA)	Medium
31. RTOs in the North Coast to liaise with relevant industry skills councils with respect to the progress of the GSA	Medium

5.2 Training opportunities to address skills gaps on the North Coast

This section provides an indication of the skills development that could be undertaken by training providers in the North Coast. The majority of this content has come directly from the recommendations made earlier in this report.

University

There are opportunities to develop a range of undergraduate courses in engineering, business and strategic planning courses.

Engineering:

- (Electrical) General electrical and power engineering; Renewable energy system design and installation; Energy auditing for commercial and industrial premises; Energy efficient HVAC
- (ICT) Energy efficient IT systems; Smart electricity networks; IT networks and building power control
- (Mechanical) Design and installation of mechanical aspects of renewable energy and HVAC systems
- (Bioenergy) System design and integration (a relevant combination of ecology, agricultural science and other engineering disciplines)

Business:

- Energy financing and carbon accounting in accountancy and business courses

Strategic planning:

- Strategic regional planning for renewable energy, including energy options and employment impacts

Opportunities for postgraduate courses include courses in sustainable building design, renewable energy systems and smart grid technologies.

TAFE & VET Sector

Opportunities for Training Packages and Qualifications include:

- Energy assessment and auditing (all sectors)
- Cert IV in NatHERS assessment
- Clean Energy Council Solar install and grid connect accreditation package
- Certificate IV in Renewable Energy
- Renewable energy site assessment and system design (covering all technologies)
- Diploma or Advanced Diploma in Engineering

Continuing professional development

The CPD sector has an important role to play, as it can be particularly flexible and adaptable to changing circumstances (e.g. fast developing technologies, government incentive programs). Training opportunities include:

- Energy literacy for the community and tradespeople
- Sustainable energy overview, including the regulatory and planning context
- Energy-related business and financial skills including business case, carbon accounting
- Energy assessment and auditing (all sectors)
- Thermal performance of buildings
- Energy efficient systems and technologies in buildings
- Energy efficient pools and spas
- Renewable energy systems in buildings
- Commercial-scale solar PV
- Bioenergy systems (including biomass handling and procurement)
- Medium scale wind energy (site assessment, design and installation, maintenance)
- Home area networks
- Smart metering and displays

- Sub metering
- Installation and maintenance of smart appliances
- Energy storage systems
- Electric vehicles, including batteries and smart grid connection
- Leadership and innovation.

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INTRODUCTION

This research report has been commissioned to inform the proposed *Regional Skilling for Change Implementation Program* for the North Coast, which will address the current and future skills required to achieve a sustainable energy future. This project is part of a broader Energy Action Plan developed by Sustain Northern Rivers, a collaboration of peak government, educational, commercial and community bodies working together to improve the sustainability and resilience of the Northern Rivers Region.

This research project is coordinated by *Regional Development Australia – Northern Rivers* on behalf of the members of *Sustain Northern Rivers* and funded by the *Department of Education, Employment and Workplace Relations* (DEEWR) through the Flexible Funding Pool. The aim of the research is to:

- Investigate the skills required to transition to a sustainable energy future in the North Coast, with a focus on identifying skills gaps in existing and emerging local job sectors;
- Investigate skills needed in the transition to an increase in energy use autonomy with the introduction of the NBN/high speed broadband, smart metering and control systems
- Investigate the relevant training available on the North Coast, and the extent to which this training is able to meet these skills gaps;
- Make recommendations to inform the Regional Skilling for Change Implementation Program

The research considers education and training leading to a vocational or higher education qualification, and Continuing Professional Development (CPD). Sectors covered include the Vocational Education and Training (VET) sector and the higher education (University) sector. The VET sector includes public providers such as TAFE, community education providers, and private Registered Training Organisations (RTOs) who all provide nationally recognised training. Where relevant, businesses providing in-house training have also been considered.

RESEARCH METHODOLOGY

This section provides a brief overview of the approach taken by the Institute for Sustainable Futures (ISF) in conducting this research. Given the ambitious scope of the project, we decided on an approach that was primarily interview-based to provide the best outcomes for the available budget. This allowed us to draw on the expertise and experience of a diverse range of industry and training experts who engage with the questions of a sustainable energy future and skills development in their everyday practice. Just under half of the participants were based in or had significant experience of the North Coast region. We augmented these findings with a literature review and the in-house knowledge of a range of ISF experts.

1. Research questions

In response to the brief developed by Sustain Northern Rivers, Building Australia's Workforce and Regional Development Australia – Northern Rivers, the following primary research questions have been identified:

1. What skills are required to transition to a sustainable energy future in the North Coast?
 - a. Now?
 - b. In the future?
2. What key skills gaps exist in the North Coast?
3. How can the various training sectors in the North Coast best fill these skills gaps?

2. Scope of research

The geographical area for the study includes Northern Rivers regions and the mid North Coast, referred to in this report as the ‘North Coast’. Whilst national skills needs are included to provide context, the main focus is on the skills needs specific to these regions.

This project is part of a broader Energy Action Plan developed by Sustain Northern Rivers. At this point, a detailed energy plan or strategy that sets out the most appropriate mix of energy options for the region is yet to be developed. Such a plan is beyond the scope of this project. Thus, the experience of ISF, Sustain Northern Rivers and project interviewees was used to identify the likely range of sustainable energy options and approaches that could be appropriate for the North Coast Region.

In considering the skills needed for a sustainable energy future, the focus is on stationary energy generation and consumption. Transportation energy is excluded from the scope of this research.

As requested by the brief, we have considered the skills needed in the energy sector as it adapts to evolving issues such as carbon pricing, demand management and energy efficiency, a lower carbon economy and the transition to renewable energy based systems. Skills needed in relation to the ‘smart’ energy systems that will accompany the introduction of the National Broadband Network (NBN) and the integration between High Speed Broadband and future energy are also considered. These sustainable energy trends are discussed in more detail in Section 5. Table 1 provides an overview of the specific energy options considered in this report.

Table 1: Overview of the sustainable energy options considered in the project

Distributed Generation	Energy Efficiency	Demand Management	Large Scale Renewables	Other
Rooftop PV	Hot water			
Small Wind	Lighting	Smart metering		Investment options
Bioenergy	HVAC		Wind	Electricity networks
Battery storage	Domestic appliances	Smart controls and appliances	Bioenergy	Energy retailing
Mini-hydro	Power factor correction		Solar PV	
Cogeneration and Trigenation	Thermal performance	Demand monitoring		
	Sustainable building design and retrofits			
	Behaviour change			

Within the scope of stationary energy, all parts of the supply chain for related services and technologies were considered with the exception of manufacturing, as most of this will occur outside the region. Aspects of the supply chain considered include development and design of services and technologies, site assessment, procurement, installation, construction, operation and maintenance.

3. Research plan

ISF adopted a five-stage research plan or methodology.

Stage 1 – Literature Review

A review of relevant literature was undertaken. The purpose of this literature review was to:

- Define what is meant by a skill and specifically a sustainable energy skill

- Scope the range of already identified relevant skills gaps in Australia
- Provide a snapshot of the sustainable energy training available in the VET sector in Australia

Stage 2 – Stakeholder Interviews

Interviews were held with 18 stakeholders from relevant industry sectors and training organisations, including national and local perspectives. Table 2 provides an overview of the number of interviewees by background, a list of the organisations interviewed is provided in Appendix A. Tailored interview questions were developed for each category of interviewee, with the aim of eliciting as much information as possible to answer the research questions underpinning this project. Specifically, energy experts were asked about the types of skills needed and skills gaps that they saw within their area of expertise and their thoughts as to how these gaps could be addressed. Training providers and experts were asked about the types of training opportunities available, skills gaps that they had been made aware of and opportunities for modifying existing training or developing new training.

Table 2: Future Energy Skills for the North Coast Project Interviewees by Category

Interview Category	Number of Interviewees
Local energy experts	4
Local training providers/ experts	5
National training providers/ experts	3
National energy experts	2
Peak/Industry Bodies ¹	4
Total	18
Energy options covered: Bioenergy, Energy Efficiency and sustainable buildings (residential and commercial), Solar PV, Small Wind, Smart Grid, NBN, Renewables generally, Community Renewables	

Stage 3 - Detailed analysis of findings

Interview transcripts were analysed in conjunction with the literature review to yield key sustainable energy skills gaps (Section 6), training available (Section 8) and additional opportunities and challenges in meeting these skills gaps (Sections 9-17). To help map the types of skills required for a sustainable energy future for the North Coast, ISF also developed a matrix of skills required for different energy options by different professions. Additionally, a table of currently available training in the North Coast and beyond was started. These matrices have been drawn on in the analysis and report writing but are not presented as they are information tracking tools for the research team.

Stage 4 - Stakeholder workshop

After the preliminary analysis of findings was completed a two-hour workshop was undertaken with members of Sustain Northern Rivers. The purpose of this workshop was to communicate and test the key research findings, and to collaboratively start to develop recommendations for the *Regional Skilling for Change Implementation Program*.

Stage 5 - Reporting of findings and recommendations

Having completed the analysis and stakeholder workshop, the findings and recommendations of this research have been synthesised into this Report.

¹ This includes the NBN interview

RESEARCH CONTEXT

4. North Coast Snapshot

The north coast region of NSW has many geographical and demographic features that support the development of a sustainable energy future.

The region has good solar resources to support the use of rooftop photovoltaic systems, flat plate solar water heating and industrial process heat. It has high rainfall which supports the generation of some micro hydro and biomass in the region and has a strong agricultural sector. The relatively benign sub-tropical climate is conducive to low energy demand in buildings, assuming they are designed based on energy efficient principles.

The region has a strong recent history in support for renewable energy, with many off-grid power supply systems being installed, and a local company (Rainbow Power Company) being a pioneer in the field. The North Coast region responded strongly following the availability of rebates and feed in tariffs for PV, with amongst the highest take-up in Australia, and the establishment of a number of businesses to install and connect systems.

The North Coast region will be one of the first areas where the National Broadband Network (NBN) will be rolled out, specifically in the Grafton and Coffs Harbour areas.

With the establishment of the Sustain Northern Rivers Energy Working Group targets for renewable energy and greenhouse gas emissions have been set for the North Coast region. Specifically, the guiding aim for the Sustain Energy Strategy is:

To empower and enable the North Coast to reduce greenhouse gas emissions by 20% and increase the proportion of renewable energy sources to 20% by 2020.¹

The region is growing rapidly, with an average of 2,500 people arriving per year since 2001. This is especially so in the coastal areas. It is also a destination for significant numbers of tourists. The demographics of the north coast have shifted from a predominantly agricultural region to a greater proportion of professional and service workers, including government services, health and education.

On the North Coast there are providers of education and training covering the VET sectors, as well as higher education. The vocational education and training providers include North Coast TAFE, seven Community Colleges and a number of private RTO's such as TURSA. The main higher education provider in the region is Southern Cross University, with its main campus located in Lismore. North Coast TAFE has campuses in 17 locations across the North Coast including Lismore, Ballina, Port Macquarie, Coffs Harbour, Grafton, Kempsey, Kingscliff, Casino, Great Lakes, Macksville, Maclean, Murwillumbah, Taree, Trenayr, Wauchope and Wollongbar. The seven community colleges in the region are located in Mullumbimby, Lismore, Casino, Tweed Heads, Ballina and Grafton. The Casino and Tweed Community Colleges are branches of the Lismore ACE College. The others are autonomous though some of them belong to a cooperative (that also has a few members outside of the north coast region) called Cooperative Learning Ltd which has the capacity to collectively tender and undertake projects. There is a big range of scales between the smallest and largest colleges. All deliver accredited training as Registered Training Organisations (RTO's) as well as non accredited community based education. There is some overlap between qualifications and skill sets (parts of qualifications) delivered by TAFE's and Community Colleges.

5. Energy trends

This section provides an overview of a range of trends and drivers emerging in the Australian energy sector. In the absence of a sustainable energy strategy for the region, this overview provides a snapshot of what a

sustainable energy future in the North Coast might include and thus provides context for what skills may be required.

Electricity prices rising

Despite recent headlines on the rising price of electricity in Australia, prices for residential and commercial customers remain low as compared to other OECD countries. On the residential side, the average price in the National Electricity Market (NEM), representing the majority of the Australian population, is currently ranked 8th out of 32 for lowest price with increases being amongst the lowest over the past two decades.² However prices have been rising quickly in the past several years, with this being especially apparent for small businesses. Between the 2009 and 2010 fiscal years, electricity prices in the NEM rose an average of 15% for small business customers.

To briefly explain the cause of both the current and historical electricity prices an understanding of electricity generation and distribution is needed. With over 75% of electricity generation fuelled by domestic coal, the cost to generate electricity remains low in Australia.³ However, steady economic growth and increasing demand for electricity have begun to stress the distribution system. Over the next decade, this is where the majority of the investment will flow. This significant investment in distribution assets is one of the primary drivers for increasing electricity prices in Australia.

Energy and Peak Demand

Australia's electricity system is structured to meet two primary factors:

- Energy demand, which is the amount of electricity used over a period and
- Peak demand, which is when there is high demand for electricity in a short period, for example on a hot summer afternoon when everyone has their air conditioners on.

In the past five years, electricity demand across the National Electricity Market (NEM) has plateaued and is perhaps even declining⁴. This has recently led the Australian Energy Market Operator (AEMO) to revise downwards its energy demand projections for the next decade.⁵ Conversely peak demand has been increasing rapidly in the NEM, growing by an average of 3.5% a year in the last six years. However, according to AEMO this growth rate is slowing.⁶ In the North Coast, a proposed new electricity transmission line has recently been postponed due to a decline in peak demand in the Far North Coast Region.⁷

Smart Grid and High Speed Broadband (HSB)

The electricity grid is perhaps the last major piece of infrastructure that is yet to utilise many of the computing and telecommunication advances of the past several decades. Maintaining the reliability of such a complex system that must balance supply and demand in real time across large distances is very challenging, and it forces electricity market actors such as electricity distributors, regulators and retailers to adopt a cautious approach to emerging technologies. However, many of the technologies required to improve the efficiency and flexibility of the grid have been demonstrated to also increase system reliability. While large scale rollout is still coming, several trials are taking place around the country including the \$100 million Smart Grid, Smart City project in Newcastle.

According to the Global Smart Grid Federation a smart grid is:

“an electricity network that can intelligently integrate the actions of all users connected to it – generators, consumers and those that do both – in order to efficiently deliver sustainable, economic and secure electricity supplies.”⁸

A key requirement of a smart grid is ubiquitous high speed communication infrastructure. The National Broadband Network (NBN) is just that. The rollout of the NBN began with Tasmania in July 2010 with the first customers being connected in the mainland in the winter of 2011. The main feature of the NBN is

faster internet connectivity throughout Australia primarily through fibre to the premises. The NBN is being leveraged in the SmartGrid, Smart City project and in larger partnerships such as that between GridNet, General Electric and SP Ausnet with a plan to link 680,000 customers with smart meters in Victoria.⁹

Decentralised Energy

“Decentralised Energy (DE) refers to energy technologies and practices that optimise the use of local resources and reduce the need for large-scale energy supply infrastructure. The three elements of DE are: efficient use of energy, peak load management and Distributed Generation (DG)”.¹⁰ Examples of DG technologies include a variety of generation technologies embedded within the distribution network including wind and solar power, cogeneration systems and battery storage. While several DG technologies are still in the R&D phase of development, many others are already more cost effective than the alternatives. The prevalence of DG in Australia is growing rapidly. Everything from fuel cells to cogeneration has made its way into Australian homes and businesses.

As of 2009, the most abundant DE technologies are solar hot water heaters and heat pumps¹¹, which are primarily considered an energy efficiency measure. However, despite widespread interest in DG, there remains significant untapped potential for growth within Australia. Some estimates of the savings potential of DE are as high as \$130 billion for Australia.¹²

The demand management (DM) element of DE includes the wide range of load management, energy efficiency, distributed generation and smart meters used to reduce electricity demand. As with DE, there is significant potential for DM in Australia at prices competitive with more centralised technologies. As the economic case for DM is generally good, it is clear that other barriers exist. Some of these barriers are explored in recent work for the Australian Alliance to Save Energy.¹³ Another report by the same organisation also found that in 2011, 624 MW of DM was reported by network service providers around the country.¹⁴ Despite this large amount of DM, peak demand in Australia is still growing at an average of 3.5% over the past 8 years.¹⁵

Decarbonisation of the grid

While the prevalence of DE and DM in Australia continues to grow, the Australian electricity grid remains one of the most carbon intensive in the world, with emissions growth of over 50% since 1990.¹⁶ Carbon from electricity generation is also the largest source of emissions in the national inventory. However, significant efforts are being made to decarbonise the grid. Major initiatives at the federal level include the Mandatory Renewable Energy Target with a renewable energy target of 20% by 2020 and the Clean Energy Bill 2011. The most recent figures from the Department of Climate Change and Energy Efficiency¹⁷ suggest that emissions from the electricity sector decreased slightly by 0.9% from 2010 to 2011.

Community energy projects

Across Australia there is an increasing interest in a more community based approach to energy infrastructure, with communities seeking to have a greater degree of input and control, as well as a greater share in the benefits. In 2011, Australia’s first community owned wind farm – Hepburn Wind, started to generate electricity and 60 more communities expressed interest and/or started to develop similar projects. In the North Coast a number of different community energy initiatives have been developed and proposed for example the Nimbin Community Solar Farm, which generates 61,000kWh per annum. These projects are part of a growing international trend, which includes thousands of community owned renewable energy projects across Europe and North America, as well as a number of interesting community based models of energy distribution and retail.

Zero carbon buildings

The combination of passive design, energy efficient technologies and distributed renewable generation has allowed a growing number of homes and buildings to claim carbon neutrality (or even carbon ‘positivity’)

across Australia. The common accepted definition of a zero carbon building (ZCB) is one that has a zero net operating carbon over a year. Well known examples include CSIRO's Zero Carbon Home, the Pixel office building in Melbourne, CSIRO Energy Centre in Newcastle, Legion House in Sydney and the German embassy in Canberra. In the North Coast, the Nimbin Sustainability House is one proposed example of a zero carbon building. These buildings all have significantly reduced grid energy consumption through the use of a well-designed building envelope (this includes attention to building orientation, glazing, shading, activated thermal mass and insulation), energy efficient building services and on-site renewable generation. The Prime Minister's Task Group on Energy Efficiency has been examining whether Australia should move in the same direction as many other countries with ZCB mandatory standards as early as 2020.

SKILLS FOR A SUSTAINABLE ENERGY FUTURE

In a 2008 report titled *Growing the Green Collar Economy*, CSIRO identified a clear mismatch between current supply and articulation of labour and the requirements of transitioning to a green economy in Australia:

Achieving the transition to a low carbon sustainable economy will require a massive mobilisation of skills and training – both to equip new workers and to enable appropriate changes in practices by the three million workers already employed in these key sectors influencing our environmental footprint. Current approaches do not appear sufficient for meeting these challenges.¹⁸

The last decade has seen much talk on the importance of developing 'green skills' to enable the transition to a more sustainable economy and energy system in Australia. However, limited research exists on the rise of employment and skills in this area. According to CSIRO, the lack of such data and enabling frameworks may be partly due to the lack of a clear, agreed upon definition about what constitutes a green job or green skill.

One of the few definitions for 'green skills' comes from the Green Skills Agreement,¹⁹ an agreement between the Australian Government and the State and Territory governments that seeks to build the capacity of the VET sector to deliver the skills for sustainability:

Skills for sustainability, also known as green skills, are the technical skills, knowledge, values and attitudes needed in the workforce to develop and support sustainable social, economic and environmental outcomes in business, industry and the community.

The skills required for a sustainable energy future form a subset of these green skills as defined above. **For the purposes of this report, 'skills for a sustainable energy future' are defined as the technical skills, knowledge, values and attitudes needed in the workforce to develop and support a sustainable energy future in business, industry, the public sector and the community.**

A number of authors have categorised the different types of green skills, and this categorisation can equally apply to the sustainable energy skills that are the focus of this report.

Martinez-Fernandez et al. explains how some "green skills represent a completely new set of skills which remain largely absent within existing labour markets"²⁰ using the examples of knowledge of sustainable materials and carbon footprint analysis skills. Other green skills are "simply traditional skills put into use in environment related sectors and activities", with Martinez using the example of a sheet metal worker constructing wind turbines.

In between these two cases lie the majority of green skills, where skills already present in the labour market are adapted to varying degrees for green projects. An example of this would be electrician wiring up a Solar Photovoltaic (PV) system, which relies mostly on his or her existing electrical skills and knowledge, but must apply up-to-date skills and knowledge specific to the task. These three general categories of green skills are supported by other studies such as Rafferty and Yu, who use terms 'greening existing occupations' and 'new green collar occupations'²¹ to describe the training response required to build the necessary

green skills. The broad categories from Martinez-Fernandez et al. and Rafferty and Lu are summarised in Figure 1 below:

Figure 1: Green Skills Categories



6. Skills gaps

Through the interview and literature review process a range of sustainable energy skills gaps were identified. However, what is meant by a skills gap? **For the purposes of this report, a ‘skills gap’ describes the deficit between available workforce skills and the skills that are required to achieve a sustainable energy future.** The National Centre for Vocational Education²² has developed a skills shortage typology:

1. Few workers have the essential skills, with a long training time required to develop the skills
2. Few workers have the essential skills, with a short training time required to develop the skills
3. Enough workers have the essential skills, but lack other qualities employers consider important
4. Enough workers have the essential skills, but do not seek jobs that utilise these skills

Of these categories, the first three can be directly addressed by training. The latter is more an issue of demand for skills, job availability and workforce conditions. The skills gaps discussed in this report mainly fall into the first two categories as discussed in Section 6.1.

The skills gaps identified through the research have been synthesised into 10 meta-areas, an overview of these is given in Table 3. These gaps are discussed in detail in the following sections and where relevant recommendations are provided as to how the skills gaps could be addressed. The skills gaps have been established based on qualitative analysis and expert judgement of the interviewees and research team, as a quantitative analysis was beyond the scope of this work. It should be noted that the skills gaps discussed in this section refer primarily to the industry workforce, a discussion of the shortage or skills gap associated with skilled **trainers** to train in these areas is provided in Section 10.

Table 3: Overview of key sustainable energy skills gaps

Skills Gap	National	North Coast	Relevant professions
Energy option specific skills gaps			
Bioenergy	✓	✓	Engineers, electricians, mechanics, machine technicians
Building Energy Efficiency	✓	✓	Builders, designers/architects, electricians, plumbers, facility managers
Solar PV in buildings	✓	✓	Builders, designers/architects, electricians, engineers
HSB, Smart-grid and Demand Management	✓	✓	Engineers, technicians, electricians, ICT experts, energy users

Skills Gap	National	North Coast	Relevant professions
Large Wind	✓	n/a	Engineers, electricians, mechanics,
Cross-cutting skills gaps			
Energy assessors and auditors	✓	✓	Energy assessors and auditors
Engineering	✓	✓	Engineers
Grid connection for large renewables	✓	✓	Engineers, electricians, energy consultants
Planning			Planners
Business case for energy options	✓	✓	Accountants, financial advisors, sustainable energy professionals
Soft-energy skills	✓	✓	Energy assessors and auditors, community development workers, entrepreneurs

6.1 Key skills gaps

6.1.1 Bioenergy

Given the fertile land, high precipitation and associated agricultural industry found in the North Coast, it is likely that a sustainable energy future for the North Coast will include a significant bioenergy sector. Already, two of NSW's largest bioenergy facilities are located on the North Coast – the Condong and Broadwater plants owned in by a partnership between NSW Sugar and Delta Energy and establishment of a new biochar facility has just been announced. One interviewee noted:

Bioenergy is a big gap with lots of potential in the area as there are a lot of agricultural facilities – piggeries, dairies, sugar cane, wheat and macadamia farms.

Bioenergy as an energy option and skills gap is different from many of the others discussed here for two reasons – firstly, the diversity of potential bioenergy technologies available and secondly, because it is not yet a commercially mature technology and sector in Australia. Although it should be noted that bioenergy systems are prevalent across Europe and North America.

Bioenergy can primarily be considered as an amalgam of two existing industries and associated skill sets – electricity generation and agriculture, although bioenergy can also cover the forestry, waste and wastewater sectors as well. There are a range of skills required depending on the type of bioenergy system chosen and the location in the supply chain. The following overview of skills at different stages of the bioenergy supply chain is a synthesis of information provided by two of the interviewees.

Stage 1 Procurement of biomass

Biomass feedstocks typically come from agricultural or forestry sectors or waste management organisations. Like other fuel based energy systems such as coal, key skills in the procurement of biomass include supply logistics and onsite fuel handling. Fuel handling includes issues in terms of health and safety, for example spore, fine dust or volatile organic compounds coming off biomass piles. There are however many similarities to other industries that have bulk materials handling systems in terms of conveyors and silos and so on.

Sustainability considerations form an important additional skill set in the procurement of biomass. Specifically, there is a need to appreciate issues such as compaction of forest floors or leaving sufficient fine material behind for nutrient balances.

Stage 2 The Energy Conversion Plant

There are many different ways of converting a biomass feedstock into energy, including combustion systems, gasification, pyrolysis and anaerobic digestion. For combustions plants there is not a big difference between small coal-fired, gas-fired or oil-fired boilers and that of biomass systems. There are already a number of anaerobic digestion systems at major sewage treatment plants across Australia as well as similar technology used in the landfill gas industry.

Within the conversion plant stage of the life-cycle there are two sub-stages – firstly, design and construction of the plant and secondly, operation and maintenance.

- **Design and construction:** Key tasks within the design and construction of a biomass plant include creating the design specifications and awarding a contract, typically a turnkey contract, to design and build the plant. Important local skills include understanding the design and construction specifications and the legal and financing frameworks. However, it is likely that much of the engineering work in the design of such systems would be done by a non-local company. Additional skills required are those involved in undertaking an Environmental Impact Statement including noise, air, traffic, water, ecological, cultural and heritage studies. Additionally, there are skills in government and stakeholder engagement to interface with a range of agencies and authorities in order to get planning approval for the project. With sufficient demand, it is likely that many of the skills involved in Environmental Impact Assessment and stakeholder engagement could be sourced locally in the North Coast.
- **Operation and Maintenance:** There are four major roles in the operation and maintenance of a biomass plant – operators, technicians, engineers and managers. At the operator level WorkCover tickets or certificates are required to operate what are called high risk plants, specifically turbine boilers, i.e. boiler certificates. At the technician level, skills in electrical and mechanical trades are required as well as in instrumentation and control. At an engineering level, mechanical, chemical or electrical instrumentation qualifications and experience are required. Finally, there are skills required in accounting and management.
- **Distributing the energy product:** For a bioenergy system, the energy products may be heat, power, process steam or combined heat and power, also known as cogeneration. Distributing the heat and electrical energy require industrial plumbing and HVAC skills (for heat distribution) and grid connection skills (for electricity distribution). The process of connecting bioenergy systems to the grid is similar to connecting any medium or large renewable energy generator to the electricity grid and is thus discussed in the associated skills gap section (Section 6.1.6).
- **System Integration:** The final stage of a bioenergy plant is the system integration from biomass procurement to energy conversion to energy distribution. This takes specific skills and experience, which are currently difficult to find as there are only a few operational bioenergy plants in Australia. Additionally, there are currently no specialised TAFE courses on bioenergy other than general ones on renewable energy²³ and no bioenergy specific university degrees, although some such as UNSW's BEng in Renewable Energy have an optional module on bioenergy. According to Ernst & Young, most bioenergy education is currently delivered through in-house training in some companies.²⁴

Recommendation 1 – Develop a Bioenergy Strategy for the North Coast Region

To expand the bioenergy sector in the North Coast, a sector that is fledgling at best, will require a concerted effort. Thus it is recommended that *Sustain Northern Rivers* brings a range of relevant stakeholders together to create a bioenergy strategy for the region. This strategy should focus on how to create a bioenergy sector that is environmentally, socially and economically sustainable. Stakeholders should include:

- Those already working in the North Coast bioenergy sector – NSW Sugar, Delta Energy and those working on biochar projects
- Key players in the North Coast agricultural sector including the Farmers Federation, and different types of agribusinesses - piggeries, dairies, sugar cane, wheat, macadamia and tea tree farms
- Essential Energy
- Relevant local council, state and federal government representatives, specifically those involved in regional development, renewable energy, agriculture and bioenergy
- Landfill and wastewater treatment plant managers
- Bioenergy consultants, researchers and technology providers
- Bioenergy Australia (peak body)
- Education providers – SCU and North Coast TAFE

Recommendation 2 – Adapt existing training programs for bioenergy and create new bioenergy training programs and placements

To create the skills necessary to establish a sustainable bioenergy sector in the North Coast will require a range of existing and new courses at both vocational and higher education levels. Thus it is recommended that new bioenergy courses should be developed, including:

- Biomass handling and associated OH&S and environmental sustainability considerations,
- Bioenergy system design and integration

It is further recommended that these new courses could be combined with existing courses such as base electrical, mechanical, chemical and/or control systems trades and engineering courses to create:

- A VET Bioenergy qualification
- A degree, degree specialisation or masters in bioenergy engineering.

Note: Mildura TAFE should be approached to explore the extent to which such training is already in development.

Additionally, it will be important to ensure that both VET and higher educational training options have a significant placement component so that trainees get experience of working in an actual bioenergy facility. As there are only a few bioenergy facilities in Australia, work experience opportunities may need to be explored. This may necessitate international partnerships.

6.1.2 Energy efficiency and solar PV in buildings

Interviewee evidence suggests there is good coverage of both energy efficiency assessors and PV designers and installers on the North Coast. For example, one interviewee stated:

“I’ve run three [housing energy efficiency] courses in Bellingen there seems to be an uptake of a group of builders there, or people in the industry, who are quite keen to embrace these technologies and are looking to expand their knowledge.”

The fact that the North Coast has one of the highest penetrations of domestic PV in the state suggests that solar PV skills are widely available when the demand exists.

Nevertheless, solar PV and building energy efficiency have been identified as skills gaps for three reasons. Firstly, retention of skills in the area is a challenge. One interviewee identified that since the NSW Solar Bonus Scheme ended that a number of solar installers in the region have migrated to Queensland, as they see more demand there.

Secondly, it is highly likely that domestic and commercial solar PV and energy efficiency will play a substantial role in a sustainable energy future for the North Coast. If this is the case, energy efficiency and solar PV could become a future skills gap, as there will not be a sufficient number of assessors and installers in the area to fulfil the strategy. For example two interviewees stated:

“To ramp up solar installation to head towards 100% renewables, there would be a need to increase the number of installers by 50% and deal with retention.”

“Solar power installation for domestic systems. There’s clearly not enough people accredited to do that.”

Finally, while there are specialist PV designers and installers and energy efficiency assessors in the North Coast, their skills are only slowly being embedded in the mainstream building industry. When a new commercial or residential building is being constructed or an existing building is retrofitted, energy efficiency principles are often not applied and solar PV not considered, i.e. they are not yet default or part of business as usual. Skills Australia identified that nationally there are a lack of “builders and tradespeople with qualifications and experience in delivering sustainable building solutions.”²⁵ This also extends to the design profession (e.g. architects, designers). Many in these professions firstly don’t understand the business case and sustainability reasons for energy efficiency and solar PV and secondly, don’t understand how to implement these solutions properly. As one interviewee stated:

“there’s still a severe lack of knowledge in the building industry on like how solar panels work, [the] purchase price... the cost benefit analysis... that’s all very new...”

Specific skills associated with energy efficiency and solar PV in buildings that must be addressed include:

- Thermal performance - There is a general consensus that residential builders and tradespeople are not well informed about building thermal performance.

“...builders, contractors and people in the industry [need] to understand, in a broader sense, what the key properties are about windows and about thermal insulation and about thermal mass and all those sorts of things ... So how windows and how thermal insulation works. Just simple stuff. [There’s] very little of that information out there. It’s either too scientific and they don’t understand it or it’s just so simple that it goes over their heads.”

“..so that when they’re putting insulation in they don’t squash it, or when they’re putting foil in, they tape it and join it correctly so they understand that the building envelope is continuously protected. None of that stuff gets covered, to my knowledge.”

Currently, the only in-depth accredited course is the Residential Building Thermal Performance Assessment course, which is a prerequisite for becoming an accredited Nationwide House Energy Rating Scheme (NatHERS) assessor in NSW. However, this is geared to the needs of assessors rather than builders and tradespeople, and is soon to be replaced by a Certificate IV in NatHERS Assessment (expected as part of the CPP07 Property Services Training Package Version 11²⁶). Other courses, such as the MBA’s Green Living, cover it to a limited extent but not in sufficient detail as it is part of a two day course in building sustainability.

- The impact of lighting and HVAC on occupants:

“We do need direct training, a lot more direct training options provided to broaden the focus [to]... around lighting, around HVAC, so heating and ventilation and air conditioning; around specific examples and not just lighting and how to wire in an efficient light, but lighting and its impact upon the occupants, HVAC and cooling and chilling and heating and its effect upon...”

- How the different rating schemes such as Green Star and NatHERS work together
- Commercial scale energy efficiency and solar PV

“(...) notable gaps in continuing development (CPD) training available to electricians appear evident in the areas of (...) Large-scale commercial photovoltaic systems (including gaps in technical and project management skills).”²⁷

“...we don't have people in the region that have the commercial scale skills.....the stimulus hasn't been here to attract them.”

Recommendation 3 – Expanding the number of current energy efficiency and solar PV professionals

It is recommended that the availability of CEC accredited solar PV installation training in the North Coast be dramatically increased. Currently, Grafton TAFE is acquiring the necessary equipment to deliver the training, but it is not yet available. To expand the number of accredited solar PV installers this training and associated prerequisite training should be made available as needed.

It is further recommended that energy assessment training programs be run more frequently on the North Coast, that Southern Cross University develop an energy auditing course for engineers to do Level 3 and Level 4 audits and that the Certificate IV in Renewable Energy also be offered by North Coast TAFE. The issue of creating demand for these training offerings is discussed in Section 9.

Recommendation 4 – Support the embedding of solar and energy efficiency content into training for relevant professions

Where it is not already the case, skills in energy efficiency, solar hot water and solar PV need to be made compulsory as part of the base training of builders, electricians, plumbers, facilities managers, designers and architects. This is the task of the relevant Skills Councils under the *Green Skills Agreement*. There is an opportunity for Sustain Northern Rivers to liaise with Skills Councils to support this process.

Recommendation 5 – Develop solar and energy efficiency CPD courses for relevant professions

CPD courses in energy efficiency, solar hot water and solar PV need to be made compulsory for builders, electricians, plumbers, facilities managers, designers and architects. This is the task of the relevant Skills Councils under the *Green Skills Agreement*. There is an opportunity for Sustain Northern Rivers to liaise with Skills Councils to support this process.

Recommendation 6 – Address specific energy efficiency and solar PV skills gaps

It is recommended that short courses that may lead to statements of attainment be designed in the following areas:

- Commercial scale solar PV design and installation
- Energy regulatory context and rating tools – how they work and how they fit together
- Designing energy efficient buildings and training building users in energy efficient practices/ behaviour
- Understanding building thermal performance

Where these courses already exist, they should be offered regularly in the North Coast and where appropriate offered as continuing professional development and in the case of the last two embedded into base training for builders and building designers.

Recommendation 7 – Retaining sustainable energy skills in the region

It is recommended that agencies involved with the design or implementation of any energy efficiency, distributed energy or renewable energy programs on the north coast (e.g. Sustainability Advantage Program) explicitly consider measures to encourage the development and participation of local businesses and tradespeople as a means of retaining skills in the region. One possible approach to skills retention could be to skill-up members of the local unemployed or under employed Aboriginal and Torres Strait Islander community, as Aboriginal communities are highly connected to country and thus are much more likely to stay within the region.

6.1.3 High Speed Broadband, Smart Grid and Demand Management

Smart Grids and demand management are an emerging sector in Australia. As one interviewee stated:

“Smart grid systems would probably be the next stage, which I think is a different kettle of electronic expertise I would imagine. I would imagine there would be a need to train people to install smart grid technology (...) I think there’s a real gap there.”

Taking advantage of the opportunities presented by HSB/NBN and a smarter grid involves a number of different elements coming together, each of which involves different skills. These are discussed in detail below.

Installing the backbone infrastructure

The backbone infrastructure of a Smart Grid is electricity poles and wires and communication infrastructure such as the NBN and/or wireless infrastructure. Additional components are the home interfaces such as smart electricity meters, in-home displays and Network Termination Box (NTD) which according to one interviewee is *“the NBN box that goes inside the house”*.

Of these pieces of infrastructure only installing the NTDs and smart electricity meters and in-home displays can be considered new skills. Installing wireless and broadband cables as well as electricity cables are existing skills and professions, however, while these skills may not be new, two interviewees noted there are a lack of professionals to deliver both at the scale required:

NBN Co need approximately 16,000 to 18,000 when we get to the peak of construction based on our current modelling.... This is building a fibre network on a scale that is significant. So in that respect we're not creating new jobs per se, we just need a lot more than currently exist today.

The electrical industry occupations in Australia, including engineers, electricians, lineworkers and telecommunication /data cablers, have been in a state of skill shortage for a many years. In fact, these skill shortages are present in most developed economies.

Nevertheless, strategies are already being put in place to meet these demands. NBN Co has developed a strategy to ensure the necessary training exists, that it is funded and that there are sufficient numbers of people completing the training. The specific skills required for the construction of the NBN high speed broadband infrastructure were outlined by one of the interviewees:

They mostly sit within the telecommunications family of jobs... in terms of occupation there's around 40 that we identified. But of those about 28 of them are involved in construction. They are semi-skilled to Cert III level... Road traffic controllers are unqualified. Earthmoving plant operators might have their tickets for operating plant and equipment but generally don't have a certification. Then we have your Cert II, Cert III telco installers and lines workers. So they're your top five jobs. We don't need engineers to the scale... NBN will provide job opportunities in local, rural areas... because if we need to dig a hole or dig a trench we most likely will use the local subcontractors to do that.

In the case of the installation of smart meters and the electricity distribution infrastructure, the electricity network provider, which in the North Coast is Essential Energy², is responsible for much of the specific training. However, it is important to note the recent Victorian roll-out of smart meters has had some examples of poor quality installations, highlighting the need for stringent training and oversight when scaling up programs.

Installing smart appliances

The next element of setting up and operating a smarter grid is installing smart appliances. According to one interviewee:

² Note Essential Energy is the Distribution Network Service Provider (DNSP) in the North Coast, it is owned by the NSW Government. It used to be integrated with a retail arm and called Country Energy. In 2011, Country Energy was split into a retailer and a DNSP, the retail arm was sold to Origin Energy and the DNSP remained state controlled and became Essential Energy. The three DNSP organisations in NSW (Essential Energy, Endeavour Energy and Ausgrid) are as of 2012 in the process of being merged.

A smart appliance isn't that much more intensive to install than a normal, everyday appliance. It's just that it happens to also have a data connection... I imagine that would be a rather quick upskilling... when we educate an electrician it's a very broad education that they receive, anyway. So I think it would be just a simple matter of tacking on a little bit of extra education at the end of their qualification, or embedding that in courses as they go... and companies marketing the products getting out there and showing the industry how to install them, how they work and how they operate.

There are already some smart appliances on the market and in the next couple of years there will be many more. Two other components of a smart grid that electricians or smart grid technicians will likely need to learn to install in the future are storage or battery systems at a household or commercial scale and electric vehicle home charging stations.

Creating and installing the control software programs

The third element of a smart grid is creating the control software to manage smart appliances and setting up Home Area Networks. This will require some combination of software design, information communications technology (ICT) and telecommunications skills.

Managing and using the smart grid

The key feature of a smart grid is it can better manage supply and demand of electricity in real time, by not only ramping up and down generation but also modulating electricity demand, using demand management strategies. There are four general approaches to demand management:

1. Reduce electricity demand across the board through energy efficiency and behaviour change (these are discussed as part of other skills gaps).
2. Energy users install smart appliances and have an agreement for these to be turned down or off at necessary times by a remote smart grid management centre.
3. Energy users enter into demand response contracts, whereby at times of peak demand the user is contacted and asked to increase local generation and/or switch off pieces of energy intensive equipment.
4. Energy users install smart appliances and software, so that they are alerted at times of peak demand and can voluntarily choose to modify their energy use (either directly or by their own personal remote control systems), usually in response to a price signal that is communicated to them wherever they are.

Across all of these approaches, there are two key skill sets that are essential: data management – using the control software systems created – and customer/end-user engagement. On the former, as one interviewee stated:

There is a big need for data managers, who monitor and interpret data around grid stability and who can ramp up and down output. Skills needs for this are IT, Electrical Engineering, Electrical technicians and data analysis

As for the latter, another interviewee proposed:

“(...) the part that's been missing I think is that that customer engagement piece for the strategic planning of the network... the bit that's been missing has been the understanding of what is on the customer side of the meter (...) It's just a matter of having the skills to easily identify what's the best value for a customer and to bring it all together”

The latter will likely be more challenging as historically *“there's been less attention paid to it [the demand side] in the electrical profession in general”*

In terms of training for a Smart Grid, access to new smart technologies in a training centre is essential. According to one interviewee the only training facility currently set-up to do this is in Silverwater in Sydney and is run by Ausgrid as part of the Smart Home Smart City trial. Additionally, EE-Oz, the Electrical Trades Skills Council, has developed some home area network and smart metering training packages.

Recommendation 8 – Create a Smart Meter, Smart Home, Smart Management Strategy

To create a smart energy sector in the North Coast will require a collaborative approach. Thus it is recommended that *Sustain Northern Rivers* brings a range of relevant stakeholders together to create a smart energy strategy for the region. This strategy should seek to answer the following questions:

- Who is best placed to deliver smart meters to energy users in the North Coast, is it Essential Energy or another party?
- How will energy users across the North Coast be engaged with around the opportunities and business associated with a smarter electricity grid and subsequently how to use smart energy technologies, such as in-home displays, home area networks, smart appliances?
- Who is best placed to manage a Smarter Grid and how? Is it Essential Energy and/or another party and/or users themselves?

Having experienced significant consumer backlash to the Victorian roll-out of Smart Meters, any Smart Energy Strategy should have an energy user engagement component as a priority. Key stakeholders to be included are:

- Essential Energy
- Local energy businesses
- Consumer advocates
- ICT businesses
- National smart grid experts such as those involved in *Smartgrid Australia* and *Smart Grid, Smart City*

Recommendation 9 – Liaise with the HSB providers of infrastructure

It is recommended that SNR liaise with NBN Co, Silcar and other fixed wireless to ensure that the NBN roll-out and skills strategy is complementary to the streamlined establishment of a smarter approach to energy supply and demand.

Recommendation 10 – Introduce existing smart grid training packages and expand them

To ensure that electrical, ICT and telecommunication trade professionals have the necessary skills to take advantage of the NBN/HSB and the establishment of smarter approaches to energy, it is recommended that North Coast TAFE, a Community College in the North Coast and/or another RTO deliver the EEOZ smart appliances and home area network training, which are currently in development. Additionally, it is recommended that *Sustain Northern Rivers* advocates for or helps EEOZ in the development of training related to grid-connected battery storage (as distinct from remote area power supply and battery storage) and electric vehicles. Once developed it is recommended that these training packages be delivered on the North Coast when appropriate.

Recommendation 11 – Creating a Smart Grid Training Centre

To fill the smart grid skills gaps identified above requires access to smart appliances and other technologies used in a smart grid system. As such, it is recommended that a Smart Grid Training Centre be established on the North Coast. This training centre could further be expanded to be a one-stop-shop for technical sustainable energy training. As one interviewee proposed, the best outcome would be to create a training facility that models what is needed, from the building envelope, to the technology to the way it is used.

6.1.4 Wind generation

While large wind generation is not likely to play a significant role in the North Coast's sustainable energy future, due to a poor wind resource, it is important to note that there are skills gaps in this sector across Australia. Specifically, there are wind engineering skills gaps associated with the siting, design and construction of large wind projects and as well as trades skills gaps particularly to do with construction and maintenance. As one interviewee noted (e.g. maintenance):

There's no registered course... for large wind turbine maintenance. So basically a piece of machinery like that will need to have both preventative maintenance and emergency repair maintenance breakdowns. So it has a range of skills. Some of them are existing training units that just need to be included into one package."

That is, there are a number of existing training units such as working at heights and basic mechanical maintenance skills that need to be pulled into one training qualification, with some new wind turbine maintenance specific courses.

There are some niche opportunities for small wind generators at household scale, and there have been training courses developed for wind site assessment by the Alternative Technology Association and the Institute for Sustainable Futures, as described in Section 6.1.5.

6.1.5 Energy assessors and energy auditors

For all sustainable energy options from domestic to large scale, energy site assessors and/or energy auditors are essential personnel. Energy auditors are specialist professionals who undertake analysis of energy use and potential options for energy efficiency and cost saving in commercial buildings or industrial premises. In many cases they are tertiary trained engineers, and require knowledge and experience in mechanical engineering, especially to deal with heating ventilation and air conditioning in commercial premises, or thermal energy flows and motor drives in industrial settings. The requirements of energy audits are specified in Australian and New Zealand Standards (AS/NZS 3598:2000).

Home energy assessors analyse domestic energy use in households, and the expected or required base level of knowledge and experience includes the ability to do basic calculations of potential savings from retrofitting efficient appliances and equipment, and diagnosing sources of energy use that can be reduced through investment or behaviour change. At the other end of the spectrum are those who have been trained to undertake NatHERS or similar rating of houses for energy performance, required in some jurisdictions (e.g. the Australian Capital Territory) for mandatory disclosure of energy performance at time of sale.

Energy site assessors are those professionals who are able to assess sites and buildings for the potential to capture renewable energy sources, and integrate this with the energy requirements of the premises, efficiency and demand management opportunities, energy storage and grid connection and supply as appropriate. Energy site assessors and/or energy auditors need to be able to understand how much energy is used for what purpose at a site, the particular energy technology or behaviour option or range of options they are assessing to reduce energy use and how appropriate they would be for a particular site, whether it is a building or other property.

Nationally, there is a shortage of wind energy site assessors particularly for small wind systems (up to 100kW) and as such the Institute for Sustainable Futures in conjunction with the Alternative Technology Association has designed and piloted a Small Wind Site Assessment Course. The course is targeted at energy service professionals and solar installers who are looking to expand into the small-wind sector. However, the focus of this course is accurately assessing whether small wind is viable for a particular location. In addition, nationally the demand for energy efficiency auditing skills is likely to increase significantly with the introduction of mandatory disclosure of commercial building energy performance.²⁸ One North Coast interviewee suggested:

“We’ve been going through the energy efficiency work for some time but we don’t necessarily have the people in the region who are skilled to conduct energy audits.”

In addition to technology-specific site assessors and auditors (e.g. a small wind site assessor or an energy efficiency auditor), there is a lack of energy site assessors and auditors that cover multiple technologies and energy options. In the upcoming years, there will be a shift from households and businesses being consumers of energy to being prosumers (producers and consumers) of energy. As such, it will be important to have energy consultants and assessors that can provide advice to businesses and households on both the energy demand and supply options available to them. For example, the authors of this report are in the process of conducting a pilot program with the NSW Government, which provides energy efficiency and renewable energy site assessments for agribusinesses. While it was possible to find site assessors who specialised in the individual energy options considered – energy efficiency, solar PV, solar hot water, small wind, bioenergy and micro-hydro, it was not possible to find site assessors who could assess a site for multiple energy options.

This lack of energy site assessors with a *comprehensive* skill set is a key skills gap both nationally and in the North Coast. However, the North Coast is well positioned to fill this gap, as there are already a couple of businesses that do multiple energy option site assessments. For a contextually appropriate transition to a more sustainable energy future in the North Coast, the number of such comprehensive site assessors will need to increase.

Recommendation 12 – Provide training in small wind site assessment

There is likely to be some potential for small wind in the North Coast. To ensure that any small wind turbines installed are sited correctly, it is recommended that the existing Small Wind Site Assessment Course be made available by North Coast TAFE, a Community College or another RTO. Note the Small Wind Site Assessment Course is currently under consideration for accreditation by the Electro-technology Skills Council, however all the training materials are available at the NSW Government Energy Efficiency Training Website²⁹.

Recommendation 13 – Help develop and introduce Building Energy Mandatory Disclosure Training

It is likely that in the next few years it will become compulsory to disclose the energy use of a building at the time of sale or lease. To ensure that the North Coast region is on the front-foot, it is recommended that training providers in the North Coast help develop any relevant training content.

Recommendation 14 – Expand the number of energy assessors in the North Coast

It is recommended that the base of energy assessors *with a comprehensive skill set* (those who can assess a site/building for the appropriateness of energy supply and demand options) on the North Coast be expanded. To do this it is recommended that SNR liaise with the relevant skills councils, the Clean Energy Council and peak energy efficiency bodies to develop a new qualification for Renewable Energy and Energy Efficiency assessments. This qualification should cover all renewable energy technologies – solar hot water, solar PV, small wind, bioenergy and micro-hydro. Such a qualification could bring together, existing accredited energy efficiency and renewable energy site assessment training. Additionally, it is recommended that a database of site assessors be established, which includes what technologies they are accredited to assess. See the Midwest Renewable Energy Associate Assessors list as an example.

6.1.6 Grid connection skills for medium and large renewable energy sources

One of the biggest skills gaps that inhibits the wider uptake of renewables currently is related to how renewable energy systems larger than 10kW connect to the electricity grid. Specific skills required include:

- Understanding the likely voltage, stability and other electrical impacts of connecting a specific renewable energy system to the grid at a specific point, including impact on power factor and how to correct it
- Understanding and negotiating the regulatory and financial framework
- Negotiating with the distribution company

At the moment most of the technical skills associated with grid connection reside within network businesses such as Essential Energy or highly specialised consultants (unlikely to be on the North Coast). However, if renewable energy systems larger than 10kW are to become more prevalent, it will be important for these skill sets to be available to a wide range of stakeholders. Additionally, it will be important to have clearer guidelines and costs for grid connection at different scales.

Recommendation 15 – Ensure local medium to large-scale renewable energy grid connection expertise

It is recommended that as the range of sustainable energy projects grow on the North Coast, that one of the member organisations of the SNR Energy Working Group employ or regularly contract a person or organisation with medium to large-scale renewable energy grid connection expertise.

6.1.7 Engineering skills

“Australian industry faces an engineering skills shortage. Professional engineers, engineering technologists and technicians have been in short supply in construction, road, rail, power generation, local Government and other industries over a period of several decades.”³⁰

In the North Coast there currently aren’t any engineering degrees taught, however according to one interviewee a large engineering program is in the process of being introduced starting with civil engineering next year. However, the issue goes beyond a lack of engineering training to a lack of interest, as an interviewee noted:

“I think right across the board, from what I can gather from talking to people at the Engineering Institute, or the Engineers Australia, it just needs to be made more attractive. I think the real problem is uptake from the schools. At the moment, we’re importing a lot of engineers with overseas qualifications, and then for the lower engineering work, we’re tending to just promote tradespeople, so people with an aptitude for doing it. So there’s a real gap there, especially at the lower end of engineering... engineering departments are struggling because they’re not getting the enrolment.”

Engineering skills are essential for most sustainable energy options, particularly those associated with commercial building construction, industrial energy efficiency, heating ventilation and air-conditioning efficiency, electricity distribution, transmission and generation at a scale beyond domestic solar panels. Particular engineering disciplines that are important include civil, electrical, mechanical, power, environmental and specific renewable energy engineers. Additionally, for practicing engineers in the energy sector, there is a need to develop new skills to capture emerging sustainable energy opportunities. For example one interviewee identified that engineers need to develop:

“commercial skills with a really good understanding of what impacts [of different energy options] could be had on communities, especially regional communities and then customers that are vulnerable, because I guess we have to have a paradigm shift.”

Recommendation 16 – Extend the range of engineering courses in the North Coast

Currently, Southern Cross University is planning on introducing a Civil Engineering degree. It is recommended that additional engineering degrees be developed and delivered in the North Coast, specifically:

- Electrical engineering with specialisations in power engineering and renewable energy engineering
- Mechanical engineering, including study of energy systems, heating ventilation and air-conditioning

- Information and communications technology engineering.

Further, it is recommended that the Civil Engineering degree include modules on sustainable construction. Additionally, the delivery of an engineering diploma or advanced diploma course, such as the UEE62011 Advanced Diploma of Engineering Technology - Renewable Energy, in the North Coast would help address the engineering skills gap at a lower level but more quickly.

6.1.8 Strategic planning and development assessment

In the local government sector, skills gaps exist in strategic planning and development assessment. This was noted by several of the interview participants. Skills that will be increasingly required in the transition to a sustainable energy future include:

- An appreciation of the appropriate energy options at a regional scale (e.g. decentralised generation, different renewable energy options) and how regional planning policies and plans can support them
- An appreciation of the impacts of a sustainable energy future on job creation in the region
- The ability to assess development applications for their alignment with the goals of a sustainable energy future

Local Councils are typically overloaded with development applications, and if the skills don't exist, assessment of those involving new technologies and approaches (e.g. sustainable energy) can take longer, providing a disincentive to applicants. Skills required to overcome this include a working knowledge of sustainable building principles and sustainable energy options.

Recommendation 17 – Ensure training options for planners include sustainable energy skills

Currently, planning courses leading to a qualification are not offered on the North Coast. This should be addressed through the *Skilling for Change Implementation Plan*. Options include:

- Introduction of a planning qualification at SCU and/ or North Coast TAFE if appropriate
- CPD that provides skills in (i) regional planning for a sustainable energy future and (ii) sustainable building. This could potentially be offered to Councils as in-house training. Some of the content could be delivered via existing programs such as the Master Builders *Green Living* program for sustainable housing

6.1.9 Business case for energy options and associated business management

“This is not about reducing environmental impacts, hugging trees, saving polar bears. This is about the business case and spending less... it is about making better economic sense.”

“...we have a real shortage of those people who can...identify energy saving opportunities and alternate energy opportunities through the business cases...”

“It is recommended that Ministerial Council on Energy (MCE, now SCER – Standing Council on Energy and Resources) and the Ministerial Council for Tertiary Education and Employment (MCTEE) encourage courses at VET and higher education level to incorporate training in the development of a business case for energy efficiency at all levels, informed by examination of comparable courses in North American universities and colleges.”³¹

From an energy efficiency program to a large biomass plant, making the business case for different energy options and associated business management is an essential skill in the transition to a more sustainable energy future, and one that is lacking in the right places. There are many professions – such as sustainability professionals, energy managers, accountants, senior managers and policy makers – that have a role to play in making the business case for different energy options and each has a slightly different skill or knowledge gap. Specifically:

- Sustainability, sustainable energy and energy professionals, whether consultants or embedded within an organisation, need to have an understanding of key business tools (e.g. net present value, payback period, cost-benefit, etc.) and how to communicate them to the appropriate decision makers.
- Accountants need to apply and expand their existing skills in the new context of sustainable energy. A recent study into accounting and management training needs for energy efficiency, found that while accountants “have the generic skills required to support Energy Efficiency initiatives, material which demonstrates how to apply such skills to Energy Efficiency would be useful.”³² It can be assumed that a similar statement would apply to all sustainable energy options, not just energy efficiency. Additionally, “training in risk analysis and risk management is required for accountants and managers to deal with uncertainty” around various government initiatives.³³
- Senior managers need to be more conversant with the business case as it applies to sustainable energy options, and the high-level implementation issues. Another recent study found that the one of the greatest skills gaps are in “the development and promotion of the business case to senior management extending to the integration of findings into cross-business operational plans”.³⁴
- Policy makers and business managers according to one interviewee “need more information, more training, more skills around how to finance” sustainable energy options and more awareness of “where the risks can be managed.”

In summary, those who have the knowledge about sustainable energy options need more business and financing skills and tools, while those with business skills and tools need greater awareness and knowledge of the opportunities and specifics of sustainable energy options and how to embed them into an organisation’s operations.

Recommendation 18 – Provide energy and carbon accounting courses for accountants, managers and business students

In line with a recommendation from the recent study into accounting and management training needs for energy efficiency, it is recommended that existing sustainability courses for accountancy and business students both at a VET and higher education level be modified to have a more specific focus on energy management and costing.³⁵ Additionally, that a CPD course be developed for accountants, managers and business students around energy opportunities; this course could complement the existing carbon accounting courses being delivered in the North Coast.

Recommendation 19 – Provide business case courses to sustainability and energy professionals

That a CPD course be developed for sustainability and energy professionals about creating a business case for different sustainable energy options. It is possible that this could be an online or virtual module. It is assumed that all renewable energy courses at a vocational and university level include business case training. If not, such a module should be embedded within those courses.

6.1.10 “Soft skills”

While the business case skills described above are essential for embedding sustainable energy within the current business and decision making paradigm, there is a complimentary set of skills required to help create a new sustainable energy business paradigm. These (for want of a better term) “soft” skills include:

Sustainability and energy literacy

- Leadership
- Social innovation
- Cross-disciplinary and meta-systems thinking

- Communications
- Behaviour and practice change

A recent study into accounting and management training needs for energy efficiency stated “Soft skills as well as analytical / technical skills are important... There is a need for leadership, organisational change and influencing skills, as well as the ability to analyse tasks.”³⁶

Specifically, sustainability and energy literacy skills are essential for understanding the need to be more sustainable and associated problems or challenges that are faced in the North Coast, Australia and globally. This includes understanding in broad terms why energy is important, and what the opportunities and possible solutions are. This knowledge base is needed within the general population and is slowly being established. A number of interviewees stated that “*sustainability is the new OH&S*”. Where occupational health and safety (OH&S) used to be the responsibility of one OH&S officer, now all employees across most if not all workplaces have to undertake basic OH&S training; it has been embedded. This needs to be the case with sustainability.

There is also a need for general leadership skills. As one interviewee put it:

“I think like leadership programs and the leadership programs having the specific objective of assisting people to understand who they are first, to then understand what a customer or what the market might need, I think that's the skill set that could be missing.”

Skills increasingly associated with sustainability leadership include cross-disciplinary or meta-systems thinking skills. These skills help practitioners firstly understand the context in which they are working, including its complexity and interconnectedness, and secondly bring different stakeholders together to implement holistic solutions and adapt as the context evolves. Two interviewees suggested:

“I would say that we need practitioners who can redesign the system... we [need to] take a whole system perspective and that obviously encompasses both the users i.e. demand as well as the supply side, and look at that scale and say what's really going to be involved...”

“We're trying to arm assessors and trainers within organisations to broaden their thinking when making a recommendation [to a client]... Think more broadly, let's not just think about the installation of the units and isolation of everything else, think about how this can work from a practical point of view when it comes to sustainability practices.”

To implement the sustainable energy solutions developed, innovative business models and social entrepreneurs are required, as are communication skills and skills in developing behaviour and practice change programs. These ideas were commented on by a number of interviewees as well as in the literature:

“The other message for the builders is to teach people how to use their houses. Behaviour's really important... I'd like to see the basic - I'll call it sustainability training, even though that term's a bit of a misnomer. But basic training in all the trades. I'd like to somehow or other educate homeowners how to use their buildings.”

“There is a critical role for really strong environmental education professionals, to use a very broad generic term; sustainability educators; community educators, whatever you want to call the practice area, but to really look at how do we build direct content related literacies but at the same time how do we actually build the capacity to implement behaviour change and kind of change practices... we're talking about.”

“There is demand for communication skills (...) financial and energy data must be communicated to decision-makers in ways that they will understand.”³⁷

These skills, particularly sustainability and energy literacy, are a skills gap both nationally and in the North Coast. There was a perception amongst several interviewees that levels of sustainability and energy literacy are higher in the North Coast compared to many other regional areas in Australia. Indeed, SNR has already

developed a course in complexity leadership that teaches managers and practitioners the value of applying complexity science and distributed leadership to tackle the wicked problems of climate change and sustainability.

Recommendation 20 – Bring social innovation and sustainability leadership programs to the North Coast

There are a number of highly successful leadership and social entrepreneurship courses that are being delivered in other parts of Australia and sit outside the traditional training framework. Examples include the *School for Social Entrepreneurs* and the *Centre for Sustainability Leadership*. It is thus recommended that *Sustain Northern Rivers* investigates the possibility of bringing such programs or modified versions of such programs to the North Coast. It is likely that they would be a good fit with Byron Region Community College or another Community College in the area, as they run non-accredited courses.

Recommendation 21 – Expand existing behaviour change and communications courses

SCU, North Coast TAFE, Community Colleges such as Byron Region Community College all have courses that incorporate behaviour change and sustainability communication skills. It is thus recommended that such courses where possible within the training package framework become core modules of as many relevant qualifications as possible and that they continue to be offered regularly.

6.2 Summary

In summary, there is a range of skills required for a more sustainable energy future on the North Coast of NSW and unfortunately, but not surprisingly, a range of skills gaps. However, the majority of these skills gaps are not new green skills, most are a combination of traditional and new skills in a green context, with many of the skills identified above being purely traditional skills applied in a green context. Table 4 provides some example skills gaps using these categories outlined at the beginning of this Section in Figure 1.

Given the categories of skills gaps that are most prevalent in this analysis, most skills gaps can be considered to sit in the second skills shortage typology - *few workers have the essential skills, with a short training time required to develop the skills*. It is only really the engineering and bioenergy skills gaps that sit firmly in the first skills shortage typology - *few workers have the essential skills, with a long training time required to develop the skills*. As such, many of the skills gaps identified could be addressed relatively quickly, with the right coordination and resourcing. It then becomes a question of prioritising.

Section 18 outlines a Skilling for Change Implementation Plan, identifying whether the recommendations within this report should be a high, medium or low priority. Some of this work has already been done, with the National Framework for Energy Efficiency identifying the trades and professions that could make the greatest impact on energy savings. This analysis revealed the top four as follows:

- Electricians
- Heating, ventilation and air conditioning (HVAC) specialists
- Engineers
- Facility Managers

Table 4: Example skills gaps by green skills categories

Traditional skills in a green context	Combination of traditional and new skills in a green context	New green skills in a green context
Plumbing and electrical skills applied to installation of solar hot water	Bioenergy supply chain development and operation	Holistic energy site assessments and audits
Behaviour change and communications skills	Understanding and managing smart network data and control systems	Sustainability and systems thinking
Finance sector knowledge of finances and incentives for different energy options	Electrical skills applied to the installation and maintenance of smart appliances	-

7. Sustainable energy job sector projections for the North Coast

There are a significant number of studies to indicate that a sustainable energy pathway, that is, an energy strategy that is dominated by energy efficiency, demand management, distributed generation and renewable energy, will generate a higher level of permanent employment than a fossil fuel based, centralised energy strategy.

This is even more significant, and likely to be even more pronounced, in a region such as the North Coast, which has over the last 30-50 years lost jobs in the energy sector as the generation of electricity and the structure of the electricity industry has become more centralised. Energy sector jobs have recently been boosted with the rise in business development and jobs in PV installation, the home insulation program and other initiatives, but as noted by several interviewees, this has manifested in ‘boom and bust’ cycles that have probably exacerbated any existing vulnerability of the North Coast economy to fluctuations in the building and housing industry.

While a sustainable energy future for the North Coast has not yet been fully defined and analysed, this project has made plausible assumptions regarding the types of options and initiatives it would include. Assuming the implementation of these options and initiatives, it is reasonable to make the claim that there will be an increase in employment, based on the following background data. Recent analysis, undertaken by the Institute for Sustainable Futures for Greenpeace International³⁸, considered the employment implications of a future global energy scenario involving a major focus on renewables and energy efficiency, compared to a reference case of centralised fossil fuel use, extrapolating existing practices. This showed that there would be, by 2030, an increase in jobs from 9.3 to 11.3 million by 2030, compared to a decrease in the reference case scenario from 9.3 million to 8.1 million by 2020, rising to 8.6 million by 2030.

This means a 30% difference for the sustainable energy scenario relative to the reference case. While it is not possible to extrapolate this to a specific region, the likely distributional impacts of such a change would be likely to disproportionately favour an area such as the North Coast due to the potential for energy efficiency, demand management and renewable energy.

The employment benefits of energy efficiency programs have been apparent, for example, in the recent Queensland Government Climate Smart Home program, which has engaged over 150 electricians and other support staff in the rollout to over 300,000 homes.

TRAINING FOR A SUSTAINABLE ENERGY FUTURE

8. Snapshot of training available on the North Coast

The following is an outline of the potential energy related training available on the North Coast that could help to address the gaps outlined above. It should be noted that at the moment training in energy related skills has a mostly vocational/industry focus on the North Coast.

8.1 North Coast TAFE

Diploma & Certificate courses:

- Diploma of Sustainability (includes behaviour change skills) 22105VIC
- Certificate II in Sustainable Energy UEE22107
- Certificate IV in Renewable Energy (available, but no current demand on North Coast) UEE41910

Units of competency covering:

- Design, installation, commissioning and maintenance in standalone and grid connected renewable energy systems UEENEEK024B UEENEEK025C UEENEEK026B UEENEEK027B UEENEEK028B UEENEEK034B UEENEEK035C UEENEEK039B UEENEEK048A
- Installation and testing of power saving hardware and software for IT systems ICTSUS4184A ICTSUS4185A NSWTICA530A NSWTICA531A NSWTICA532A
- Assessing solutions for sustainable household energy use UEENEEK012B NSWTSUS116A
- Implementing and monitoring sustainable energy management principles, policies, procedures and practices MSACMT270A MSS405070A UETTDRIS23B
- Building thermally efficient and sustainable structures CPCCBC4020A CPCCSV5013A CPCCPB3027A
- Measuring and reporting Carbon Footprint MSS05001A BSBITU304A
- Education for sustainability TAE10 TAESUS501A TAESUS502A
- Solar Hot Water Training for Plumbers CPCPPS5003A TAFENSW 18997

Accredited courses covering:

- Home sustainability assessment, advice and retrofitting to improve energy and water efficiency 21854VIC 22005VIC CPP41110

Non-accredited training:

- Carbon accounting

8.2 Southern Cross University

Currently SCU does not have any courses specifically related to engineering and energy. However, it will in the near future offer an undergraduate degree in Civil Engineering. There are currently a range of undergraduate (UG) and postgraduate (PG) degrees relevant to energy related skills, including:

- Environmental Science (UG, PG)
- Forest Science and Management (for bioenergy) (UG, PG)
- Education (UG, PG)
- Business (UG, PG)
- Accounting (PG)

- Information technology (UG, PG)
- Vocational education and training (PG)
- Technology Education (UG)
- Technology and management (PG)
- Psychological Science (UG)

8.3 Byron Region Community College

Units of competency in:

- Sustainable building design
- Energy efficiency and sustainability (Retail)
- Waste management in building & construction
- Education for sustainability

Non-accredited course:

- Non-accredited course in energy efficient house design including site visits

8.4 Other locally available training

- Master Builders *Green Living* continuing professional development short course for builders and designers working in the housing industry - www.mbansw.asn.au/Services/Environment/Green-Living/
- Eco-smart electricians continuing professional development short courses - www.ecosmartelectricians.com.au/
- Sustainability Advantage program by OEH (tailored training for businesses) - www.environment.nsw.gov.au/sustainbus/sustainabilityadvantag
- Master Plumbers NSW has online training in sustainable plumbing including solar and heat pump hot water systems - www.masterplumbers.com.au/
- The Clean Energy Council has e-learning 'toolboxes' to complement TAFE courses, with content on PV, energy efficiency and demand management – contact the Clean Energy Council for more information
- The Dusseldorp Skills Foundation's *Trade Secrets – skills for the future* videos - www.tradesecrets.org.au/videos/
- In-house and clean energy product training by clean energy companies in the area e.g. Rainbow Power and SI Clean Energy

TRAINING CHALLENGES AND OPPORTUNITIES

Through the research process a range of challenges and opportunities associated with training provision to meet energy skills gaps were identified. These are discussed in the following sections and where relevant, recommendations are given as to how to address the specified challenge or make the most of the identified opportunity.

9. The importance of demand

In many cases, the training programs required to address the key sustainable energy skills gaps identified above already exist. In such cases, the skills gaps exist because there is not sufficient demand for the

available training. The importance of creating demand for sustainable energy skills, and therefore for sustainable energy training, was a key theme identified by a number of interviewees. For example:

There's a Certificate 4 in renewable energy but we haven't the demand to deliver that...

We put in a VET in schools program for renewable energy; we didn't have one kid take it up, not one...

We have had a little difficulty in the uptake [of plumbing solar hot water courses] again... I think training delivery is a big part of it and relevance of training has been maybe a barrier to some of the delivery of our training.

A range of factors were identified by interviewees as possible contributors to the lack of demand for sustainable energy related training, including:

- General lack of energy and sustainability literacy in the public and in many job sectors
- No incentive for electricians or builders as there's enough 'traditional' work
- Government policy can create spikes and troughs in demand for sustainable energy and thus for sustainable energy training
- High proportion of people on the North Coast are employed in small business, with limited time or budget for training and professional development
- Ageing workforce
- Small population base

Additionally, strategies to address lack of demand were also identified. Both these factors and strategies are discussed in the following sections.

9.1 Lack of energy literacy in the public and in many job sectors

Skills Australia, Anderson and Ernst & Young indicate there is a general lack of understanding of career possibilities within the energy efficiency and renewable energy industries.³⁹ Indeed, a more general lack of energy literacy, sustainability literacy and sustainable energy literacy may impede sustainable energy from being perceived as an area of emerging business opportunities, and as a legitimate source of future employment. As a consequence, it is understandable that training in sustainable energy has not historically been recognised as an advantage. As noted by two interviewees, when asked about the key priority in moving towards a sustainable energy future:

"One thing would be to have everyone recognise that renewable energy is a legitimate industry in its own right and not touchy-feely green (...) this is a legitimate business, it's a legitimate industry that will employ people and will probably more than likely be the future of energy anyway."

"Convincing people that environmental issues are of concern and that they need to be implemented in workplaces... I think that there's a bit of a skills gap at the moment in people even understanding why do we actually need to do it, to engage people"

One possible solution is to re-think how sustainability is communicated in general (e.g. via the media) and in the specific context of career planning. One suggestion is to move away from a language focused on reducing environmental impacts to one that emphasises the economic benefits of sustainability and what this means for people's lives and future career possibilities. As one interviewee puts it,

"This is not about reducing environmental impacts, hugging trees, saving polar bears. This is about the business case and spending less on your buildings. So it is about making better economic sense. So the need to sell that is a little bit puzzling. We're trying to tell people how to save money, and it needs to be communicated like that."

9.2 Lack of incentive for builders and tradespeople as there's enough 'traditional' work

In the North Coast specifically and in Australia more broadly, builders and trades people such as plumbers and electricians have enough work and as such do not see a need to acquire new skills such as PV installation etc. One interviewee commented:

“... at the present time there's a whole lot of other work that the guys can be doing that they don't need to be trained up for to do and they can make just as much money...”

9.3 High proportion of people on the North Coast are employed in small business

According to one interviewee between 90 and 95% of people employed on the North Coast work in small business. Small to Medium Enterprises (SMEs) are generally characterised by having limited financial scope to invest in training of staff, as well as to dedicate to emerging businesses opportunities that are not core to what they currently do, but may be strategic in terms of market control.⁴⁰ Thus in the North Coast, there is a very large proportion of the workforce who are less likely to participate in continuing professional development or to invest in sustainable energy options, despite a potential business advantage. As one interviewee notes:

The majority of our businesses are micro and small businesses...the usual time poor, money poor small business where they don't have the cash flow to invest in energy efficient things

The high proportion of SMEs in the region highlights the need for promotion strategies that target this industry sector and provide support to encourage their uptake of training, as well as the need to develop training suitable to their limited time and budget. However, this is often easier said than done:

the difficulty has always been accessing small business, you know, particularly retail and hospitality industry which is a very large sector in the North Coast, and actually getting some sort of impact from that has been difficult

However, one possible approach already being trialled by North Coast TAFE is to work through the Chamber of Commerce to access smaller businesses.

9.4 Ageing workforce

According to a recent energy skills report for Queensland a key challenge currently facing the renewable energy industry nationally is an “ageing workforce and an alarming decline in apprenticeship completion rates.”⁴¹ This suggests that existing training may not be attractive or flexible enough to suit the time constraints and learning needs of workers. As such, it highlights the importance of providing training opportunities targeted at those already in the workforce, not only at new entrants to the job market, as well as the importance of engaging industry in the development and co-investment of these opportunities. This is further discussed in Section 10.

9.5 Impact of government policy on demand

In the Australian sustainable energy sector there has been a history of short-term government policies that create boom-bust cycles of work for specific sustainable energy technologies. Examples include the Federal Government's Green Loans, Home Insulation Program (HIP) and various residential solar PV policies such as the federal rebate and the NSW Government Solar Bonus scheme. The implementation and abrupt cessation of such policies affects demand for related training, as a number of interviewees noted:

When we had the [solar] rebate scheme in NSW, there were six month waits to get into the solar courses and a number of RTOs were looking to gear up to deliver it. Then the rebate disappears and so the demand drops right off...

A lot of the emerging skills needs that have been around job outcomes have arisen through government stimulus programs...we were involved in building skills in those areas because there were jobs

As highlighted in the above quote, government policies can be extremely beneficial in helping to address skills gaps by stimulating demand for training. However, issues arise when government policies are short term, do not consider how the specific training requirements will be provided and/ or are cancelled abruptly. To prevent this occurring, governments need to consult with key stakeholders and consider training needs when developing sustainable energy policies. As one interviewee states:

"(...) when Governments and when the policy writers are actually developing the policy and attaching the funding to it... give us [energy experts] a call and ask us what we think. We won't try and drop it down or stop any progress, but it's just about making it work a whole lot more effectively and productively and efficiently and all those things that we're looking to try to move towards in this future of ours..."

Raising the profile of sustainable energy related professions

One of the most effective ways to address the lack of demand for sustainable energy training is to promote training opportunities and the associated benefits and opportunities of such training. Specifically, information is needed that helps people already working in relevant industries and those looking to enter them to identify appropriate training and career pathways. This should include information about pay and work conditions, different levels employment available and different levels of training available (e.g. trade, post-trade, degree and postgraduate level)⁴². This point was emphasised by one interviewee:

"There does need to be more awareness of what courses are already out there (...) somebody should bring all this together (...) There is a need for greater awareness about the courses which are already in existence because I'm sure that there are lots of people who don't know that we run courses like this, and we don't know about a lot of other people who do run courses. So one way of pooling that information together a lot more."

Information dissemination and profile-raising should be targeted to key sustainable energy skills gaps. For example, general engineering skills have been identified as a major skill gap that needs to be addressed to transition to a sustainable energy future both in the North Coast and nationally. At a national level, this issue is addressed to some extent by the work of Engineers Australia, in particular, their various strategies to "promote engineering as an attractive career option for young Australians of all backgrounds, and for others seeking to practise as engineers".⁴³ As noted in a report into educating electrical power engineers, aspirations for an engineering career can be shaped or rejected as early as in primary school. As such, programs to influence perceptions of engineering as a career option need to target both primary and secondary school levels. However, as this report adds, raising the profile of engineering may "take more than contributions to the education schemes to turn around skills shortages. The media, political campaigns and the entertainment industry also influence student perceptions."⁴⁴ Engineering is just one example of a skills gap identified, and appropriate strategies for promoting associated training will be required for each skills gap.

9.6 Flexible working arrangements and attracting women to sustainable energy engineering and trades

In addition to raising the profile of sustainable energy professions, further demand for training that addresses skills shortages may be developed by implementing flexible working arrangements. This has been noted by a report on the issue of Preparing Australia's workforce for the implementation of a Smart Grid: "Longer term solutions include: (...) workplace flexibility especially to attract women to trades and engineering".⁴⁵

A number of other strategies that would help increase demand for training, for example increasing the profile of nationally accredited qualification standards.

Recommendation 22 – Develop a Sustainable Energy community engagement strategy

To help increase general public demand for sustainable energy skills in the North Coast region, it is recommended that *Sustain Northern Rivers* develops a community engagement strategy. This strategy should promote the range sustainable energy options available and their associated economic, environmental and social benefits. It should also include a sub-strategy that engages young people as early as primary school with the topic of sustainable energy in a fun and attractive way. Example resources to support this strategy could include a career pathway document and a centralised location for training information (see Recommendation 26)

Recommendation 23 – Develop a training promotion strategy

It is recommended that *Sustain Northern Rivers* develops a comprehensive promotion strategy for existing and future sustainable energy related training. This promotion strategy should be targeted at the appropriate audience for each training option, and options that meet key skills gaps should be prioritised for promotion. The promotion strategy should include:

- Working with partner organisations who have better networks into target groups for example working with NORBEC, Industry Associations, Chambers of Commerce etc to develop and promote courses for small businesses; and
- Communicating the benefits of sustainable energy to a business' bottom line.

10. Trainer shortage

Recent research indicates there is currently a national shortage of the skilled trainers needed to assist the Australian workforce to transition to a sustainable energy future. Anderson notes, “the lack of Technical Trainers is a problem which is affecting the entire Energy sector across Australia.”⁴⁶ This scarcity of trainers is a result of insufficient numbers of technical experts to cater for demand, and also, the continuing challenge of incentivising current experts to teach in the field rather than work in it directly.⁴⁷ This is further complicated by the need for VET trainers/ assessors to retain current industry skills once they are working as a trainer/ assessor (as per the requirements of the VET Quality Framework). While the trainer shortage is experienced on a national scale it is particularly prevalent in regional areas and in the Vocational Education and Training (VET) sector. The NSW Council of Environmental Education found that, in some cases, decisions on environmental education are made by staff without appropriate information, expertise or adequate training to enable a holistic and fully informed approach to training.⁴⁸ This provides evidence that the current pool of trainers may not only be too small to service demand but that the trainers may need to update their own training and may not have access to sufficient opportunities to update their knowledge and skills. This sentiment was echoed by a number of the interviewees:

“... all this stuff wasn't around when they [the teachers] were actually working on the job so they're mainly having to teach themselves about the new technologies that are coming in”

“There's the skills gap within the training sector itself. The people that have traditionally helped deliver the training.”

“...whilst there's a shortage of teachers they can't release the teachers to do the professional development, so it's a sort of catch 22.”

Some of the factors contributing to the trainer shortage include the typically lower pay, relative to industry, of VET sector positions⁴⁹. Long lead-in times for VET teachers and barriers hindering professionals in new or cutting edge sustainable energy technologies from teaching in state education institutions, like TAFE, as

they cannot demonstrate the industry employment requirements (owing to the industry not yet having formed).

However, to stimulate real change towards sustainability, educators need more than technical expertise. They also need to be able to embed pedagogical principles of *Education for Sustainability* in their training curriculums encouraging systems thinking, problem solving, reflection, and allowing the student to cultivate a personal perspective and sense of commitment toward sustainability⁵⁰. As the Australian Regional Skills Agreement points out, “this approach is entirely consistent with best practice in VET teaching as a whole .”⁵¹ Recently, the Department of Education, Employment and Workplace Relations (DEEWR) in partnership with the National Centre for Sustainability (NCS), Swinburne University of Technology and Innovation & Business Skills Australia (IBSA) released a series of teaching and learning resources designed to support the delivery of the *Sustainable Practice Skill Set*.⁵²

Recommendation 24 - Develop a strategy to address trainer shortages

It is recommended that a strategy be developed from this research, identifying the sustainable energy technology streams where trainer shortages are most critical, and developing system level approaches to create pools of specialist trainers in these fields⁵³. Mechanisms to address trainer shortages could include:

- Offering existing sustainable energy practitioners not currently teaching, and technical experts that are approaching retirement, the opportunity to deliver training on a casual basis⁵⁴;
- Provision of access to online learning, as this may help to ease pressure on local trainers.

11. Need for a ‘roadmap’

A common theme emerging from the literature review and the interviews was the need for a ‘roadmap’ or strategy to guide and coordinate training development, to address the skills gaps identified in this report. As a starting point, this requires the development a shared and holistic vision for a sustainable energy future. When asked what the single most important action towards addressing skills gaps would be, one interviewee expressed it this way:

Having the secure future. Having a roadmap that we’re all following, that we know is going to stay there.

A vision for a sustainable energy future in the North Coast would need to encompass the range of industries that need to be involved in the transition to a sustainable energy future across the entire supply chain, and would need to include a clear vision for medium to long term skills needs. It would need to articulate outcomes in regional employment as well as energy-related outcomes.

We’ve got to have the full perspective of what energy technologies are going to deliver for us, not just the energy outcome...assimilating the whole of the support industries as well rather than just the one that generates the energy

An energy skills strategy for the North Coast would be need to be informed by the sustainable energy vision, and developed with input from all the appropriate industry and training sectors, including relevant stakeholders from outside the region (e.g. peak industry organisations, industry Skills Councils, etc.) The strategy would need to have a particular focus on priority occupations where skills shortages have been highlighted.

11.1 A collaborative and adaptive approach

The development of an energy skills strategy for the North Coast would be valuable in facilitating widespread collaboration across the training sector, local industries and regional councils. This allows for efficiencies in training development, better cross-sectoral alignment of courses, and better articulated

career pathways for the various trades and professions. It would also create a shared understanding within the workforce about the role each vocation can play in a sustainable energy future.

The energy skills strategy needs to include mechanisms for its on-going monitoring, evaluation and adaptation, and should facilitate regular working groups between the training sector and industry. Anderson notes that successful collaboration between traditional industry competitors, across the sustainable energy supply chain, hinges on fostering genuine industry willingness and interest to participate in addressing workforce skill development.⁵⁵

Partnerships between training organisations, local industry groups and regional councils can be an effective way to deliver training that pools resources and meets industry needs. Skills Australia has recommended regional or cluster-based models to develop capacity for energy skills in the VET sector. These models allow for sharing of infrastructure and expertise, and could be coordinated under the Green Skills Agreement, which intends to up-skill VET practitioners to deliver training in sustainability skills.⁵⁶

Recommendation 25 – Continue with Sustain Northern Rivers’ collaborative approach and Energy Action Plan

As this section has highlighted it is important to have a collaborative approach and a strategy. It is the understanding of the authors that *Sustain Northern Rivers* has a successful collaborative model that can be used to deliver, monitor, evaluate and adapt the *Skilling for Change Implementation Plan* in the upcoming years. However, the *Skilling for Change Implementation Plan* should not be delivered in isolation from other parts of the *Energy Action Plan*, particularly the analysis of the potential for different energy supply and demand options in the North Coast. Thus it is recommended that *Sustain Northern Rivers* continues and enhances its collaborative approach and furthers its Energy Action Plan

12. Resourcing training

One of the key challenges facing any new and even existing training programs is resourcing. The need for target funding to deliver training was emphasised by one interviewee:

Right across the board in TAFE, there have been substantial declines in funding for basic training. We need more money... [it's].. very expensive to set the training up. There's no point in training tradespeople just theoretically. They really need that hands-on, so you need a lot of plant for them to muck around with.

So it's a question of having access to the technology to do the practical training, which could be expensive (...) not a lot of private RTOs do trades training because a lot of it is high cost, high establishment costs with equipment.

Developing energy industry partnerships and placements as discussed in Section 11, may reduce the need for such extensive training equipment, as trainees can experience much of the equipment on placement. However, such a strategy naturally has its limits.

13. Career pathways

Another issue raised by interviewees was the importance of clearly articulated career pathways. An energy skills roadmap would need to facilitate this outcome.

There are currently very limited linkages between schools, the Vocational Education and Training sector and the Higher Education sector. This is crucial for identifying career options and articulation pathways for people within the industry and those looking to enter it.⁵⁷

Well articulated career pathways provide clear guidance about learning options and enable learners to choose the path that best suits them, encouraging skills development:

So there would have to be a core set of skills and then there would be branches going out into a certificate 4 diploma, advanced diploma and associate degree in renewable energy and having a major - as you do with a bachelor degree, having a major speciality. So it gives people a base and lets students and people who want to get into the career then branch off into what their workplace is about or areas that they want to go into; solar, PV, they want to go into wind turbine, they want to go into biogas, bioenergy and then go from there.

There's a real mix of between people wanting just the information or longer learning experiences...what we'd probably try and come up with is a suite that sort of suits everyone in terms of how and what they want to study

There's a fairly high percentage [of apprentices].. [who] are going, "look, now that I'm finished, have I got any other options?"

The *Enterprise Based Productivity Places Program* provides a supporting framework for developing career pathways to meet existing and future industry skills demands. This program is part of the Australian Government *Skilling for the Future* initiative, and aims to support workers wanting to gain or upgrade their skills⁵⁸.

Recommendation 26 – Articulate career pathways in the areas of key skills gaps

Ensure the Skilling for Change Implementation Plan facilitates collaboration between the different educational sectors on the North Coast to better articulate career pathways in the areas of key skills gaps. One resource that could be developed as part of this could be an Energy Skills Pathway document similar to the *Career in Aged Services Sector* pathway document.⁵⁹

14. Accreditation and quality assurance of training

Another theme that emerged from the interviews and literature review was the importance of having systems in place to quality-assure energy skills development.

Developing well-recognised licensing and accreditation standards for emerging energy-related technologies and processes is seen as essential. Although there may already be some nationally accredited qualifications in the areas of energy efficiency and renewable energies (such as the Clean Energy Council's accreditation requirements for solar installations), these are not a well-established brand or well recognised by the public. As noted by one interviewee:

..there needs to be specific training programs put in place that affirm the qualification that is recognised by industry (...) so there needs to be a marketable accreditation system so that when you're asking somebody to put renewable energy systems in your house or your business (...) you know [they] (...) have passed a quality test and are a member of certain organisations

Another interviewee had this to say on the subject:

(...) Some of the specialised stuff like the connection studies and the stability studies required for the electricity networks.. They're very, very specialised and the providers need to be recognised by the authorities, the electricity authorities or you just aren't going to be able to satisfy them that your plant's going to meet their requirements.

Besides avoiding the risk of bad installations due to workers' poor or lack of training,⁶⁰ this would provide an incentive for practitioners to undertake training, and as such increase demand for it. Research conducted for Skills Australia in 2011 found that:

It is important that regulatory needs are anticipated and appropriate standards are set in place. Several interviewees drew attention to regulatory issues associated with new technologies. There is a risk that some workers are installing energy efficiency technologies without adequate training. Interviewees have also indicated that there is a shortage of regulators to inspect the work.⁶¹

One possibility for increasing demand for training is making on-going continuing professional development (CPD) part of accreditation and licencing requirements. This ensures practitioner skills remain current. One interviewee specifically suggested renewable energy skills gaps for electricians or builders could be addressed by integrating specific training into the trade licencing requirements:

"... New South Wales has a CPD requirement for their building licences and most states have a similar thing... If you could get to the powers that be with at the licensors and say right, CPD, apart from getting 20 points a year you must get points in a particular range of subjects and you could mandate subjects."

Recommendation 27 - Advocate for more robust sustainable energy accreditation and licencing and for this to be linked to CPD requirements

It is recommended that *Sustain Northern Rivers* advocates for more robust sustainable energy accreditation and licencing requirements, this could include liaising with the Clean Energy Council, ABSA, relevant skills councils, Workcover and NSW Department of Fair Trading. Additionally, the accreditation and licencing process should be linked to compulsory sustainable CPD requirements. Finally, *Sustain Northern Rivers* should promote the existing accreditations, to ensure that sustainable energy systems in the North Coast are assessed and installed by accredited professionals .

15. Responsiveness to local industry needs

In the rapidly changing area of sustainable energy, training needs to be responsive to local industry needs. This can be a challenge given lead times in obtaining funding and setting up courses, reinforcing the need for a proactive skills 'roadmap' that includes a medium and long-term view of skills needs. It also points to the important role of continuing professional development (e.g. short courses or on-the-job training) to keep practitioners up to speed with latest developments. As one training sector interviewee reflected:

..the danger that can happen is that your training can be so slow that you often don't actually connect with the labour market at the right point in time

This can be a particular issue for foundation learning (e.g. University and TAFE qualifications) which generally require much greater development time:

Industry and community are trying to respond to the pressures to transition and engineering programs are not renewing themselves quickly enough

Continuous improvement of training packages needs to happen and the identification of some of the new technologies can be a little bit slow so I think there is still considerable work around trying to keep up with some of the technologies and developing skills and training units of competencies around that

A recent Clean Energy Jobs in Regional NSW report reinforced these general findings:

"There is a view from stakeholders that the national training system is unable to keep pace with developments in technology and therefore nationally accredited courses do not always match local industry requirements. Regional courses and initiatives are required but funding is hard to obtain and

the length of time to develop courses inhibits the timely reaction of the training industry to new developments. Stakeholders argued that greater collaboration between industry and training providers is needed.”⁶²

16. Flexible and applied learning

The format of training must suit the needs of industry, particularly in the case of training targeted at those already in the workforce. As one interviewee explained:

..because the industries are emerging and people are trying to work as hard as they can, there’s a real need for flexible learning options.. in a way that doesn’t impede their career or the people available to work in the industry.

The importance of providing training options that will suit the needs and preferred learning styles of different professions is paramount in maximising participation in learning. Another interviewee gave the following examples:

Different people and professions need the information in different ways. So, as you’ll know, there’s some more traditional people who like the one - face to face classroom learning, and there are others who need online modules. There are others yet who want to see the case studies, the business case.

If you talk to facility managers, for example, they tend to be very time poor and they have .. short blocks of time. So developing learning modules which last for 10 minutes each, which they can watch one at the beginning of each day for a week, is probably a very good way to go. Similarly, you’ll get local government staff who want to attend a half day course on site, which is an in-house course put on, tailored to them and their needs.”

Flexible learning options are also useful attracting time-poor small businesses, which account for a high proportion of employment on the North Coast:

So people are, in the North Coast anyway, 90 to 95 per cent are small businesses. So to find the time to go to a workshop is difficult, whereas the plus in some business where the actual work or the ability can be in a workplace and delivered in the context of that workplace is an issue that we’re dealing with.

16.1 On the job learning

These findings point to on-the-job learning as a significant opportunity. A study by GHD found that industry participants preferred on-the-job learning as the favoured professional development method. However good program design and assessment processes are important:

One of the potential issues with significant levels of learning on-the-job, especially where this learning is not part of a formal accredited program, is that of knowing and guaranteeing the quality of the skills learned. Without a well-designed on-the-job program, with appropriate assessment, it is difficult to determine the standard of the skills developed and they are likely to be highly variable. Again the effectiveness of this method of skills development related to energy efficiency assessments can, to some extent, be tested by independent evaluation during the verification process for the programs.⁶³

16.2 Case studies and demonstration sites

Case studies and demonstration centres were also seen as important enablers of skills development. As one interviewee said:

People learn most from the case studies - well, not the theory necessarily, but the case study. Where has it worked? Where has it been seen to work? Where has it not worked so well? Where are there examples, because that, in essence, takes the risk out of it. Somebody's done it. It's worked. They're getting these energy efficiencies. How can this be repeated?

A report by Ernst and Young recommended case studies and site visits as important for the renewable energy sector:

Promoting practical, applied learning for renewable energy trainers and educators. For example, by encouraging visits to wind farms and to understand the practicalities of their operation.⁶⁴

Case studies are also important in the context of skills related to energy supply and distribution:

I think a wonderful combination would be to ..engage the district network service provider .. to come along and help apply practically for the real life case study situations, what they learnt, what they didn't learn, where they think they could have outsourced things a little better or could have planned it better or could have looked in a more sort of comprehensive way at what the actual problem was.

As outlined previously, training for the energy industry needs to be 'hands on' and often relies on having the relevant technologies set up in training venues. One interviewee reflected:

There's no point in training tradespeople just theoretically. They really need that hands-on, so you need a lot of plant for them to muck around with. I'd rather have people happy to get their hands onto things and get dirty, and maybe take a little bit of a risk and try something than be afraid to touch it at all, or just not have the opportunity because there's only one and that's the only one we've got.

16.3 Online and distance learning

Online learning plays an important part in flexible learning and can help overcome issues of trainer shortage in regional areas, but is generally best combined with face-to-face training. A study by Ernst and Young recommended developing training mechanisms which are more responsive to demand, such as on-line, distance learning or accelerated courses.⁶⁵ One interviewee agreed that online learning is beneficial but felt it was best used in combination with more traditional forms of learning:

With e-learning in trades.. it definitely doesn't replace the practical hands-on stuff, but it supplements what can be done face to face and gives the learner more flexibility..

Integration of online learning into courses allows students to learn at their own pace and in their own time, reducing the amount of face-to-face time required. In many cases, this means that face-to face time can be more effectively used for discussion and reflection. This format may be particularly helpful for learners who are already in the workforce and experienced. As one report found, training for experienced tradespeople needs to be quicker and more 'user driven'.⁶⁶

Recommendation 28 – Consider the use of flexible learning options in training design

If new courses are being developed from the Skilling for Change Implementation Plan ensure that flexible learning options in training design is considered (this may be particularly important for CPD, where learners are already in the workforce).

17. Embedding sustainability

A common theme throughout the interviews and literature review was the need to embed sustainability (including sustainable energy) as core units of competency in training, rather than seeing it as an add-on:

"(...) we do have a lot of those skills available. A lot of them are seen as add-ons; so you learn about architecture or you learn about planning, then you do an add-on about green or about sustainable or about environment. So, firstly, we need to stop seeing them as add-ons.

As touched on in Section 6.1.10, a parallel was drawn between sustainability and occupational health and safety, which was previously seen as an add-on and is now core to industry training and processes. As one interviewee explained:

If you go back 10 years or so, to when I was working in the landscape industry, occupational health and safety was seen in very much the same way. You would tend to have one, maybe two, people who would be an OH&S manager and it was their job to follow up, to chase, to nag everyone to do the right thing, to fill in the, say, [point] method statements, to fill in the chemical form, to wear steel toed boots. It was one person's job. Nowadays, you can't set foot on a building site unless you've taken the course, sat the exam, you're carrying the card (...) We need sustainability.. energy efficiency to be seen in the same way. It's not just one person's job, one sustainability manager in the company and they'll chase and nag everyone else. It's everyone's job. So one of the skills gaps is that it needs to be embedded at every level of industry training - people need to understand how these buildings work and it needs to be, as I said, at every level.

A report by the NSW Council of Environmental Education explains how sustainability might be embedded:

A more effective method of 'teaching' the principles and skills of sustainability is to embed them into the fabric of all relevant units of competency. This is achieved by identifying potential or implicit sustainability skills in the training specification, and documenting these skills as part of the learning and assessment strategy. The IBSA TAE10 unit and part sustainability skill set, TAESUS501a Analyse and apply sustainability skills to learning programs, has been developed to assist VET practitioners to achieve this.⁶⁷

As this report implies, the issue is not so much about developing new skills, but applying existing skills in the context of new technologies and approaches. For many sectors of industry, the new 'skills' required are adjuncts or overlays to existing skill sets.

The Green Skills Agreement has the following four objectives:

1. develop national standards in skills for sustainability within the requirements of the national regulatory framework
2. upskill VET practitioners so they can provide effective training and facilitation in skills for sustainability
3. review and revise Training Packages to incorporate skills for sustainability
4. implement strategies to reskill vulnerable workers in the transition to a low-carbon economy.

These objectives are gradually being met, for example, in relation to objective 1 with Industry Skills Councils reviewing and making changes to a broad range of Training Packages to identify qualifications and units that require the addition of skills for sustainability.

Thus this is reflected in practice with courses offered by RTOs such as TAFE including sustainability in their courses, for example for builders and tradespeople (apprentices).

The up skilling or the broadening of the whole industry through their basic training: I really think that's the key. We need to teach young apprentices and the guys entering the industry - this is your trade but these are the sorts of things you need to think about as part of that

However strategies are needed to ensure those already working in the industry are exposed to the same skills development opportunities (e.g. via continuing professional development).

Recommendation 29 - Encourage Southern Cross University review how sustainability is embedded across degrees

If Southern Cross University has not recently reviewed how sustainability is covered in its degrees, it is recommended that Sustain Northern Rivers encourage them to do so. If sustainability is found to be lacking it is recommended that action be taken to encourage more sustainability competencies to be embedded within core modules. Additionally, it is important that sustainability is embedded into a wide range of courses in two ways. Firstly, in such a way that it appears mainstream and the normal thing to do and secondly in such a way that outlines the importance and underlying social and environmental reasons for a sustainable approach.

Recommendation 30 - Encourage North Coast TAFE and the Community Colleges in the area to review how sustainability is embedded across training content not covered under the Green Skills Agreement (GSA)

If North Coast VET organisations such as North Coast TAFE, Community Colleges, other RTOs, have not recently reviewed how sustainability is covered in their training not covered under the Green Skills Agreement, it is recommended that Sustain Northern Rivers encourage them to do so. Additionally, it is important that sustainability is embedded into a wide range of courses in two ways. Firstly, in such a way that it appears mainstream and the normal thing to do and secondly in such a way that outlines the importance and underlying social and environmental reasons for a sustainable approach.

Recommendation 31 – RTOs in the North Coast to liaise with relevant industry skills councils with respect to the progress of the GSA

It is recommended that RTOs on the North Coast liaise with the relevant skills councils to determine the progress of the Green Skills Agreement and through this communication encourage more sustainability competencies to be embedded within core training.

RECOMMENDATIONS

18. Skilling for change implementation plan

The series of recommendations identified earlier in this report have been synthesised into a *Skilling for Change Implementation Plan*. The *Skilling for Change Implementation Plan* is outlined in Table 5, and includes a brief assessment of the relative priority of the different recommendations. Whether a recommendation is a high, medium or low priority is based on ISF expert judgement with respect to five criteria:

1. The likely effort it would take to undertake the recommended action
2. To what extent the recommendation would address key identified energy skills gaps
3. The likely extent to which the recommendation would lead to the creation of new jobs
4. The likely contribution the recommendation would have in meeting the North Coast 20% Renewable Energy by 2020 target
5. The likelihood of the recommendation being successfully implemented, this is mainly due to the level of control Sustain Northern Rivers has over the delivery of the action.

It should be noted that a full multi-criteria assessment of all the recommendations has not been undertaken, as it was beyond the scope of this project. These scores are based on the knowledge and experience of the researchers, informed by the literature review and stakeholder interviews. *Sustain Northern Rivers* may find it beneficial to undertake a more comprehensive multi-criteria assessment to refine the prioritisation of these recommendations.

The *Skilling for Change Implementation Plan* provides contextual notes and also outlines (where known) the target audience and who is best placed to deliver the recommendation.

Table 5: Skilling for Change Implementation Plan

Recommendation	Priority	Who delivers?	Effort	Address Skills gap	Job creation	Energy Target	Likelihood of success	Notes
1. Bioenergy Strategy	Medium	SNR	Medium	High	Medium	Medium	Medium	
2. Adapt existing training programs for bioenergy and create new bioenergy training programs and placements	Medium	SCU, NCT, CCs & other regional RTOs	High	High	Medium	Medium	Medium	This should flow from Recommendation 1
3. Expanding the number of energy efficiency	High	SNR, NCT, CCs & other regional	Low	Medium	High	High	High	

Recommendation	Priority	Who delivers?	Effort	Address Skills gap	Job creation	Energy Target	Likelihood of success	Notes
and solar PV professionals in the North Coast		RTOs						
4. Support the embedding of solar and energy efficiency content into training for relevant professions	High	SCU, NCT, CCs & other regional RTOs	Medium	High	Medium	High	Medium	
5. Develop solar and energy efficiency CPD courses for relevant professions	High	SCU, NCT, CCs & other regional RTOs	High	High	Medium	High	High	
6. Address specific energy efficiency and solar PV skills gaps	Medium	NCT, CCs & other regional RTOs	Medium	Medium	Medium	Medium	High	
7. Retaining sustainable energy skills in the region	Medium	SNR, SCU, NCT, CCs & other regional RTOs	Low	Low	High	Low	Medium	
8. Create a Smart Meter, Smart Home, Smart Management Strategy	High	SNR	High	High	Medium	Medium	Medium	
9. Liaise with the NBN and other HSB providers	Medium	SNR	Low	-	-	-	-	
10. Introduce existing smart grid training packages and expand	Medium	NCT	High	High	Medium	Medium	High	This should flow from Recommendation 7
11. Creating a Smart Grid Training Centre	Medium	SNR, SCU, NCT, CCs & other regional RTOs	High	High	Medium	Medium	High	This will be required to properly deliver Recommendation 9
12. Provide training in	Low/Medium	NCT, CCs & other	Low	High	Low	Low	High	

Recommendation	Priority	Who delivers?	Effort	Address Skills gap	Job creation	Energy Target	Likelihood of success	Notes
small wind site assessment		regional RTOs						
13. Help develop and introduce Building Energy Mandatory Disclosure Training	Medium	SCU, NCT, CCs & other regional RTOs	Medium	Medium	Medium	Low/Medium	Medium	
14. Expand the number of comprehensive energy assessors in the North Coast	High	SNR, SCU, NCT, CCs & other regional RTOs	Medium	High	High	High	High	
15. Ensure at least one North Coast energy organisation has medium to large-scale renewable energy grid connection expertise	High	SNR + Energy Orgs	Low	High	Low	High	Medium	
16. Extend the range of engineering courses in the North Coast	Medium	SCU, NCT	High	High	Medium	Medium	High	
17. Ensure training options for planners include sustainable energy skills	Medium	SCU NCT, CCs & other regional RTOs	High	High	Medium	Medium	Medium	
18. Provide energy and carbon accounting courses for accountants, managers and business students	Medium	SCU, NCT, CCs & other regional RTOs	Medium	Medium	Low	Medium	High	
19. Provide business case courses to sustainability and energy professionals	Low/Medium	SCU, NCT, CCs & other regional RTOs	Low	Medium	Low	Medium	High	
20. Bring social innovation	Medium/High	SNR, BRCC, LCSA-	Medium	Medium	Medium/High	Medium	High	

Recommendation	Priority	Who delivers?	Effort	Address Skills gap	Job creation	Energy Target	Likelihood of success	Notes
and sustainability leadership programs to the North Coast		FNC						
21. Expand existing behaviour change and communications courses	Medium	SCU, NCT, CCs & other regional RTOs	Low	Medium	Medium	Medium	High	
22. Develop a Sustainable Energy community engagement strategy	High	SNR	Medium	Medium	Low	High	High	
23. Develop a training promotion strategy	High	SNR	Medium	High	Low	High	High	
24. Develop a strategy to address trainer shortages	Medium	SNR	High	Medium	Medium	Medium	Medium	
25. Continue with Sustain Northern Rivers' collaborative approach and Energy Action Plan	High	SNR	Low/Medium	Medium	High	High	High	
26. Articulate career pathways in the areas of key skills gaps	Medium	SNR	Low	Low	Low	Medium	High	
27. Advocate for more robust sustainable energy accreditation and licencing and for this to be linked to CPD requirements	Low	SNR	High	Low	Low	Medium	Low	
28. Consider the use of	Low	SCU, NCT,	Medium	Low	Low	Low	High	

Recommendation	Priority	Who delivers?	Effort	Address Skills gap	Job creation	Energy Target	Likelihood of success	Notes
flexible learning options in training design		CCs & other regional RTOs						
29. Encourage Southern Cross University review how sustainability is embedded across degrees	Medium	SNR	Low	Medium	Low	Low	High	
30. Encourage North Coast TAFE and the Community Colleges in the area to review how sustainability is embedded across training content not covered under the Green Skills Agreement (GSA)	Medium	SNR	Low	Medium	Low	Low	High	
31. RTOs in the North Coast to liaise with relevant industry skills councils with respect to the progress of the GSA	Medium	NCT, CCs & other regional RTOs	Low	Medium	Low	Low	Medium	

19. Training opportunities to address skills gaps on the North Coast

The various education sectors present in the North Coast could provide new training courses to address identified skills gaps. As highlighted above, it is vital for the different sectors to develop courses in a cooperative way to ensure effective use of resources, and create coherent and progressive learning pathways through the education and training system.

The following list provides an indication of some of the areas of education and skills development that could be undertaken by providers in the North Coast. The majority of the course areas have come directly from the recommendations earlier in the Report.

University

Electrical Engineering

General electrical and power engineering

Renewable energy system design and installation

Energy auditing for commercial/industrial premises

Energy efficient heating, ventilation and air conditioning (HVAC) systems

Information and Communication Technology Engineering

Energy efficient IT systems (servers, power control, etc.)

Smart electricity networks

IT networks and building power control

Mechanical Engineering

Design and installation of mechanical aspects of renewable energy and HVAC systems

Bioenergy Engineering

Including bioenergy system design and integration, and a relevant combination of ecology, agricultural science, electrical, environmental, mechanical, chemical and ICT engineering

Post Grad courses in energy and sustainable building related topics

Sustainable building design

Renewable energy systems

Smart grid technologies

Energy finance and carbon accounting in accountancy/business courses

Business case for energy efficiency and renewable energy for the commercial sector

Carbon accounting and reduction strategies

Strategic regional planning

Planning for renewable energy, including energy options and employment impacts

TAFE & VET sector – Training Packages and Qualifications

Energy assessment and auditing - all sectors

Certificate IV in NatHERS Assessment, which will replace the current short course qualification

Solar

Clean Energy Council Solar Install and grid connect accreditation package

Sustainable Energy (general)

Certificate IV in Renewable Energy

Renewable energy site assessment and system design (covering all renewable energy technologies)

Engineering

Diploma or Advanced Diploma in Engineering

Continuing Professional Development (CPD)

The CPD sector has an important role to play in providing energy training. It can be much more flexible and adaptable to changing circumstances than degree and certificate courses that have to go through long periods of development and approval. This can be a problem in the case of fast developing technologies, or where a large number of people need to be trained quickly in a new skill due to a government incentive program.

CPD courses can be developed quickly and delivered flexibly to meet a specific demand. They also have the potential to reach people who would not consider enrolling in TAFE or university courses.

Energy literacy for the community and trades

If it was one thing I think it would have to be an awareness thing rather than a technical skill...so sort of literacy, energy literacy

Sustainable Energy (general)

Understanding the energy regulatory context

Regional and strategic planning issues

Energy related business and financial skills

Creating a business case for energy efficiency and renewable energy

Business opportunities in sustainable energy

Carbon accounting

Energy assessment and auditing - all sectors

Energy auditing

Power factor correction

Motors and chillers, variable speed drives

Sustainable building design (could be CPD for builders, designers and planners)

Thermal performance of buildings including:

- General principles of passive design
- Building envelope materials

- Shading systems
- Glazing choice and installation
- Insulation choice and installation
- NatHERS ratings and tools

Energy efficiency (hot water systems, heating & cooling, lighting, etc.)

Energy efficient pools and spas

Renewable energy systems

Solar

Design and installation of commercial solar PV systems

Bio energy systems

Biomass handling

Sustainable biomass procurement

Wind energy systems – medium scale

Site assessment

System design and installation

Turbine maintenance

Smart grid technologies

Home area networks

Smart metering & displays

Sub metering

Installation and maintenance of smart appliances

Energy storage installation and maintenance

Electric vehicles

Battery technology and maintenance

Smart Grid connection

Data/computing related skills

Other

Leadership and innovation

These existing training and mentoring programs could potentially be run in the North Coast:

Centre for Sustainability Leadership program

School for Social Entrepreneurs program

Appendix A – List of Organisations Interviewed

Association of Building Sustainability Assessors

Bioenergy Australia

Byron Region Community College

Clean Energy Council

EE-Oz, NSW Utilities & Electrotechnology Industry Training Advisory Board

Essential Energy

Ficus Environmental

Green Buildings Council of Australia

NBN

North Coast TAFE

NSW Sugar

SI Clean Energy

Smart Grid Australia

Southern Cross University

Southern Cross University

State Training Services

Suntech Design

TAFE NSW - New England Institute

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