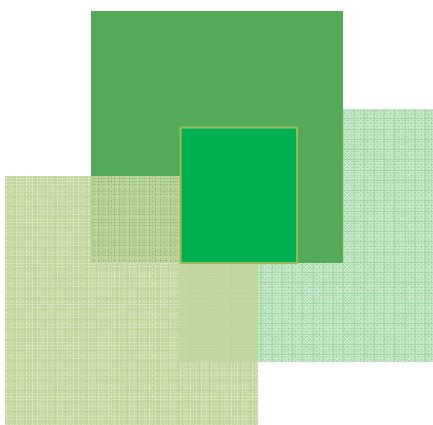




International  
Labour  
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Geneva



# **Skills for green jobs in Australia**

## **Unedited background country study**

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ILO Skills and  
Employability  
Department

2010

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## Foreword

The world finds itself in a slow recovery after the deepest recession since the Great Depression. The world is also coping with a host of environmental problems and the urgent need to reduce carbon emissions. A greener future also promises an enormous potential in a much needed employment growth. However, without suitable skills, this potential cannot be realized. Today, skills gaps are already recognized as a major bottleneck in a number of sectors, such as renewable energy, energy and resource efficiency, green building and retrofitting, environmental services and green manufacturing. Training response measures are successful where they are coherent across policy domains, systemic and systematic, and targeted at disadvantaged groups. These training measures can only be effective if based on timely identification of skills needs. Effectiveness of training measures is decisive not only for the economic recovery but also for a longer-term sustainability agenda.

This report was produced in the framework of the project, ‘Skills for green jobs’. The project was implemented in cooperation between the International Labour Organization (ILO) and the European Centre for the Development of Vocational Training (Cedefop). The project identifies skills needed for greener economies with respect to structural shifts, and new, emerging and changing occupational profiles. The ‘Skills for green jobs’ study is embedded in the Green Jobs Initiative, a joint initiative of the United Nations Environment Programme (UNEP), the ILO, the International Employers Organization (IOE) and the International Trade Union Confederation (ITUC), to assess, analyze and promote the creation of decent jobs as a consequence of the needed environmental policies. The global study was jointly funded by the Skills and Employability Department of the ILO and the Green Jobs Initiative.

The following countries have been included in the study: the ILO covered Australia, Bangladesh, Brazil, China, Costa Rica, Egypt, India, Indonesia, the Republic of Korea, Mali, the Philippines, South Africa, Thailand, Uganda and the United States. In addition, Cedefop covered six European Union (EU) member States: Denmark, Estonia, France, Germany, Spain and the United Kingdom. The ILO global synthesis report,<sup>1</sup> which analyzes the situation in all 21 countries involved in the study and the European synthesis report,<sup>2</sup> which covers the six EU countries, as well as all individual country reports, are available at: [http://www.ilo.org/skills/what/projects/lang--en/WCMS\\_115959/index.htm](http://www.ilo.org/skills/what/projects/lang--en/WCMS_115959/index.htm) (the ILO website) and <http://www.cedefop.europa.eu> (Cedefop website; look under *Skills Needs* theme). The unedited background country studies have been published in the electronic form in order to make them available quickly. The summaries are published as part of the synthesis reports.

The global project in the ILO was coordinated by the Skills and Employability Department and, in particular, benefited from comments and technical guidance by the team under the leadership of Olga Strietska-Ilina, Christine Hofmann, Mercedes Duran and Shinyoung Jeon. The ILO coordinating team would like to express great thanks to the authors of the report, Mike Rafferty and Serena Yu, for their background country research which contributed to the global study. Special thanks also go to the ILO regional and country field offices for the project support and the ILO colleagues who assisted research at national level.

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<sup>1</sup> Strietska-Ilina, O.; Hofmann, C.; Duran Haro, M.; Jeon, S. (forthcoming 2010). *Skills for green jobs: A global view. Synthesis report based on 21 countries* (Geneva, ILO Skills and Employability Department).

<sup>2</sup> Cedefop. (forthcoming 2010). *Skills for green jobs: European synthesis report* (Luxembourg, Publications Office of the European Union).



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The report’s principal purpose is to set the scene in terms of the key challenges and priorities for climate change mitigation and adaptation for the Australian economy. The report also focuses on the imminent skills development issues, and the current education and training responses. The Workplace Research Centre, at the University of Sydney, was commissioned by the ILO to coordinate the research, and to prepare the Australian contribution to the report.

The research team gratefully acknowledges the funding support provided by the following agencies:

- Australian Government, Department of Education, Employment and Workplace Relations
- NSW Department of Education and Training
- Victorian Department of Innovation, Industry and Regional Development
- Victorian Department of Sustainability and Environment
- Queensland Department of Education and Training
- Queensland Department of Employment, Economic Development and Innovation

The authors also wish to acknowledge advice and assistance from a number of colleagues, as well as personnel from the supporting agencies and case study participants. The report represents solely the views of the authors and the usual caveat applies concerning any remaining errors or omissions.

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## Abbreviations and acronyms

ABS	Australian Bureau of Statistics
ACTU	Australian Council of Trade Unions
AGO	Australian Greenhouse Office
ARRT	Advanced Resource Recovery Technologies
BMP	Best Management Practices
CAPHCC	California Plumbing, Heating, Cooling Contractors
CCS	carbon capture and storage
CED	Clean Energy Council
CFMEU	Construction, Forestry, Mining and Energy Union
COAG	Council of Australian Governments
CPSISC	Construction and Property Services Industry Skills Council
CPRS	Carbon Pollution Reduction Scheme
CRC	Cotton Catchment Communities
CRDC	Cotton Research and Development Corporation
CSIRO	Australian Commonwealth Scientific and Research Organisation
DEEDI	Department of Employment, Economic Development and Innovation
DET	Department of Education and Training
EE-Oz	Electrocomms and Energy Utilities Industry Skills Council
EITE	emission-intensive, trade-exposed
ESD	Ecologically Sustainable Development
GHG	greenhouse gas
GNP	Gross National Product
GTO	group training organization
GW	gigawatts
IBSA	Innovation and Business Skills Australia
ILO	International Labour Organization
IMS	Integrated Management System
IOE	International Employers Organization
IPART	Independent Pricing and Regulatory Tribunal
ISC	Industry Skills Council
IT	Information Technology
ITUC	International Trade Union Confederation
JAG	Justice and Attorney General

LNG	Liquefied natural gas
LULUCF	land-use, land-use change and forestry
MCVTE	Ministerial Council for Vocational and Technical Education
MPMSAA	Master Plumbers and Mechanical Services Association of Australia
MSA	Manufacturing Skills Australia
Mt	mega tons
NAICS	North American Industry Classification Standards
NRM	National Resource Management
NSW	New South Wales
NVSSAP	National VET Sector Sustainability Action Plan
PETU	Plumbing Trades Employees Union
QCIDS	Queensland Cleantech Industry Development Strategy
QEEILG	Queensland Energy Efficiency Industry Leaders Group
R&D	research and development
RPL	recognized prior learning
RRPGP	Renewable Remote Power Generation Program
RTOs	Registered Training Organisations
SESFS	Sustainable Energy Skills Formation Strategy
SMEs	small and medium enterprises
TAFE	Technical and Further Education
UNEP	United Nations Environment Programme
VARRI	Victorian Advanced Resource Recovery Initiative
VET	Vocational Education and Training
WMAA	Waste Management Association of Australia
WRC	Workplace Research Centre, School of Economics and Business, University of Sydney

## **1. Introduction**

This paper to the International Labour Organization (ILO) reports the Australian component of a multi-country research project being conducted under the aegis of the ILO into ‘Skills for Green Jobs’. The report’s principal purpose is to set the scene in terms of the key challenges and priorities for climate change mitigation and adaptation for the Australian economy. The report also focuses on the imminent skills development issues, and the current education and training responses. The Workplace Research Centre (WRC), at the University of Sydney, was commissioned by the ILO to co-ordinate the research, and to prepare the Australian contribution to the report. In developing a response to the ILO’s research project, the WRC is collaborating with a number of governmental and non-governmental bodies in Australia.

The ILO ‘Skills for Green Jobs’ project is part of a wider ‘Green Jobs Initiative’ jointly implemented by the ILO, the United Nations Environment Programme (UNEP), the International Employers Organization (IOE) and the International Trade Union Confederation (ITUC). The Green Jobs Initiative is intended to support efforts by governments, employers and trade unions to promote environmentally sustainable jobs and developments in a climate challenged world (ILO Skills for green jobs terms of reference 2009, 1).

The primary objective of the Skills for Green Jobs research project is to identify the major challenges and priorities for skills development related to climate change and the strategic development responses currently in place, as well as those being contemplated. Specifically, these challenges and priorities relate to:

- Mitigating displacement in industries and occupations;
- Supporting the emergence of new, green jobs; and
- The greening of established jobs.

The paper is structured as follows. Section 2 provides an economic and policy context for the current debate on climate change, and the skills strategy arising from the transition to a carbon constrained economy. Section 3 identifies the industries which are likely to see jobs become obsolete, be created, or be reshaped by the green skills agenda. Section 4 recaps the key conclusions, and Section 5 provides a set of policy and research recommendations to move forward with.

## **2. Policy context**

### **2.1 Climate Change Policy - The challenge ahead**

We note at the outset that any policy agenda for environmental sustainability, and the skills policy response required for a greener economy, must pay heed to the socio-economic context within which it is ultimately embedded. Amidst global recognition of the need to transition quickly to a carbon-constrained future, Australia’s unique combination of natural endowments, historical development of industry and trade, and social trends, point to imminent, and critical, policy questions. The scope of those questions extends beyond the basic issues of ecological sustainability, to economic and social sustainability. Furthermore, while we emphasize the importance of appropriate policy settings in the drive for more environmentally sustainable outcomes, we also highlight the need to ground these within industry-relevant needs, practices and initiatives.

Australia is the eighth largest player in the world's energy markets, accounting for 2.4 per cent of the world's energy production. Sixty-six per cent of Australian energy production is exported to the world's markets. Coal (54 per cent) and uranium (26 per cent) dominate Australian energy production, whereas currently only 2 per cent of energy production is attributable to renewable energies (Department of Resources, Energy and Tourism, 2009). Clearly, any transition to a more environmentally sustainable future will change that energy production mix, and our analysis of a greener Australian economy will necessarily assess the impact on, and management of, displaced industries and workers.

In terms of Australian patterns of energy consumption, black and brown coal (driving electricity generation) account for around 40 per cent of the fuel mix, with around 5 per cent derived from renewable energies (Department of Resources, Energy and Tourism, 2009). Primary energy consumption is dominated by the manufacturing, electricity generation, and transport industries. In 2007, these industries taken together accounted for over 75 per cent of total energy consumption (ABARE, 2008a). The commercial and residential sectors – namely, energy used in buildings - account for a disproportionately large share of end-use electricity consumption (and associated emissions), comprising over 50 per cent of total electricity usage in 2007, compared to less than 18 per cent of overall energy usage – see Table 1. Improvement in the energy efficiency performance of buildings, therefore, represents a significant opportunity for reducing Australia's carbon emissions outcome.

**Table 1. Commercial and residential energy consumption, 2006/07**

	Electricity (PJ)*	Coal (PJ)	Natural gas (PJ)	Petroleum (PJ)	Total (PJ)
Commercial and services	178.2	3.7	43.8	23.0	255.8
Residential	230.5	0.2	133.5	1.3	440.2
All sectors	804.8	214.3	823.0	1,738.2	3,894.8
Commercial+Residential %Total	50.8%	1.8%	21.5%	1.4%	17.9%

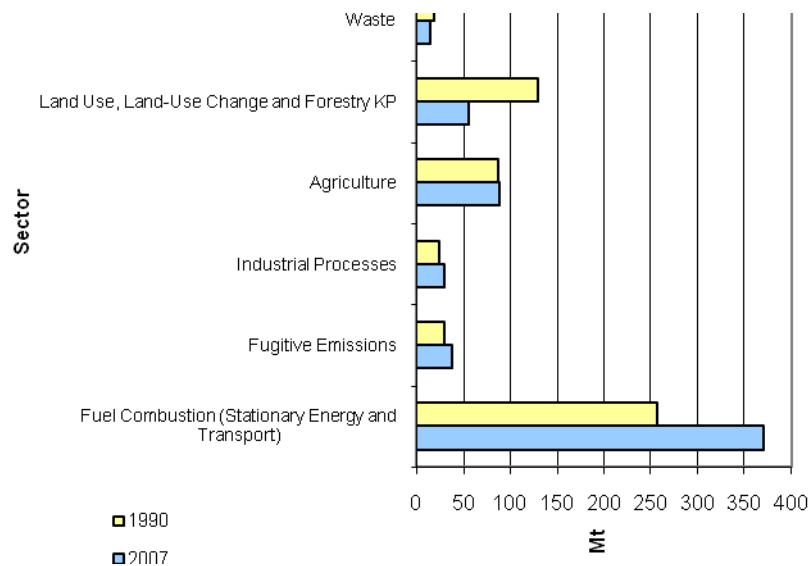
Source: ABARE (2008b)

\*Pico-Joule

The historical development of industry in the energy and emissions-intensive agricultural and resource markets, and a dominance of coal used for electricity generation, has underpinned Australia's disproportionately high level of **carbon emissions per capita**. According to UNEP, greenhouse emissions per capita in Australia have grown steadily from 16.5 mega tons (Mt) to over 19 Mt between 1990 and 2004, compared to a relatively stable average of 10 Mt across the OECD countries.

Aside from providing a standardized basis of comparison, the Kyoto Accounting system highlights the significant contribution of fugitive emissions and waste management processes, and the declining contribution of emissions from land-use, land-use change and forestry (LULUCF). Decomposing Australia's emissions profile according to the Kyoto Protocol Accounting system underlines the key contributors to national emissions. Snapshots of Australia's emissions profile between 1990 and 2007, according to the Kyoto Accounting system, are provided in Chart 1. Clearly, fuel combustion processes dominate the emissions outcome.

**Chart 1. Carbon emissions, Kyoto Accounting, 1990 vs 2007**



Source: Department of Climate Change (2009)  
Mt: mega tons

## 2.2 Climate Change Policy - The current response

### 2.2.1 Green shoots?

Australia's current environmental institutional and policy mix has developed through the evolution of its federal structure (with the State governments initially allocated responsibility for environmental matters, but with increasing Federal government influence due to both its fiscal dominance and later use of its external affairs powers to enable greater direct influence), as well as by the way it has confronted issues such as the preservation of its natural, rural and urban environments. Being a very dry and remote continent with a history of reliance on rural industries, yet having a highly urbanized pattern of population settlement, has presented a number of particular environmental challenges for Australia, including soil quality, introduced animals and plants, urban pollution, and the enduring issues of drought and water quality. The challenge of mitigating global climate change therefore has some parallels in several environmental issues that have, from time to time, faced parts or all of Australia (Crowley and Walker 1999; Papadakis 2004).

In Australia, however, the last decade or more has been characterized by a lack of a coherent and nationally coordinated environmental sustainability policy agenda. There has been a proliferation of responses to environmental sustainability at the federal and state levels of government, targeting emissions reduction, energy efficiency, and the promotion of renewable energy technologies. Many of these initiatives have been innovative, but poor integration and co-ordination of federal, state and private sector initiatives has resulted in overlapping programmes, fragmented objectives, and unclear signals for students, consumers, businesses and industries considering the climate change imperative.

The current environmental sustainability agenda is undergoing a period of transition, which might be thought of as 'green shoots' rather than a fully fledged policy transformation. Since the

election of the current Australian Government in 2007 and its ratification of the Kyoto Protocol<sup>3</sup>, a process of consolidation and streamlining of programmes has been underway, culminating in the introduction of legislation on the Carbon Pollution Reduction Scheme (CPRS) to the Australian Parliament in 2009. The legislation proposed a national cap and trade emissions trading scheme as the primary mechanism for delivering on Australia's commitment to reducing GHG emissions by 5 per cent from 2000 levels by 2020.

However, in April 2010 the Australian Government announced that, in light of the continued absence of Parliamentary support for the CPRS, it would not move to legislate the CPRS until after the end of the current commitment period of the Kyoto Protocol and only when there is greater clarity on the actions of major economies, including the Republic of China, India and the United States. This means that the Government will not move to legislate the CPRS before the end of 2012, and will only do so after this time if there is sufficient international action.

The Australian Government however, remains committed to tackling the challenge of climate change and in the short term will boost existing investments in clean and renewable energy and support greater energy efficiency measures in order to bring down greenhouse gas emissions. Examples of Commonwealth policy initiatives include:

- the Renewable Energy Target (RET) which commits Australia to deriving 20 per cent of its electricity from renewable energy sources by 2020, up from current levels of around 5 per cent. The RET is one step toward a more extensive set of policies supporting the renewable energy sectors, and should help drive growth in those markets. Legislation passed in June 2010 splits the Renewable Energy Target into two parts from 1 January 2011:
  - The Small-scale Renewable Energy Scheme will provide support to households installing technologies such as solar panels and solar hot water systems.
  - The Large-scale Renewable Energy Target will drive investment in renewable energy projects like wind farms, commercial solar and geothermal.
- a \$652.5 million Renewable Energy Future Fund for the development and deployment of large and small scale renewable energy projects, for example further investments in geothermal, solar and wave energy; and to enhance take-up of industrial, commercial and residential energy efficiency, helping Australian businesses and households reduce their energy consumption.
- a comprehensive 10-year National Strategy on Energy Efficiency to improve minimum standards for energy efficiency and accelerate the introduction of new technologies through improving regulatory processes and addressing the barriers to the uptake of new energy-efficient products and technologies.

### **2.2.2 Issues of data collection and classification**

Considerable policy and academic literature now exists about green jobs and green skills. Many definitions abound, and these differ in degree and scope of what a green job entails. In part the problem here is that the scope of green jobs has been evolving rapidly, and in part it reflects the fact that as the scope broadens, so to does the range of historical analogies with which to understand the possible role of green jobs. For example, we could think of analogies with the effects on working conditions (and skills) of public interest concerns that drove earlier regulation of child labour, working hours and occupational health and safety, or the impact of significant shifts in technology such as railways, telegraph or more recently Information Technology (IT). The ILO/UNEP current definition of green jobs is:

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<sup>3</sup> The information provided on Australian Government policy in this report is current to 16 July 2010. On this date, the Prime Minister requested that an election be held on 21 August 2010.



**Figure 2. Australian taxonomy of green jobs – An example**

Job Description	Sust / Env	Occupation Code	Skills Level	Industry Code	Code
Electrical engineer with a university degree working for a power utility on policy issues	S	3	1	D	S31D
Construction worker helping build a government-funded solar power facility for a remote community	E	8	5	E	E85E
Director of an environmental consultancy advising organisations on lowering their carbon footprint	ES	1	1	M	ES11M
Sustainability manager helping senior management in a credit union devise their environmental strategy	S	2	2	K	S22K
Sustainability manager helping to transform the culture of the organisation to become more sustainable	S	2	2	Depends on industry	S22x
Lawyer specialising in sustainability and/or environmental issues.	S	2	1	M	S21M
Journalist writing about environmental issues for a major newspaper (or an Internet newsletter)	ES	2	1	J	ES21J
Manufacturer's or retailer's technician installing solar panels or insulation in people's homes	E	3	4	M	E34M
Market researcher analysing green issues for corporate clients	S	2	1	M	S21M
Transport company OH&S officer confirming compliance with environmental standards	S	3	2	I	S32I
Dairy farmer struggling with reduced water allocations and climate change	E	1	3	A	E13A
High school teacher teaching students about green issues	ES	2	1	P	S21P

Source: Ehmcke et al. (2009)

An electrical engineer with a university degree working for a power utility on green policy issues, for example, would be classified as “S31D” (predominantly sustainable = S [whereas jobs classified as predominantly environmental = E and jobs classified as both environmental and sustainable = ES], ANZSCO Occupation = 3, ANZSCO Skill Level = 1, ANZSIC Electricity Industry = D).

While no standard of classification nor regular data collection has yet been embraced, the Australian Bureau of Statistics have expressed interest in both designing a methodology and delivering a dataset which will profile the Australia-wide green workforce once a clear green workforce classification is determined and resources identified.

### 2.2.3 Green skill responses to the economic crisis

While the global financial crisis certainly took attention away from the climate change agenda, a significant feature of the government's response to the current economic crisis has been efforts to target environmental abatement, including green jobs and skills. On 30 July 2009, the Australian Government committed to the development of a Green Skills Agreement<sup>5</sup> with the state and territory governments to build the capacity of the Australian vocational education and training (VET) sector to deliver sustainable skills, competencies and knowledge. The Agreement was endorsed at the 7 December 2009 COAG meeting in Brisbane. The four objectives of the Agreement are:

1. Develop national standards in skills for sustainability within the requirements of the national regulatory framework;

<sup>5</sup> The Green Skills Agreement can be found at <http://www.deewr.gov.au/Skills/ClimateChangeSustainability/Pages/GreenSkillsAgreement.aspx>



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; and
4. Implement strategies to reskill vulnerable workers in the transition to a low carbon economy.

The Australian Government allocated \$5.3 million across four financial years in the 2010-11 Budget to implement the Agreement and the Green Skills Agreement Implementation Plan was noted by the Ministerial Council on Tertiary, Education and Employment at its June 2010 meeting. Work is already underway to achieve the four objectives of the Agreement:

- Australia's 11 Industry Skills Councils have identified gaps in sustainability knowledge and skills in national Training Packages and commenced revising them. The revision of Training Packages will be substantially completed by December 2010.
- The Innovation and Business Skills Australia Industry Skills Council has developed a training unit to assist the Australian VET sector and the VET workforce deliver and assess training for sustainability. The new unit has been added to the elective pool for the Diploma of Training and Assessment, and will form part of a Skill Set in the new Training and Assessment Training Package designed to underpin professional development programmes for VET practitioners. DEEWR is also conducting a broader review of skills for sustainability professional development initiatives being delivered in jurisdictions across Australia.
- The National Quality Council's review of the Australian Quality Training Framework (AQTF) specifically considered how the objectives of the Green Skills Agreement could be addressed and whether any additional changes should be made to the AQTF Essential Conditions and Standards to support implementation of the Agreement. Stakeholders unanimously agreed it was not necessary to specifically address skills for sustainability in the standards, as these skills will be incorporated within all relevant Training Packages.

On 30 July 2009, the Australian Government also announced the National Green Jobs Corps initiative<sup>6</sup>, which will provide 10,000 unemployed 17 to 24 year olds with access to a 26-week environmental work experience and training programme, designed to provide job-ready skills.

## **2.3 Climate Change Policy - Skills development strategy**

### **2.3.1 A work in progress**

The policy context for skills and green workforce development has, until recently, lacked coherence and been characterized by fragmented state and national initiatives. As a result, both the demand for, and supply of, green skills in the Australian economy has been inadequately analyzed and coordinated. For example, government initiatives which pay rebates on solar panel installations in order to stimulate consumer demand have not been coordinated with investment in the development of new technologies. Uncertainty around feed-in tariffs particularly for commercial scale solar systems, and a lack of education programmes to assist the supply of skills are also limiting capacity to meet solar installation demand. Some of the issues with growing this supply of green skills, which are explored more extensively in Section 3, include the lack of availability of relevant training courses, the lack of teaching resources to disseminate green skills knowledge, and lack of policy coordination which would support uptake of green skills training and greater certainty around the demand for green skills and technologies. However, even in the absence of strong top down leadership there are many interesting initiatives being taken within Australia, initiatives that might be understood as bottom-up in nature. In democratic countries like Australia, social and economic change is always a complex mix of top-down and bottom-up

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<sup>6</sup> For more information please see <http://www.deewr.gov.au/Employment/JobsandTraining/Pages/newgreenjobs.aspx>

initiative, so finding bottom-up initiatives is not surprising. The case studies explored in Section 3 also show considerable innovation and leadership has been occurring in these areas.

These issues of skills and climate change underpin what can now be seen as a transition in both state and national skills policies.

At a national level, the Green Skills Agreement will ensure that training in, and the delivery of, skills for sustainability are an integral part of the VET system and are relevant to the needs of industry. Under the Agreement, the Australian and state and territory governments are working collaboratively with employer and employee representatives, the VET and higher education sectors and community organizations to ensure that Australia's VET system delivers the skills for sustainability that will enable individuals and businesses to contribute to a sustainable, low carbon economy in their workplaces and communities, and the provision of sustainable jobs, services, products and advice.

Also, the National VET Sector Sustainability Action Plan (NVSSAP) 2009-2012 was endorsed by the Ministerial Council for Vocational and Technical Education (MCVTE) on 12 June 2009.<sup>7</sup> The Plan seeks to coordinate and support green workforce development initiatives in place at the state and industry levels. Additionally, the Plan aims to build capacity in the VET sector to facilitate ongoing innovation and technology diffusion. The measures flagged by the Action Plan range from embedding sustainability topics across all training products and building the capacity of trainers and assessors, to developing standards of certification for Registered Training Organizations (RTOs) and articulation paths between education and training sectors. Importantly, the Action Plan emphasizes a collaborative effort between the education sectors, industry and employer associations, Industry Skill Councils and governmental agencies in delivering on the vision.

Significant initiatives are also underway in the state of New South Wales, where the 'Green Skills NSW Strategy' (NSW Department of Education and Training, 2008) has prioritized green workforce development and business opportunities, amongst numerous other sustainability programmes. We elaborate on this in Section 3.2.4. Key also among NSW environmental programmes is the \$340 million Climate Change Fund, which includes \$20m earmarked for energy efficiency training for trades and professionals to ensure the NSW workforce has the skills required to implement environmental measures. The Fund also encompasses broader initiatives such as the NSW Energy Efficiency Strategy and Renewable Energy Development Fund.

In the state of Queensland, numerous initiatives have emerged which will ultimately support a broader, more holistic policy framework. Focus Box I below outlines the policy framework emerging in Queensland, which aims to promote successful coordination of the demand and supply of green skills in Queensland. Amongst recent initiatives are the development of a Queensland Cleantech Industry Development Strategy (QCIDS), which aims to support the increasing demand for clean, green technologies, products and services, and will be launched in 2010; and the Carbon Outlook Project. The Carbon Outlook project is the first of its kind in Australia, and aims to provide cutting-edge industry analysis of the impacts of the Carbon Pollution Reduction Scheme on small and medium enterprises (SMEs). During the project, fifty SMEs across seven key industries throughout Queensland regions have been trained in the preparation for carbon costs. A key finding of Carbon Outlook has been the significant shortage in some of the generic skills required to take better account of the environmental impacts of business activity, such as those relating to carbon reporting and advice on mitigating the potential flow-on effects of a carbon price on a firm's supply chain.

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<sup>7</sup> Details on the NVSSAP can be found at:  
<http://www.deewr.gov.au/Skills/Programs/WorkDevelop/ClimateChangeSustainability/Pages/NationalVETSectorSustainabilityActionPlan.aspx>

## **Focus Box I. Emerging Green Skills Policy in Queensland**

### **Context**

Queensland is the state the most at risk in terms of mitigation and adaptation to climate change. It is Australia's most carbon intensive state both in per capita and absolute terms. This is due largely to its mineral deposits and processing plants being central to its economic base. It also has Australia's most decentralized population with regional employment relying heavily on the agricultural, mining and tourism sectors. Employment sustainability and growth is therefore highly sensitive to the volatility of demand for commodities and subsequent commodity prices as well the relative price of the Australian dollar. These economic underpinnings provide strong drivers for interagency policy coordination and collaboration to ensure the Queensland economy and employment opportunities continue to grow in the current carbon constrained environment.

In March 2009, the Queensland Government implemented major machinery of government changes by reducing the number of stand-alone government departments from 23 into 13. The changes created clusters of agencies under the key government priorities of employment, social development, environment and law and justice. This new framework aims to foster cross agency collaboration in projects and bring together networks of relevant stakeholders to address critical issues holistically, as opposed to traditional fragmented policy approaches. It also presents opportunities for issues such as 'skills for a carbon constrained economy' to be embedded across industry and regional development, employment, and work policies.

### **Existing framework**

Queensland has been exploring innovative skills policy since 2002, recognizing that traditional processes of supplying skills to the economy were flawed and had resulted in considerable wastage of public resources. An early dual skills policy regime was introduced whereby skill formation arrangements for industry and individuals were separated into two models, namely an Industry Development Skills model and an Education Services Skills model. This dual system was formalized in the Queensland Skills Plan of 2006 which introduced several new forms of industry engagement to enable greater industry and community ownership of skills formation.

An example of this is the Sustainable Energy Skills Formation Strategy (SESFS). The SESFS commenced in 2008, designed to encourage more collaboration between industry, government and the education sector in implementing workforce strategies in the sustainable energy industry, specifically, the energy efficient built environment. Numerous regulatory changes and government initiatives targeting energy efficiency improvements have underpinned the need to develop the industry workforce to meet these imminent demands, with an imperative to head off labour and skill shortages. The SESFS aims to do this by articulating overall industry skill needs, integrated education and training pathways, accreditation schemes and standards, licensing and safety issues. The strategy is comprehensive, taking into account job design and career paths, utilization and retention of staff and new training approaches, and is directed by the Queensland Energy Efficiency Industry Leaders Group (QEEILG), a group of key industry, union and government stakeholders.

The Queensland Skills Plan of 2006 also introduced 'Skill Ecosystems' as a concept for industry engagement, seeking to foster demand side (meaning workplace) changes in skills attraction, development, effective utilization and retention of skilled workers, and promoting (with varying degrees of success) the alignment of skills to business and community needs. This model was extended in the Primary Industries sector where the focus was placed on multiple industry needs as opposed to single government programmes that deal with one-off issues. As part of the broader Skills Plan, the Industry Development Skills Policy model has been designed to support high risk industries, regions and communities which need to ensure sustainable access to green skills, and which are vulnerable to carbon pricing. It aims to create a skilled and adaptable labour force, promote demand-side utilization of skills and job design, provide opportunities for the progression of low skilled workers, and to develop 'high skill equilibriums' in regions over time.

### **Moving forward**

In 2009, this Industry Development Model is being further explored in a pilot process between three of the recently created mega departments, namely Justice and Attorney General (JAG), Department of Employment, Economic Development and Innovation (DEEDI) and the Department of Education and Training (DET). The combined industry development programmes of each agency cover sustainable business development programmes; safe, fair and meaningful work developed through partnership based on a mutual gains philosophy; and skills. At the same time, the training system is incorporating green skills, knowledge and technical competencies in its training programmes and, combined with the other industry development strategies that foster a green culture, the intent is to ensure a consistent industry development greening process across government. Supporting this holistic policy framework are numerous initiatives, including those recently announced such as the Queensland CleanTech Industry Development Strategy, the Carbon Outlook Project. These are more fully described above in Section 2.3.1.

One learning outcome that is emerging from the process of dealing with green skills, or the greening of traditional skills, through linking skills to business or regional development processes, is that government agencies themselves need to acknowledge that networked governance as occurs in service integration, requires a new set of skills within government as well as other stakeholders. Monitoring process and relationships is as equally important in networks as monitoring numerical and efficiency outcomes. Accordingly, the integration of policy agendas that is beginning to occur in Queensland is requiring significant development of stakeholder capability to operate in networks. The relevance for green skills and green jobs is that they are increasingly developed within an industry or regional development process and not solely through an Education Services Skills Model which is based on supplying pools of skills; consequently, they are tailored to specific needs and developed and owned by industry and/or regions.

Skills policy at a national level is assisted by Skills Australia, an independent statutory body which advises the Government on current, emerging and future workforce skills and development needs. Its objectives include increasing workforce participation, identifying training priorities,

addressing skills shortages, improving productivity and competitiveness, and promoting a highly skilled workforce. In order to meet these objectives, Skills Australia's activities include internal analysis, commissioning research and engaging with industry stakeholders, distributing information to facilitate business training and employment decisions, and providing advice to the Government to inform skills formation policy and drive changes to the education and training system.

The 11 Industry Skills Councils (ISCs) also play a key role in the development of skills policy in Australia. The ISCs support the development, implementation and continuous improvement of training and workforce development products and services including Training Packages and provide advice to Skills Australia, industry and government on the workforce development and skills needs of their respective industries. The ISCs are independent, not-for-profit companies whose funding is substantially provided by the Australian Government. The ISCs include:

- Agri-Food Industry Skills Council
- Community Services and Health Services Industry Skills Council
- Construction and Property Services Industry Skills Council
- Electro Communications and Energy Utilities Industry Skills Council (trading as EE-Oz Training Standards)
- Government Skills Australia
- Forest Works
- Innovation and Business Skills Australia
- Manufacturing Skills Australia (MSA)
- Resources and Infrastructure Industry Skills Council (trading as Skills DMC)
- Service Skills Australia
- Transport and Logistics Industry Skills Council

ISCs work with educators, industry groups and other stakeholders to meet the changing industry landscape with an adequately skilled workforce via the national VET system. From a skills response point of view, this has critically involved developing and reviewing Training Packages as broad as water management training (Government Skills ISC), sustainable farming practices (Agrifood ISC), and waste management skills (Construction and Property Services ISC), amongst many others. Collectively, the ISCs have examined the current impacts of environmental sustainability on their industry sectors (ISCs, 2009) and implemented a range of initiatives to address current and emerging priorities. Each ISC is however a product of the collaborative arrangements within each industry sector, and while some ISCs have been able to pioneer a range of innovative approaches to green skills, others have been much less impressive.

The ISCs will have a significant role in the implementation of the Green Skills Agreement – all skills for sustainability gaps in Training Packages will be identified by ISCs by the end of March 2010, and the revision of the suite of Training Packages will be substantially completed by December 2010.

ISCs have identified three guiding principles which underpin all VET activity in skills for sustainability:

1. **Industry specific** - Environmental sustainability must be approached in a manner that is specific to the needs of the job and the industry within which the employee works.

2. **Appropriately timed** - Environmental sustainability skill needs will emerge in an incremental way and at different rates from industry to industry. Those sectors affected by compliance requirements will be primary instigators for new developments in technology and work practices.
3. **Value adding** - Workforce skill requirements to support environmental sustainability objectives must be carefully assessed to determine the need for new skills and the appropriateness of existing skills. It is important that skill development adds to workforce capacity in a meaningful way and does not add unnecessarily to the burden faced by enterprises in meeting the new focus of environmental sustainability.

Environmental sustainability is clearly an evolving field of expertise, with serious capacity considerations in many areas requiring significant investment in research and teaching resources. The experience of international counterparts and other best practice models will be important to the growth of Australian green industries.

### 3. Anticipation and provision of skills

Prevailing trends in the Australian economy, and the global imperative to move towards a carbon-constrained future, provide the backdrop for imminent changes to national skill needs and required policy responses. The decline of energy and emission intensive industries such as agriculture and manufacturing, and the commensurate rise of less energy-intensive services industries will require a delicate but well coordinated skills policy response (with implications far beyond environmental sustainability). Opportunities for energy efficiency improvements in the energy-hungry commercial/residential sectors, and for growth in the renewable energies sectors, will be depend heavily, at least initially, on consistent policy support and innovation in order to translate into production and employment growth.

#### 3.1.1 Green structural change and the labour market

A number of key reports have attempted to forecast the impact on aggregate employment (and therefore demand for green skills) of transitioning to a carbon constrained future, including the Treasury's report, 'Australia's low pollution future – The economics of climate change mitigation' (2008), and the Australian Commonwealth Scientific and Research Organisation's (CSIRO) "Growing the Green Collar Economy" (Hatfield-Dodds et al., 2008).

The Department of Treasury's report describes Australia's economic trajectory to 2050 under four emissions and emissions-pricing scenarios, with medium term emissions targets ranging from 5 per cent to the 25 per cent below 2000 levels by 2020. That report examines the repercussions on gross output, employment, wages, prices, as well as sectoral drivers.

The Treasury modelling recognizes that countries that defer action on climate change face longer term economic costs, because global investment (and therefore jobs growth) will be directed to less emissions-intensive countries and industries. In light of Australia's relatively high mitigation costs (given our exposure to energy and emissions intensive industries), the report argues for a globally coordinated response in order to minimize distortions related to trade-exposed industries, accelerate cost reductions on low-emissions technologies, and prevent further entrenchment of emissions-intensive industry and infrastructure.

The main findings of the modelling highlight slightly lower short-run growth in gross output, with Gross National Product (GNP) per capita growth averaging 1.1 per cent between 2010 and 2050 in the policy scenarios when compared to a rate of 1.2 per cent in the reference, zero impact scenario. The difference is driven primarily by the increasing cost of (emissions-intensive) capital relative to labour, and a shift towards labour intensive, low emissions sectors

such as services. The slowing in output, and an assumed stickiness in wages, results in some temporary unemployment. However, slower real wage growth returns employment to reference scenario levels over the medium term. Falls in employment tend to reflect falls in production in emissions-intensive sectors, including coal and gas mining, and aluminium. The Government has committed resources to facilitating the retraining of workers and regional planning, as we elaborate in the case studies in Section 3.1.4.

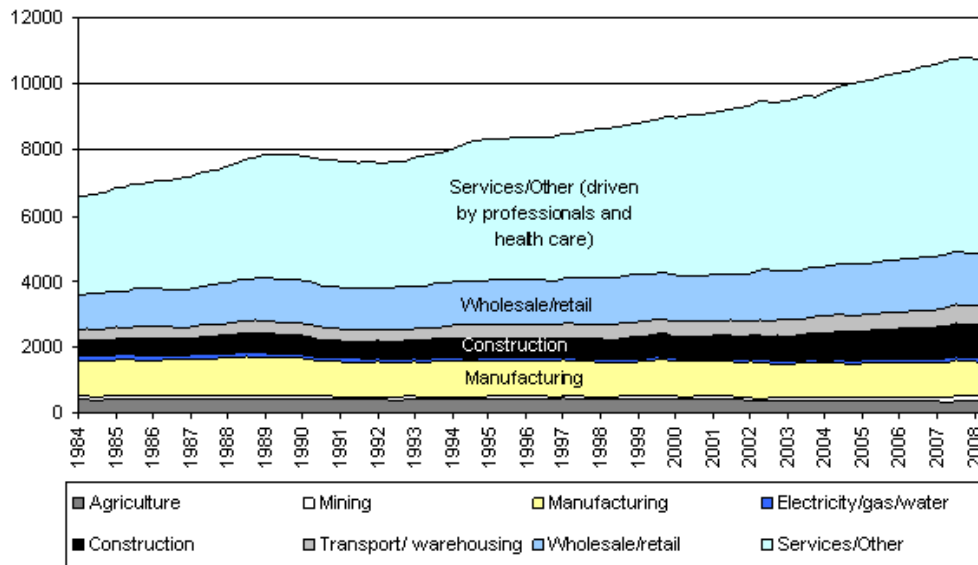
The findings of the CSIRO report parallel a number of the Treasury report's results, despite focusing on different emissions-reduction and resource usage outcomes. The focus of the CSIRO paper, however, is squarely on the impact on employment. The key finding is that a transition to a sustainable economy has little impact on employment, with 230,000 to 340,000 new jobs (above usual turnover) in, for example, the transport and construction industries. Sectoral employment shares are likely to remain stable, based on assumptions of aggregate jobs growth of between 2.5 million and 3.3 million between 2005 and 2025.

The emphatic theme of these two climate change modelling reports is that the effects of a business-as-usual scenario of unabated climate change would be both ecologically and economically disastrous. Mitigation strategies need to be aggressive in order to reach CO<sub>2</sub> emissions stabilization levels commensurate with a more sustainable global economy. While estimates vary depending on underlying model assumptions, mitigation costs are small relative to the forecast costs of unabated climate change, with a relatively small cumulative fall in GDP growth over the period from 2010 to 2030 (around 2 per cent) and neutral to positive outcomes for employment in Australia.

Existing structural shifts in employment within the Australian economy, namely the decline in the manufacturing and agricultural sectors, are likely to be exacerbated by the transition to a carbon-constrained future. Most notably, while employment in services industries, driven by professionals and health care workers, has expanded from around 45 per cent to 55 per cent of total employment since 1984 (ABS, 2009a), manufacturing employment's share has declined from 17 per cent to less than 10 per cent over that 25 year period, while agriculture has halved to 3 per cent over the same period. These trends are highlighted in Chart 2.

Given the pressure of global demand shifting to low-emissions goods and services, the adverse effects this will have on employment in emissions-intensive industries such as manufacturing, agriculture and energy production are clear, and have been modelled in the reports mentioned above.

**Chart 2. Employment by industry, 1984-2008**



Source: ABS2009a, Detailed Labour Force Survey, Cat. No. 6291.0

### 3.1.2 Identification of training needs

Following from the macro-economic modelling by such organizations as Treasury and the CSIRO, there have also been an increasing number of attempts to identify the skill needs of climate change abatement at industry and State level.

At a sectoral level, the ISCs are instrumental in identifying changes in skills needs. The ISCs foster close relationships between business enterprises, industry organizations and the education and training system, and amongst other research and workshop activities, typically conduct annual ‘environmental scans’ which document industry wide trends and concerns regarding the skill requirements of the workforce. For example, Manufacturing Skills Australia (MSA, 2008) has identified that the introduction of a carbon pricing mechanism will have a strong impact on the manufacturing industry, which is the third highest carbon emitter in Australia. The introduction of a carbon pricing scheme would impose compliance costs in terms of measuring and reporting firms’ carbon emissions on the highest emitting industries, and put substantial pressure on businesses to develop more environmentally sustainable products and technologies. In response to these imperatives, MSA recognizes the need to develop generic and specialized skills in relation to more sustainable manufacturing practices, to be delivered through the existing vocational education and training system. Through a rigorous process of industry research leveraging relationships with manufacturing enterprises, industry organizations and educators, MSA has developed units of competency relating to sustainable manufacturing which embody skills to be accredited and combined within the national qualifications framework. This framework is elaborated upon in Section 3.1.3, MSA (2009) cites numerous case studies from the manufacturing sector where sustainability projects have produced strong cost savings, as well as delivering better environmental outcomes. These case studies assist in identifying areas of demand for training and skill development that businesses will need in order to meet growing sustainability imperatives.

The mining industry will also be strongly impacted by climate change policy, and has been the subject of numerous government initiatives aimed at developing technologies to reduce the environmental impact of coal use, including the \$500 million National Clean Coal Fund and the Coal21 Program (now NewGenCoal). The ISC for the resources and infrastructure sectors, Skills DMC, is responding incrementally to these changes and focus on environmental sustainability within the vocational education and training system remains on safe environmental conditions and site management of waste, water and other resources. However, Skills DMC has developed two software tools for firms in the resources and infrastructure sectors aimed at estimating labour and skills needs. The Future Workforce Manager models an enterprise's labour needs, customized for the expected number of work sites and labour force attrition. The Skills Maximiser integrates the framework of national competencies and qualifications with a business's profile and training needs to promote skills development. The programme attempts to match the skills needed for work performance to those present in the workforce, and the enterprise-level training needs for addressing skills gaps, in terms of the competencies deliverable through the national training system. While such tools simplify the complex nature of skills needs, and there is little information regarding their uptake, they would be useful in highlighting the most relevant training resources available for individual firms.

### **3.1.3 Skills response**

The skills response to the emission abatement challenge has proceeded along several paths. Broadly, we can identify that at the government level, state and territory governments have moved in different ways and via different paths toward a serious engagement with the skills challenges especially via education and training initiatives, but importantly also via attempts to integrate abatement policy into a wide range of government policy areas.

At the enterprise level, the case studies show how important on-the-job training has been to increasing the supply of, and meeting the demand for, green skills. As capacity and expertise within training organizations and education institutions develops, enterprises have focused on internal training, in forms varying from mentoring to structured information sessions, to keep abreast of the changing business environment. As policy makers grow increasingly aware of the benefits of facilitating business understanding of and engagement with the environmental agenda, we expect that the dissemination of best practice, the accessibility to, and relevance of, training resources will improve markedly. For example, the NSW Green Skills Strategy has established a Business Guide and Course Finder to help businesses identify strategies and resources to develop a greener workforce.

At the industry level, and especially via some of the leading tripartite industry institutional forms, such as the ISCs, we can observe some very innovative approaches to skills formation with a general move to not just recognizing green skills as an important add-on to existing skills training, but to integrating green skills into all areas of training. For example, MSA has developed a 'Competitive Manufacturing' qualification, nationally recognized within the vocational education and training system, which builds units of competency into Training Packages, which then contribute to different levels of qualification from Certificate I to Advanced Diploma. This initiative has been in response to expected increased compliance costs, energy costs, and other costs of production, and the changing skills required to promote more sustainable manufacturing practices. Indeed, 60 per cent of 392 surveyed businesses employing 205,000 people intended to boost the capacity of its personnel in managing the impact of an emissions trading scheme (Australian Industry Group and KPMG, 2009).<sup>8</sup> MSA's work in developing a timely skills response has included individual competency units such as

- MCMT272A Participate in environmentally sustainable work practices

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<sup>8</sup> Over half the respondents were manufacturing firms.



- MCMT472A Implement and monitor environmentally sustainable work practices
- MCMT672A Develop workplace policy and procedures for sustainability

These units are combined within broader manufacturing technology Training Packages, which form the building blocks for more advanced qualifications such as the Competitive Manufacturing Graduate Certificate,<sup>9</sup> which has been developed with a focus on the whole value chain present in the manufacturing process.

Similarly, the ISC relating to the rural and food processing industries, AgriFood Australia, has played a large role in facilitating numerous government initiatives to promote more sustainable farm and land management practices. The agricultural industries are large consumers of water, and emit 17 per cent of Australia's carbon emissions, and will face increasing pressures from both climate change and policies implemented to mitigate climate change.<sup>10</sup> Through its networks of industry, educational and community contacts, AgriFood Australia is able to assess demand and capacity with respect to green skills, and articulate their development through the review of units of competency, Training Packages, and corresponding qualifications. For example, AgriFood Australia is responsible for review ten Training Packages, including

- AGF07 AgriFood Training Package
- FDF03 Food Processing Industry Training Package
- MTM07 Australian Meat Industry Training Package
- RGR08 Racing Training Package
- RTD02 Conservation and Land Management Training Package
- RTE03 Rural Production Training Package
- RTF03 Amenity Horticulture Training Package
- RUV04 Animal Care and Management Training Package
- SFI04 Seafood Industry Training Package
- SUG02 Sugar Milling Training Package

Within these Training Packages, a large suite of units of competency address the need for sustainability skills. These include:

- RTE5524A Develop and implement sustainable land use
- RTE4603A Implement an irrigation related environmental protection programme
- RTD2202A Conduct erosion and sedimentation control activities
- RTD4504A Monitor biodiversity
- RTD5003A Manage natural area restoration programmes
- RTC5504A Develop a management plan for a designated area

AgriFood's sustainability initiatives now include mapping units of competency to the skills needed to deliver on government initiatives such as the National Resource Management (NRM),

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<sup>9</sup> For details, see <http://www.mskills.com.au/DownloadManager/Downloads/MSA71109%20Vocational%20Graduate%20Certificate%20in%20Competitive%20Manufacturing.pdf>

<sup>10</sup> For details, see [http://www.aph.gov.au/senate/Committee/eet\\_ctte/employ\\_climate/submissions/sub49\\_agrifood.pdf](http://www.aph.gov.au/senate/Committee/eet_ctte/employ_climate/submissions/sub49_agrifood.pdf)

Ecologically Sustainable Development (ESD), and Farm Ready programs. These will be reflected within the Training Packages mentioned above, and become recognized in the national qualifications framework.

### 3.1.4 Case studies – Retraining needs

#### Case Study A. Coal Miner, Australian Coal Mining Industry

Australia is the world's largest exporter of coal, shipping about 260 Mt of coal each year, or about 30 per cent of the world's total coal export trade. In the 2008 calendar year, this trade generated an estimated \$24.8 billion in export income for Australia, more than any other single product or service (Australian Coal Association 2009). Australia exports coal to over 30 countries, but India, Japan, South Korea, and Taiwan account for about three-quarters of the nation's coal exports.

Given the importance of the energy and mining industries to the Australian economy, the question of managing the structural change imposed by the imperative to reduce greenhouse emissions is a critical one. The Construction, Forestry, Mining and Energy Union (CFMEU), Mining and Energy Division has, for a number of years, taken a proactive stance on this threat to its industries and workers. This early and active response to climate change by a union with a large workforce in an affected industry is the subject of this case study.

When industries face a major challenge, such as new competition or restructuring pressures, unions in these industries often adopt a defensive position, seeking to protect industry conditions, including operating conditions, or slow the rate of change. In respect to climate change, heavy industry unions have tended to urge caution toward efforts to reduce greenhouse emissions, including the adoption of targets and other measures. This has seen unions tending to follow the position of heavy industry businesses. The overall effect has been to slow down, delay or postpone responses to global warming.

The CFMEU has however taken a leadership role both domestically and internationally on the issue of climate change. Its position has instead sought to:

- recognize the seriousness of the global warming problem, and accept the need for major emissions reduction;
- embrace key elements of greenhouse gas reduction strategies that are both essential to reducing emissions, and to having public credibility on the issue; and
- promote major action by the coal, gas and power industries to transform coal and gas use technology so that they have a future in a carbon-constrained world.

The dominant coal mining union, the CFMEU, has been involved in the climate change issue since 1990, when it led Australian union involvement in the Federal Government's Ecologically Sustainable Development Working Groups.

The union also attended the 1992 Earth Summit in Rio de Janeiro, where the UN Framework Convention on Climate Change was adopted, and was present in 1997 when the Kyoto Protocol was agreed on in Japan. At these meetings, the union began its advocacy that social justice needed to be a key consideration in the development of climate change responses. The union was not uncritical of the Kyoto Protocol, because it felt that even if everyone signed up and stayed to their commitments, it would not solve the climate change problem. The CFMEU position was that a more comprehensive solution was needed, but some groups interpreted this criticism as opposition to climate change abatement initiatives. The union's position has been vindicated, with the first commitment period coming to a close with most nations not meeting their Kyoto targets. Even if they had we now know that it would not have reduced the global warming problem.

The union also wrote the first union publication on the issue in 1992, entitled, "The greenhouse effect: Employment and development issues for Australians". It took a lower profile on the issue during the late 1990s and early 2000s due to bitter struggles with the Federal Government and some companies over efforts to de-unionize traditional labour heartlands like mining and the waterfront.

In the last few years the CFMEU has been able to deploy more resources to the climate change issue, and this has coincided with a shift by the coal industry itself to move from climate change denial-ism. In 2001, the CFMEU co-wrote the climate change policy of the international union of workers in the mining and energy industries - the ICEM.

From 2006, with the launch of discussions on its new climate change position paper, the CFMEU has renewed its call for all stakeholders to work together to address the threat to humanity and the environment that is posed by global warming.

The CFMEU is therefore balancing its commitment to reduced greenhouse emissions and the welfare of its workers by advocating the deployment of carbon capture and storage (CCS) technologies. It has enlisted the support of the Federal Government, which has committed \$100m in funding for the Global CCS Institute (established in September 2008), with the objective of commercializing and deploying of CCS technologies. Already, the G8 nations have committed to 20 commercial-scale CCS projects being operational by 2020. Further, the Federal Government has committed \$2 billion over nine years to developing at least two industrial scale (ie > 300MW) "CCS Flagship Projects".

Since it began its engagement with the climate change issue the CFMEU has therefore supported:

- The ratification of the Kyoto Protocol
- Australia's Minimum Renewable Energy Target of 20 per cent by 2020
- A CCS Target of 5 per cent by 2020
- A greenhouse emissions trading scheme
- The establishment of a CCS Taskforce in order to champion the effort and investment required to commercialize CCS technologies.

### **Green jobs and skills**

It may seem paradoxical, but employment prospects in the coal industry in Australia are extremely good even in the light of acknowledged climate change demands. If anything, a shortage of skilled labour exists in (especially the export) coal industry. New mines, and the expansion of existing mines, will see the mining workforce grow, albeit with existing and new mines increasingly having to take account of fugitive emissions (especially of methane gases).

On the other hand, CCS represents a new industry stream, with new skills demands. CCS plants are going to be vastly more sophisticated than a conventional coal-fired power station. According to Peter Colley, the CFMEU's national research manager, the best way to imagine the new CCS power stations is that they will be more like petrochemical plants than simple coal fired steam turbine plants. Australia hasn't built an oil refinery for many years, and while it has built export liquefied natural gas (LNG) plants, these construction projects ran up against significant skills shortages. Even to build the first new CCS plants, there will be major demand for appropriately qualified technical and professional staff. If Australia can get 2-4 of the world's first 20 plants there will be huge demand for Australian skills and expertise. It has been estimated for instance that there are less than half the engineers with the skills and experience needed to build and run CCS power stations. Engineering and the science faculties will need to be encouraged to target and direct enough students. As Peter Colley says "We literally don't have enough people in the country with the right skills right now." We were unable to determine whether and how planning for those skills needs are going to be addressed. For example, it has been estimated that the CCS Zerogen project will cost \$4.3 billion and involve 2,000 construction jobs.<sup>11</sup>

And significantly, most heavy manufacturing that use fossil fuels as a feedstock (e.g. steelmaking and all chemical plants) will have to practice some form of CCS rather than simply dumping the CO<sub>2</sub> in the atmosphere. Moving from "end-of-pipe" solutions to product and waste husbandry (with the carbon coming out of the ground and going back there), is going to become a challenge at least as significant as burning coal for electricity generation.

Also, the pipeline construction task associated with CCS will involve new skills as well as new jobs. The pipeline network for CCS will ultimately be in the order of 5,000 km and cost up to \$30 billion. It will involve large diameter pipes (greater than 24") that have not been constructed in Australia since the mid 1980s. The civil construction industry will have to up-skill and retool to do the work. At this stage it is difficult to obtain estimates on the likely shifts in employment as a result of a move to CCS, because both the technology/ies that are finally used, and Australia's role in the initial take-up are not yet clear. The potential skill implications will also depend on the speed that CCS moves back down the pipeline. But it seems clear that CCS will have a significant impact on the Australian mining industry, and that both miners and mining unions are actively taking up the challenge.

Overall, addressing the issues of climate change and the changing skill demands for the coal industry, the union conceives of work needed to address the climate change problem as a task equal to post-war reconstruction, with CCS as just one part of the suite of solutions. All will involve enormous investments, new jobs and new skills. It is clear that there are large implications for skills and training, but from planning the skills training needed for this to occur is currently only at a rudimentary stage.

### **Case Study B: Cotton farming, Australian cotton industry Best Management Practices (BMP)**

Cotton is a key global agricultural commodity and the global demand for cotton is expected to double by 2050. Key environmental issues for cotton will be water and carbon, while the industrial structure of the industry is expected to continue along the path of longer supply chains with fewer players (Rouse 2005). Issues of sustainability are becoming mainstream issues for the cotton industry and especially for the big businesses that are coming to dominate global cotton supply chains.

Australia's Cotton BMP is in some ways a prototype of an emerging international cotton industry programme, the Better Cotton Initiative, which aims to link improvements in environmental practices in cotton growing with international buyer and other value chain actor commitments to sourcing 'better (environmentally managed) cotton'. Australia's cotton BMP programme began as a response to two environmental challenges facing the industry, water efficiency and pesticide usage. But in addressing those challenges the cotton BMP programme is now moving to address environmental issues more generally.

<sup>11</sup> <http://www.zerogen.com.au/faqs.aspx#Answer%2011>

Australia has an enviable reputation on the world market as a reliable supplier of high quality cotton. In a non-drought year, the Australian cotton industry generates in excess of \$1 billion per year in export revenue, is one of Australia's largest rural export earners and helps underpin the viability of many rural communities. In 2006/07 Australia yielded 1.3 million cotton bales (from 142,000 hectares) compared to China's 31 million bales and the USA's 20 million bales. In 2006/07, the Australian cotton industry yield was 1,792 kg/ha (7.89 cotton bales per hectare), almost two and a half times the world yield average (747 kg/ha). The next highest yielding countries were Brazil (1,338 kg/ha), Mexico (1,247kg/ha) and China (1,246 kg/ha) (ICAC, 2007).

In 1996, the cotton industry began an environmental focused stewardship programme called Cotton BMP (best management practices). Initially, this was to implement the industry research and development (R&D) for pesticide movement off farm into on farm management practices. It has since evolved into the broader implementation of industry funded R&D across many aspects of farming practice changes at the field level, including sustainable land use, irrigation systems, and business management. Along with that has come third party audits and a certification scheme, where farms can be BMP accredited if the guideline standards are implemented that reflected industry BMP.

The Australian Cotton Industry BMP is an example of a continuous improvement programme developed as a voluntary, self-regulated approach to the protection of resources and environmental management in the cotton growing industry. The Cotton BMP system provides self assessment mechanisms, along with practical tools and auditing processes to ensure that cotton is produced with best practice across a range of focus areas, including:

- Human Resources
- Water Management
- Greenhouse and Carbon
- Soil Health
- Quality
- Natural Assets
- Technology
- Biosecurity
- IPM
- Pesticide Management
- Petrochemicals

BMP is implemented by individual growers, with support from Cotton Australia staff and the investments by Cotton Research and Development Corporation (CRDC) and Cotton Catchment Communities (CRC) in the Australian research and extension community.

The BMP programme has led to a set of guidelines which awards BMP accreditation to individual farm properties, on the basis of a range of environmental and sustainable production criteria.

The main attributes of the cotton BMP programme is that it is comprehensive, emphasizes continuous improvement, and is readily auditable either at the firm/industry level and/or by a third party.

In 2007, the Australian Government (via the Cotton Industry Co-operative Research Centre) funded a cotton industry initiative to map the skills and learning implied by a farmer managing a BMP accredited farm to a formal vocational qualification. The process has culminated in the development of a formal qualification – the Diploma of Agriculture, and its accompanying industry award, the Certified BMP Farm Manager.

The skills embedded in the Diploma of Agriculture, the associated delivery of training, and the accreditation process can be summarized as follows:

- The Diploma is comprised of ten competency modules, mapping industry requirements underlying BMP guidelines to the national training framework underpinning the vocational education system.
- A system for the recognition of prior learning exists, involving an assessment process which identifies existing industry skills and skills gaps. This analysis is used to both award farmers on BMP accredited properties, and develop future training programmes
- In New South Wales, the Diploma has been endorsed by the Registered Training Organisation, Tocal College. In Queensland, the programme has been taken up by the Australian Agricultural College Corporation
- Innovations to the training programme are an ongoing theme, with the focus on implementing advances in research and development. Additional topics currently under construction include Human Resource Management, biosecurity, water management, and greenhouse gas and carbon management.

The Industry BMP documentation and evidence required for the farm accreditation has been aligned to competency standards and from that a Diploma qualification was developed. The assessments are done by on farm holistic recognized prior learning (RPL) assessments that focus on the business management aspects (the how) of implementing BMP. While

the farm level focuses on the "what" is implemented. The cotton industry has also created a new award called a Certified BMP Farm Manager. This was launched to the industry late last year.

The BMP programme continues to evolve. More recently, the BMP programme has undergone a revamp and extension to include more topics that encompasses previous modules material and updated standards. The renewed focus is on the implementation of research and development by farmers to grow the business. The new topics under construction are human resources, bio-security, soil health, integrated pest management, greenhouse gas and carbon, water management, natural assets and quality, pesticide management, petrochemicals and technology. These will be released to industry later this year.

According to Cotton's National Training Manager, Mark Hickman, the whole BMP programme is about the practical implementation of agricultural science to producing cotton with the least environmental impact and the BMP Farm Manager award is about acknowledging and setting the standard for future producers to meet the evolving BMP principles. The programme itself is further embedded in business growth fostered by an innovation-driven industry.

## 3.2 New and changing skill needs

Global markets for sustainable energy are growing rapidly, with investment and capacity projected to continue to flourish. While the global financial crisis has slowed down venture capital investment, green industries' proportion of this funding nonetheless grew from 1.6 per cent to 11 per cent between 2003 and 2008, representing \$US3 billion globally in 2007 (Ernst & Young, 2008). Given a coherent and supportive policy environment, Australia is well positioned to take advantage of this growth in global demand.

In their report "Green gold rush" (2008), the Australian Council of Trade Unions (ACTU) identified the following six industries as representing areas in which Australia is well positioned:

- **Renewable energy** – Australia has a number of high wind capacity locations, more sunlight hours, a long coastline, and prospective geothermal resources than European averages, thereby positioning the nation well in the markets for renewable energy
- **Energy efficiency** – given the relatively high electricity consumption of commercial and residential buildings in Australia, any advances in energy efficient technologies to be used in buildings, industrial processes and appliances will yield substantial results
- **Sustainable water systems** – given its geography and recurring droughts, Australia has a strong history of innovation in the water sector, notably in water use efficiency and treatment
- **Biomaterials** – these are materials converted from renewable resources such as starch, sugar and oils, and include products such as packaging, plastics and chemicals. While it is a fledgling industry, Australia stands to benefit from its growth, given its expertise in agricultural production and management of natural resources
- **Green buildings** - given the electricity consumption of commercial and residential buildings, strong reductions in emissions can be made by retrofitting buildings, and ensuring new buildings meet higher energy efficient standards
- **Waste and recycling** – Australia already competes for waste and recycling contracts, a sector poised for strong growth

These opportunities represent a mix of both greening of existing industries and occupations, and new green industries and occupations.

### 3.2.1 New green collar occupations

New green collar occupations are at the frontier of technological, regulatory and of course, environmental change. With technologies and regulatory regimes in their infancy, many occupations and their underlying skills and training are likewise in a developmental stage.

In Australia, the Renewable Energy Target (20 per cent of energy consumption to be derived from renewable sources by 2020) will promote the development of new renewable technologies.

Research by the Climate Institute (2009) indicates that around 8 gigawatts (GW) of commercial scale renewable energy capacity is currently installed, compared to the 2020 target of 45 GW. Over 1,200 people are currently permanently employed in the operation and maintenance of clean energy facilities, in addition to supporting over 7,300 indirect jobs. Their analysis further indicates that, in relation to existing, committed and planned clean energy projects, over 2,400 direct permanent jobs are likely to be created, with a further 25,000 construction and indirect jobs being generated by 2020. This compares to global estimates in the wind energy sector alone of 85,000 direct jobs in the United States and over 108,000 in Europe in 2007. While the Australian projections are subject to significant uncertainty, the pace of both private and public global investment in renewable energy businesses, and the changing Australian regulatory environment, indicate substantial growth in these new green collar industries and occupations.

Our three case studies covering new green collar occupations relate to:

- technicians at Infinity Solar, a solar and wind energy service provider
- engineers at Clearmake, a water system management service provider
- business analysts at the Victorian Advanced Resource Recovery Initiative (VARRI), a government project aiming to divert waste from landfill towards more sustainable options.

Several recurrent themes are highlighted in our case study analysis, namely:

- **The importance of regulatory certainty and consistency in driving market demand, and in turn, the demand for green skills.** Case study participants clearly defined the necessity to create a viable market, leveraging Australia's natural comparative resource advantages, ahead of the drive to supply green skills.
- **The role of the government in providing incentives/disincentives to drive behavioural and business process changes.** These incentives range from solar installation rebates and feed-in tariffs, to restriction and enforcement of water consumption regulations. Many of these systems of incentives and disincentives continue to be fragmented at a national level, although there are ongoing efforts to streamline such measures.
- **The importance of industry and government collaboration in fostering both the development and commercialization of technologies, and the design and delivery of training courses.** The issue was raised that government policies supporting a particular technology or product needs to be designed with the advice of industry expertise, in order to foster a strategy that industry, education providers, and government are prepared for.
- **The lack of specialised training options both within the industry and through the vocational or higher education systems, leading to a strong incidence of skills acquired on-the-job.** The pioneering of new markets, products and technologies necessarily means changing skill requirements and evolving expertise. As the industries have developed, education and training courses are being re-designed to cater to these new skill demands, although they are clearly in their infancy.

We will look at these issues in more detail throughout the case studies.

### 3.2.2 Greening existing occupations

As mentioned previously, the greening of existing occupations, such as plumbers installing solar hot water systems or energy and water efficient systems and appliances, or lawyers assessing the energy efficiency ratings of buildings, creates significant ambiguity when seeking

to define and measure green jobs. While a stock-take of Australia's green skills and workforce capabilities is still forthcoming, a number of international studies may provide indicative results.

The key result from a study by the US Washington State Employment Security Department (Hardcastle, 2009) was that green jobs are concentrated in a small number of industry classifications and occupational titles which 'promote environmental protection and energy security'. The study obtained responses from 9,500 employers in relation to directly employed green employees, their job titles and associated qualifications, and identified **four core areas** of direct green employment – energy efficiency, renewable energy, pollution reduction and pollution clean-up and mitigation.

While this study is a snapshot of green jobs in Washington State, it is likely that the findings relating to the industry and occupational coverage of green employment will be relevant to the Australian experience. In particular, most developed economies have identified buildings as a dominant consumer of emissions-intensive electricity generation, and accordingly have focused initiatives pertaining to the energy-efficient design, construction, and performance measurement of commercial and residential buildings.

The study classified green jobs by the North American Industry Classification Standards (NAICS) and these four core areas, and found that 86 per cent of all green jobs existed in **just six industry classifications** (see Table 2):

- Specialty trades – namely trades associated with residential, commercial and industrial construction;
- Professional, technical and scientific services – dominated by law, engineering, accounting, advertising and architectural firms;
- Crop production;
- Building construction;
- Waste management and remediation services, and
- Agricultural and forestry support activities – refers to crop-harvesting services.

Within these results, 53 per cent of green jobs were identified as being within the energy efficiency sector, with almost half of these jobs falling in the specialty trades classification. Over 30 per cent of green jobs related to the reduction of pollution, with strong representation in the crop production occupational category.

**Table 2. Industry composition of green jobs, 2009 – Washington State**

NAICS**	NAICS TITLES	ENERGY EFFICIENCY	RENEWABLE ENERGY	REDUCING POLLUTION	MITIGATION OR POLLUTION CLEANUP	TOTAL EMPLOYMENT GREEN JOBS	TOTAL ALL EMPLOYMENT REPORTED 2007 THIRD QUARTER	GREEN JOBS AS A PERCENT OF INDUSTRY EMPLOYMENT
238	Specialty Trade Contractors	12,215	278	1,152	341	13,985	127,632	11.0%
541	Professional and Technical Services	3,627	442	1,748	1,604	7,456	152,274	4.9%
111	Crop Production	629	160	6,321	160	7,270	76,548	9.5%
236	Construction of Buildings	5,287	211	1,045	200	6,743	51,541	13.1%
562	Waste Mgmt. and Remediation Services	210	60	1,262	1,384	2,918	14,188	20.6%
115	Agriculture and Forestry Support Activities	140	160	1,949	134	2,384	19,239	12.4%
423	Merchant Wholesalers, Durable Goods	134	10	602	87	832	68,059	1.2%
327	Nonmetallic Mineral Products Manufacturing	480	1	213	57	751	10,865	6.9%
335	Electrical Equip. and Appliance Manuf.	368	290	34	-	694	4,285	16.2%
221	Utilities	622	56	1	1	679	4,698	14.5%
237	Heavy and Civil Engineering Construction	291	55	192	86	624	25,071	2.5%
112	Animal Production	48	42	225	154	469	6,170	7.6%
522	Credit Intermediation and Related Activities	403	2	5	3	412	52,260	0.8%
113	Forestry and Logging	2	60	285	59	406	5,206	7.8%
326	Plastics and Rubber Products Manuf.	209	2	103	64	377	10,528	3.6%
813	Membership Assoc. and Organization	17	0	261	55	334	25,592	1.3%
321	Wood Products Manufacturing	114	65	97	40	311	19,035	1.6%
332	Fabricated Metal Products Manufacturing	39	74	55	25	193	19,721	1.0%
811	Repair and Maintenance	46	3	83	4	136	26,663	0.5%
454	Nonstore Retailers	43	1	20	6	70	10,975	0.6%
531	Real Estate	46	-	5	3	55	37,037	0.1%
334	Computer and Electronic Products Manuf.	3	48	-	-	51	22,873	0.2%
325	Chemical Manufacturing	1	7	6	-	14	6,063	0.2%
322	Paper Manufacturing	-	-	5	7	12	11,171	0.1%
114	Fishing, Hunting and Trapping	1	1	5	4	10	1,894	0.5%
336	Transportation Equipment Manufacturing	-	-	-	6	6	93,731	0.0%
523	Securities, Commodity Contracts, Investments	1	-	1	-	2	10,892	0.0%
	<b>Totals</b>	<b>24,976</b>	<b>2,027</b>	<b>15,676</b>	<b>4,483</b>	<b>47,194*</b>	<b>914,211</b>	<b>5.2%</b>
	<b>Total For All NAICS Industries</b>						<b>2,974,524</b>	

Source: Lee et al. (2009)

Moreover, the top 25 occupations within these green industries comprise over 74 per cent of green jobs, dominated by a strong presence of the trades, including electricians, construction labourers, carpenters, heating/air-conditioning mechanics/installers, and plumbers. This is shown in Table 3. Together these trades accounted for around 30 per cent of total green employment.



**Table 3. Occupational composition of green jobs**

SOC	OCCUPATIONAL TITLE	ENERGY EFFICIENCY	RENEWABLE ENERGY	REDUCING POLLUTION	MITIGATION OR POLLUTION CLEANUP	TOTAL EMPLOYMENT GREEN JOBS	PERCENT OF TOTAL GREEN JOBS
452092	Farmworkers and Laborers, Crop, Nursery, and Greenhouse	557	149	4,065	43	4,814	10.2%
472111	Electricians	3,651	84	17	32	3,784	8.0%
472061	Construction Laborers	2,050	217	651	217	3,136	6.6%
472031	Carpenters	2,394	38	208	34	2,674	5.7%
452099	Agricultural Workers, All Other	37	1	2,381	225	2,645	5.6%
499021	Heating, Air Cond., and Refrig. Mechanics and Installers	2,341	42	127	82	2,590	5.5%
172051	Civil Engineers	1,157	98	627	197	2,085	4.4%
472152	Plumbers, Pipefitters, and Steamfitters	1,675	6	176	19	1,875	4.0%
171011	Architects, Except Landscape and Naval	1,433	83	176	12	1,702	3.6%
172141	Mechanical Engineers	610	71	127	235	1,047	2.2%
472121	Glaziers	831	-	8	-	838	1.8%
472181	Roofers	658	33	75	56	821	1.7%
519199	Production Workers, All Other	406	35	234	71	747	1.6%
537081	Refuse and Recyclable Material Collectors	220	8	299	218	745	1.6%
533032	Truck Drivers, Heavy and Tractor-Trailer	30	14	416	282	744	1.6%
119021	Construction Managers	498	22	97	32	648	1.4%
471011	First-Line Sprvrs./Mgrs. of Const. Trades and Extraction Wrkrs.	560	-	42	14	616	1.3%
472131	Insulation Workers, Floor, Ceiling, and Wall	533	10	16	10	569	1.2%
452041	Graders and Sorters, Agricultural Products	-	-	518	3	521	1.1%
172071	Electrical Engineers	378	31	17	30	458	1.0%
474041	Hazardous Materials Removal Workers	6	-	63	380	449	1.0%
192041	Environmental Scientists and Specialists, Including Health	24	14	149	222	409	0.9%
472211	Sheet Metal Workers	370	-	22	9	401	0.8%
119199	Managers, All Other	228	24	90	52	396	0.8%
537062	Laborers and Freight, Stock, and Material Movers, Hand	126	5	205	47	383	0.8%
	<b>TOTAL</b>	<b>20,772</b>	<b>985</b>	<b>10,806</b>	<b>2,520</b>	<b>35,096</b>	<b>74.4%</b>
	<b>Total of All Green Jobs by Core Areas*</b>	<b>24,976</b>	<b>2,027</b>	<b>15,676</b>	<b>4,483</b>	<b>47,184</b>	<b>100.0%</b>

Source: Lee et al. (2009)

As an indicative measure of current skills requirements, the study also recorded the educational qualifications of current green employees. It found that 27 per cent of green employees required 1-4 years of vocational training, with a further 13 per cent requiring degree or higher qualifications.

Our case studies describing the greening of existing occupations relate to:

- Consultants at Ernst & Young, a professional services firm
- Plumbers at the Plumbing Action Centre, a training centre delivering specialized courses to existing plumbers
- Apprentices at the WPC Green Skills Initiative, a training provider and employer to apprentices
- Ecotourism operators at Hidden Valley Cabins, an eco-friendly resort which also provides training to other tourism operators

Responses from case study participants indicated a number of important themes:

- Again, regulatory consistency and stability featured as something that investment in technology and training will continue to pivot on. While this affects infant green collar industries on a bigger scale, the challenge of adapting to a changing business environment is likely to create competitive opportunities and risks amongst transitioning industries and enterprises, such as tourism and professional services.
- The dissemination of current and ongoing legislative requirements and/or standards, and their interpretation by industry participants, was of significant importance. Existing trained plumbers or auditors, for example, need to be aware of changing standards in water

consumption efficiency and carbon accounting standards, respectively. There may be a clear role for government to diffuse such changes to industry groups on an ongoing basis.

- Green skills education and training, while still substantially learnt on the job in some instances (such as at Ernst&Young), has seen some coordination at industry and regional levels. For example, the Master Plumbers and Mechanical Services Association of Australia has designed a GreenPlumbers training programme which is being rolled out across the industry and now internationally. Similarly, Hidden Valley Cabins, an ecotourism operator, is educating local tourism operators about greening their energy generation systems.

### **3.2.3 Identification of skills needs**

As mentioned earlier, the 11 ISCs manage the revision of Training Packages to meet the skills development needs of Australian businesses. The ISCs engage with government, industry and the training sector and support continuous improvement in the vocational education and training (VET) system through the development and review of high quality training products and services.

While our case studies show that the process is far from systematic or comprehensive, the work of ISCs represents an industry driven, methodological approach to the review of Training Packages. The identification of skills needs is typically derived through ongoing stakeholder consultation and research, extending from training authorities and service providers, to employer and employee representatives and government agencies. An example of the process is provided by the ISC for the electrotechnology, gas and electricity generation and distribution sectors, EE-Oz. EE-Oz's activities relating to its responsibility for four Training Packages has been articulated in its 'Continuous Improvement Plan' (the Plan).<sup>12</sup> The Plan describes the scope and methodology for restructuring, creating and delivering new training units, and the industry imperatives for doing so. The expansive consultative process involved helps ensure delivery of relevant, and formalized, training.

Such a process is typical of the ISCs in Australia. Their presence has helped trigger a better national, sector-based approach to the identification of skill needs. While the process is inherently difficult due to the dynamism and uncertainty relating to sustainability policies, networks of consultation are already active and representative of a broad range of stakeholders, and the institutional structures for taking the next steps already exist. In the next few years, better coordinated systems of skill formation and training will emerge or consolidate. Once the current political debate about the scale of the wider regulatory response, and its timing, is settled, we anticipate that there is capacity to quickly take the next step in green skilling the Australian workforce. The Green Skills Agreement is a positive development in this area. The Agreement will facilitate the reskilling and upskilling of existing workers in skills for sustainability, and enable individuals, businesses and communities to adjust to a sustainable, low carbon economy.

### **3.2.4 Skills response**

While a fragmentation of skills policies by State and industry has been a feature of Australia's sustainability agenda, a number of State governments have now formulated quite comprehensive and coherent approaches to the key issues of skills and sustainability. The case studies of the New South Wales and Queensland State governments presented in this paper provide illustrations of this point, but other State governments have also been moving to embed sustainability into training regimes. Although we recognize that the supply of green skills is in some respects secondary to establishing stable and supportive policy settings for the growth in

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<sup>12</sup> For details, see [http://www.ee-oz.com.au/files/Continuous%20Improvement/Continuous%20Improvement%20Plan\\_halfyearlyrevision09.pdf](http://www.ee-oz.com.au/files/Continuous%20Improvement/Continuous%20Improvement%20Plan_halfyearlyrevision09.pdf)

demand for green skills, a strong framework with ongoing enhancements will be instrumental in meeting the growing demand. In the Focus Box below, we discuss examples of how environmental challenges are being responded to in the NSW Green Skills Strategy.

In general terms, it is possible to observe an important evolution in the skills response to the challenge of climate change. The initial phase of green skills training was the preserve of a small group of occupations, firms and industries (often led by the initiative of a few progressive leaders in industry or training bodies), mostly at State level, and treated for a time as a sort of optional add-on to existing skill training.

In recent years, green skilling has shifted towards becoming a more comprehensive agenda across many occupations and industries, with sustainability becoming embedded in training especially on-the-job, but also in more formal training. This change clearly shows that there are many in industry and the training sector that have understood the long-term significance of climate change abatement for the nature of work.

As noted earlier, Australia's 11 ISCs support continuous improvement in the VET system through the development and review of training products and services. ISCs are privately registered companies run by industry-based boards of directors, but whose funding is provided substantially by the Australian Government through the Department of Education, Employment and Workplace Relations.

Each of ISCs have identified key drivers in their industries with respect to environmental sustainability, including

- Construction and Property Services Industry Skills Council (CPSISC): representing a workforce of around 1.6 million Australians, the CPSISC is developing its property services and asset maintenance Training Package curricula to target more sustainable waste management and building design and construction. One specific example of the CPSISC's response to skills needs is the development of qualifications and training pathways relating to the home sustainability assessment. The Certificate IV course includes core units including the evaluation of home energy and water usage, and waste generation.
- In Agri-foods, several important initiatives are underway, including for instance the Cotton BMP case study earlier in the paper. Another such initiative seeks to embed environmental and social sustainability into all training programmes. An example here is the Rural and Related Industries Integrated Management System (IMS). The drivers for the development of the IMS are the greater public awareness and regulatory attention given to environmental issues and food safety, the difficulty in managing multiple compliance systems, the need to embed existing efforts toward environmental stewardship as well as safety and quality, as well as the need to recognize the increasing importance of these factors in market access to global supply chains. In terms of environmental sustainability, the IMS begins from the ground up by selecting an activity, product or process, identifying environmental aspects of the activity and environmental impacts. These are documented, and attempt to measure the scale and severity of impact, probability of occurrence and duration of impact. Such data can then be used to assess possible ways of mitigating/eliminating impacts, as well as linking to the training requirements for existing and future work changes.
- Electrocomms and Energy Utilities Industry Skills Council (also known as EE-Oz) represents the electrotechnology, communications, electricity generation, transmission and distribution, rail traction and gas supply industries. Their initiatives in developing appropriate Training Packages have focused on energy efficiency training and renewable energy systems, in particular in training accredited renewable energy system designers, installers and technicians. Concerns of skills shortages in this area have already been raised, and a key challenge for EE-Oz will be to upskill the existing workforce and attract new entrants, while maintaining industry standards.

- Government Skills Australia monitors workforce development in the public sector, water industries, public safety and correctional services. It is responsible for five Training Packages relating to these areas. While environmental protection has always been on the agenda, the focus is very much on integrating new technologies into the planning and development of local projects. Another key focus, particularly for the water industries, will be on resource management and conservation, and the associated technical capabilities required. Such focus is articulated through review of the curricula underlying the Training Packages which comprise the Certificate I to IV, and Diploma to Graduate Certificate qualifications relating to Water Operations, Water Sustainability and Water Industry Leadership.
- Innovation and Business Skills Australia (IBSA) is responsible for eleven Training Packages relating to business services, cultural industries, financial services, education, information and communications technologies and graphic arts. They recognize that in such workplaces, organizational change will be driven by leadership. One current focus of development is on compliance training and the level of coverage of sustainability units.

Across the ISCs, review of training design and content, in line with broader sustainability initiatives, is undertaken continually and directed by industry consultation and feedback.

At state and institutional levels, the design and delivery of suitable green skills training has started to gain traction. For example, Registered Training Organisations (RTOs) in several states now offer courses covering areas as broad as sustainable building design, electrotechnology, conservation and land management, and waste management. These courses provide nationally recognized qualifications ranging from Certificate I to Advanced Diplomas, and have been designed in collaboration with the ISCs as well as at the industry and regional levels.

Similarly, responses from engineering and science faculties at various universities have seen some progress. As we will see, many of these courses are relevant to the scope of a number of the case studies, although their relative infancy means that many skills are currently being learned on-the-job, and the curricula and uptake are likely to evolve.

With numerous government initiatives targeting energy efficiency (particularly as it relates to the built environment) and supporting renewable energy markets, the demand for the skills key to these developments will need to be a key focus of skills policy and training delivery. While much of this skill demand is being currently met by on-the-job training as the demands for such skills grows, we can anticipate a much larger role for formal training providers both in offering training and developing comparable training standards.

#### **Focus Point II. NSW State Government Green Skills Strategy**

The NSW State Government Green Skills Strategy is a coordinated policy effort by the NSW government to foster skills development and business opportunities for more environmentally sustainable outcomes in the State. Its key strategic elements involve allocating resources to:

- Prioritize availability and uptake of training related to environmental sustainability, through the provision of subsidies for accredited training;
- Build training capacity of trainers and training organizations;
- Establish industry partnerships to identify training and business opportunities, including the development of new training courses and resources;
- Support business take-up of green skills training through an online Green Skills Business Guide and Course Finder ;
- Support additional research and data collection on green jobs, green skills and green training; and
- Implement skills strategies for NSW government environmental programmes.

The implementation plan identifies nine priority industries, based on their contribution to carbon emissions and potential for the VET sector to meet anticipated skill requirements. For each of these industries, the NSW government has identified the key environmental challenges and opportunities, VET-related occupations, and specific environmental targets. Moreover, the

Green Skills Strategy outlines an action plan for each industry according to the five principles listed above. Finally, the Strategy details the underlying 'units of competency' to be delivered via Training Packages, or learning modules, by registered training organisations (RTOs). By way of example, in the manufacturing industry, the Strategy identifies the following elements:

- Key environmental challenge – rising costs of raw materials and transport
- Key environmental opportunity – large potential cost/energy savings from reduced use of raw materials
- Key VET-related occupations – Trades/Technicians, such as plumbers, mechanics and electricians
- Government targets – improve efficient water use, saving 145 billion litres per year by 2015
- Training – include relevant units of competency in the NSW Strategic Skills Program 2009/10, delivering initial and continuing training for different levels of qualifications relating to each priority industry
- RTO Capacity – embed sustainability in Training Package curricula
- Green industry partnerships – work with three employers to explore business opportunities and training gaps in green markets. Projects are identified from research and stakeholder consultation, with partner organization asked to address the extent to which their project addresses gaps in the educational and training system, the potential for environmental gain, industry demand, and industry participation
- Relevant units of competency – for example, a *'develop and manage sustainable energy practices' unit in a 'competitive manufacturing' course.*

The Green Skills NSW Taskforce was commissioned to advise Government on future priorities and policies that will build on current initiatives of the Green Skills NSW Strategy. Together with other state and national programmes, a coherent framework is being developed such that the policy environment for businesses and industry, households and consumers, workers, educators and students, is becoming clearer.

### 3.2.5 Case studies – New green collar occupations

#### Case Study C. Business analyst, Victorian Advanced Resource Recovery Initiative (VARRI)

The waste collection, treatment and disposal services sectors directly employ close to 29,000 workers in Australia. The sector includes areas such as waste remediation and recovery services, landfill operators, waste treatment facilities, and industrial waste collectors. According to a 2003 survey by the Australian Bureau of Statistics (ABS), the industry then comprised 1,100 waste management services firms, contributing \$2.7 billion (or 0.2 per cent of GDP) to the Australian economy.

The VARRI is a \$10 million Victorian State Government initiative aimed at improving organic (food and garden) waste recovery in metropolitan Melbourne. The VARRI project will facilitate the introduction of new 'Advanced Resource Recovery Technologies' (ARRTs) for processing metropolitan Melbourne's municipal solid waste.

The establishment of ARRT facilities will enable more waste to be diverted from landfill, with a focus on organic waste. Some technology solutions may offer the option of additional sorting and separation of glass, metal and plastics from a mixed waste stream, recovering more recyclables. Different facilities can produce useful end products ranging from clean renewable energy to enriched compost and fertilizers.

The important first step of the process is the development of a business case to explore a range of ARRT options. The business case will consider the costs and benefits of different ARRT options from a financial, environmental and community perspective. It is expected following the completion of the business case, the State government will work with local government during 2010 to seek tenders, incorporating the first 2 resource recovery facilities.

The establishment and operation of up to eight facilities, as recommended in the Metropolitan Waste and Resource Recovery Strategic Plan is expected to lead to around 250 permanent jobs over the next five to ten years, in addition to indirect jobs in areas such as construction, supply chain, and marketing. Each facility is expected to have a lifetime of 25 years. It is envisaged that, once operational, the facilities will require a workforce ranging from low skill workers, through to specialized engineers and business operations managers. In this instance however, we focus on the pre-operational stages of developing business cases for such facilities, and the capabilities required to do this.

Building a feasibility study and commercialization options for ARRT facilities requires a breadth of complex considerations, including:

- The nature of changes in waste material inputs over time in terms of volume and characteristics,
- The products and associated product needed over time, including compost, recyclables and derived energies,
- The assessment of technology and associated characteristics needs, balanced against the Government and local councils role in defining the performance outcomes that technologies and associated facilities will need to meet,
- Changes to waste processing infrastructure in the context of existing infrastructure,
- Projected growth in industries such as waste processing and recycling sector. For example, the value of the

recycling industry in job creation will be considered more broadly in the forthcoming National Waste Policy, to be released in late 2009;

- The design of effective risk and liability sharing and the relative attractiveness of investing in the sector over other investment options;
- Appropriate siting and associated engagement with the community;
- An effective procurement and contracting process which provides certainty of rules around the provision of waste volumes from councils to a facility over time;
- An effective partnership between State Government and local councils,
- The relative cost of disposing waste to landfill in preference to recycling or resource recovery, and
- Appropriate policy and regulatory settings

The role of regulatory change is very important in driving change in improved practices around the management of waste. There is a direct link between regulatory settings and the establishment of a price point to attract private sector investment and the opportunity to drive behavioural and business process change. For the solid waste sector, the relative attractiveness of disposal to landfill is affected by the availability of suitably managed landfill space and the availability of a viable alternative. The regulation of landfill disposal, including tighter regulation of landfill cells and scheduling of available landfill space over time provides a supply constraint. Other regulatory tools such as landfill levies and/or bans surrounding certain material going to landfill also affect the price of disposal and in turn the attractiveness of investment waste avoidance and minimization strategies and/or alternative waste processing options.

Clearly, the skills required to construct such a business case are complex and dynamic, as a rigorous understanding of governmental objectives, private investment priorities, as well as waste processing technologies is necessary. As such, the current workforce of business analysts is comprised of degree qualified staff, with backgrounds ranging from engineering, to business and science. With regards to the specialized knowledge required relating to waste processing and recovery practices, it is largely developed on the job, from project to project, as each facility will be unique in its specifications. Nonetheless, the Waste Management Association of Australia (WMAA) identifies a number of learning paths in the industry, through both the vocational and higher education sectors.

Numerous TAFE and RTO institutions throughout Australia deliver waste management qualifications ranging from Certificate II to IV in Asset Maintenance (Waste Management). An example of the waste management specific units found in the nationally recognized Training Package is given below:

Certificate IV Asset Maintenance (Waste Management) Electives

PRMWM01B Plan waste audit

PRMWM03B Review, evaluate and document waste assessment findings

PRMWM27B Select and obtain waste management plant, equipment and materials

PRMWM33B Educate public on waste management issues

PRMWM35B Undertake process audit

PRMWM43B Develop an environmental management strategy

PRMWM52A Organize waste management operation

PRMWM53A Conduct and monitor waste management operation

PRMWM57A Develop landfill rehabilitation plan

PRMWM59A Carry out waste assessment

PRMWM60A Apply cleaner production techniques

PRMWM61A Plan resource recovery

PRMWM62A Apply waste avoidance techniques

At a university level, and likely of greater use to a business analyst team focused on valuation, forecasting and other long term feasibility issues, a number of institutions offer both undergraduate specializations, or postgraduate degrees, generally within engineering faculties. An example from the University of New South Wales School of Civil and Environmental Engineering is the Masters of Water, Wastewater and Waste Engineering. This programme features the following units:

UNSW Masters of Water, Wastewater and Waste Engineering

CVEN 9855 Water and Wastewater Analysis and Quality Requirements

CVEN 9856 Water Treatment

CVEN 9857 Wastewater Treatment

CVEN 9872 Solid Waste Management

CVEN 9881 Hazardous Waste Management

CVEN 9888 Environmental Management

#### CVEN 9892 Sustainability assessment & risk analysis in water and energy systems planning

A course description of the latter subject (CVEN 9892) relates closely to the requirements of the business analyst role at VARRI, although the reality of commercial, technological and regulatory considerations is clearly impossible to simulate within a single, or even a combination of, university courses.

“The design of water and energy systems has advanced from a cost-benefit basis to the incorporation of quantitative assessments of environmental burdens and the human and environmental risks associated with competing options. This course will equip students with the ability to apply life cycle assessment for quantifying environmental burdens, and an understanding of the factors that define human health and environmental risks. The latter include the presence of chemicals and pathogenic organisms, and the reliability of engineered systems.”

The confluence of skills required to construct a business case at VARRI requires knowledge of engineering and waste processing systems, business valuation and forecasting, advanced and new technologies, as well as government service provision. The arena to deliver these skills is largely through the university sector, although the dynamism and diversity of knowledge required makes it difficult to provide targeted training, and skills are therefore largely learnt on the job with existing experts and mentors.

#### Case Study D: Technician, Infinity Solar

According to the Clean Energy Council (CEC), Australia had over 100 megawatts of solar photovoltaic capacity installed at the end of 2008, about 0.7 per cent of global capacity, and a 25 per cent increase on the previous year. With the greatest average solar radiation levels of any continent in the world, Australia’s solar energy sector is poised to take advantage of greater focus on renewable energy sources globally.

Infinity Solar is a firm specializing in solar energy established in 2007. It is based in Queensland and northern New South Wales. Infinity Solar provides solar and wind energy solutions to domestic and commercial clients, designing and installing solar energy systems as well as distributing Exmork wind turbines across Australia. In less than two years of operation, the business has grown to thirty employees and forecast revenues for the financial year ending June 2010 of \$15 million.

The current workforce is divided fairly evenly between managers/professionals, technicians/trade workers and sales staff, ranging in ages between 21 and 59. The workforce is dominated by male workers, particularly in the technician roles. In terms of qualifications, a number of the sales staff, professionals and managers are degree qualified in the fields of accounting, marketing, and engineering. In addition, the technicians/ trades staff possess trades qualifications, predominantly in the electrical trades. The ten trades staff/technicians are CEC accredited installers, a process which involves recognition of skills and competencies relating to the design and installation of renewable energy systems for electricians and electrical engineers.

Currently, skills requirements are being met through a combination of vocational courses and on-the-job training. In Australia, VET is delivered through a combination of Technical and Further Education (TAFE) institutes and Registered Training Organisations (RTOs), with modularized Training Packages forming the basis of skills acquisition within an extensive qualifications framework. With regards to relevant courses offered within the VET system, numerous TAFEs and RTOs across Australia offer both the modules necessary to attain CEC accreditation, as well as full courses culminating in Certificates up to Advanced Diplomas in Renewable Energy specializations. In addition, university courses, from a bachelor’s degree in engineering to a masters degree in science or engineering science, are now offered with a focus on renewable energy.

The business recognizes that demand for skills is embedded in market demand for their services, and ultimately, for renewable energy. As such, responses from Infinity Solar highlighted the need for government to provide regulatory certainty (particularly in relation to the emissions trading scheme and renewable energy targets) and research and development support. Growth in the Australian renewable energies sector, while able to harvest natural advantages present in sunshine, geothermal and wind resources, will depend on a strong platform of research and development investment, and probably some protective measures to support the young industry. For example, feed in tariffs currently exist for residential solar buyers, yet gaps remain for small-medium enterprises and commercial businesses.

Overall, the mobilized skills policy response remains fragmented for a number of key reasons:

- Lack of regulatory certainty – as mentioned, demand for green skills in the renewable energy sector depends on market demand, both residential and commercial, for these services. While the Australian government has shown its support through, for example, a Renewable Energy Target and numerous solar energy rebate programmes, greater nation-wide coordination (particularly of feed in tariffs for commercial scale systems) is needed in order to establish the technologies, timing and training necessary to grow the sector in Australia.
- Pace of technological change – as new concepts are continually introduced, trialed and commercialized, training courses are necessarily lagging the dynamic skills required within the sector. As such, while skills and knowledge

of electrical engineering and the electrical trades form a key foundation, specific competencies surrounding renewable energy systems are only gradually being articulated within the educational sector and are instead learnt on the job.

- Need for ongoing coordination between industry, educators and government – industry groups with an understanding of the measures required to grow skills and experience in the sector, such as the Clean Energy Council, need to collaborate with government and educators in order to support growth in the best technologies, demand for renewable energy, and a skilled workforce to meet these demands.

Despite developments in state-based fragmented skills policies, the potential for the education and training systems to supply the renewable energy sector with the requisite skills is great, and has been focus point across both vocational and higher education sectors. The qualifications relevant to the sector range mostly from Certificate II to Advanced Diplomas in the vocational education sector, and from Bachelor's to postgraduate degrees in the higher education sector. An area of particular growth and relevance to Infinity Solar has been courses related to electro-technology, largely servicing the solar and wind energy sectors, and typically leveraging existing electrician/electrical engineering skills.

An example of such a course is shown below being the Advanced Diploma qualification by Skills Tech Australia, a leading TAFE institute based in Queensland providing vocational education and training. The course curriculum is shown below and provides training in electrical and electronic components, wind/solar/hybrid energy systems, photovoltaic electricity systems, as well as business management skills, and is delivered over eighteen months of full time study. The course has diploma level entry requirements.

Advanced Diploma in Renewable Energy, Skills Tech Australia

TPNUER01 Introduction to Renewable Energy  
TPNBB02 OH&S  
TPNUE052 Applied Electricity 1  
TPNUE054 Applied Electricity 2  
TPNUE056 Applied Electricity 3  
TPEA050 Engineering Computing  
TPNUER08 Sustainability  
TPEA002 Engineering Maths A  
TPEA011 Science  
TPRET002 Energy Auditing  
TPNUE062 Drawings/Diagrams for Electrical Work  
TPRET001 Writing and Presenting Reports  
TPNUE079 Electrotech Systems, Materials & Acc  
TPNUER03 Electronics for Renewable Energy  
TPNUE208 Introduction to Welding Practice  
TPRET003 ELV Wiring Practice  
TPRET004 SPS Installation (ELV)  
TPNUER18 AC and DC Machines for RE  
TPNUER04 Standalone Power System Components  
TPRET005 Fluid Mechanics for RE  
TPNUER02 Photovoltaic Power Systems  
TPVBB297 Introduction to Circuit Simulation  
TPNM06 Computer Aided Drafting A  
TPEA714 Thermodynamics 1  
TPNUER10 Solar Water Heating Systems  
TPNUER11 Energy Efficient Building Design  
TPNUER06 Wind Energy Conversion Systems 1  
TPNUER21 Greenhouse Reduction Strategies  
TPEB076 Intro to Environmental Management  
TPNUER09 Hybrid Energy Systems  
TPRET007 Hybrid Systems Installation(ELV)  
TPNUER13 Introduction to Distributed Generation  
TPEB111 Cogeneration



TPNUER14 Wind Energy Conversion Systems 2  
 TPNUER213 OHS Implementation and Monitoring  
 TPEA071 Planning Estimating & Costing  
 TPRET008 Small Business Management  
 TPEB079 Introduction to Marketing  
 TPNCS011 Client Interaction  
 TPEA070 Engineering Organizations  
 TPEB075 Customer/Client Relations  
 TPEB070 Engineering Management  
 TPEB031 Quality Management  
 TPRET009 Research/Assess Sustainable Energy Tech  
 TPEB050 Engineering Project or Equivalent STA Resources  
 TPNUER05 Micro Hydro Systems  
 TPNUER19 Grid Connected Inverter Systems  
 TPNUER15 Photovoltaic Installations

As can be seen from the extensive list of offerings, the design and range of courses targeting renewable energy system specialization has certainly advanced over the last few years. While we currently have little information on the uptake of these courses nor their graduates, responses from Infinity Solar focused very much on the demand for green skills, in terms of feed-in tariffs and support for research and development, being of primary concern, ahead of the supply of green skills in terms of training and education provision.

### **Case Study E. Engineer, Clearmake**

The water industry directly employs approximately 65,000 people in Australia. Water operators form the operational workforce in the water industry and include construction, asset maintenance, monitoring of water quality and distribution, water and wastewater treatment, water testing and use of water technology. Water operators comprise 18 per cent of the water industry workforce. Engineer professionals comprise 13 per cent of the workforce, the majority (70 per cent) of these are Civil Engineers. (Government Skills Australia, 2009).

The water industry also employs specialists such as hydrographers, environmental advisers, water quality officers, systems designers and managers, and specialist operators in remote essential services, trade waste and dam safety.

Clearmake is a water treatment and recycling service provider, designing, manufacturing, installing and servicing more sustainable water usage systems. It was established in 1993, and currently employs 21 full time employees.

Demand for Clearmake's services are underpinned by regulatory standards governing water pollution, consumption, and access, particularly relating to industrial sites. Amongst other legislative obligations, the Environmental Protection Act 1994 and the Environmental Protection (Water) Policy 2009 regulate and enforce water contamination levels, wastewater treatment and discharge, water consumption levels and water quality standards within their broad scope.

Like other new green collar occupations, the stability of the regulatory environment is of critical importance, and while Clearmake is less directly affected by the impending landmark carbon emissions trading scheme or renewable energy target, the broad drive behind a sustainability agenda certainly encompasses the stricter management of water systems. Insofar as this will increasingly see more guidelines or restrictions, and raise enforceability of water quality standards, efficiency of water consumption and levels of water pollution, these are the principal drivers behind demand for Clearmake's services.

The current workforce at Clearmake is predominantly male and over thirty years old, and represent a range of qualifications. Degree qualified staff include five engineers and five management employees, while eight vocationally trained staff are dominated by those in electrical trades.

The skills requirements within the Clearmake business range from generic skills in sales and finance, to specific competencies relating to the technical roles in electrical trades and engineering. While a foundational body of knowledge may be provided through TAFE or university based training, a large proportion of the water management related skills are acquired on the job. Reasons cited for this trend include an absence of targeted training availability, and until recently, a lack of coordination between industry, government and educational facilities. However, the potential for the education sector to cater to skills needs in the water system management industry is significant. Growth and development of the industry will be underpinned by regulatory restrictions and enforcement, which has already gained substantial traction. As such, the scope to engage both the vocational and higher education sectors in order to deliver specific training relevant to the design of water treatment/consumption systems, is significant. There is opportunity to develop various learning pathways, embedded in

either the vocational education sector and leveraging the skills of the electrical trades, or the higher education sector and derived from the more highly skilled engineering streams. Some of these opportunities have been mobilized.

In 2005, Government Skills Australia, the ISC for government services and administration, identified a broad set of capability gaps, including:

- technical skills in hydrogeology
- water sensitive urban design
- wetland design
- floodplain assessment
- aquifer storage and recovery
- groundwater
- stormwater
- monitoring and evaluation
- information management
- staff development
- management skills (professional, personnel and business management)
- water trading
- management of environmental flows
- GIS/modelling and development and utilisation of decision making tools
- wastewater management
- knowledge of emerging and future water quality issues
- salinity solutions

Within the VET sector, elements of water system management are present in broader courses encapsulating conservation and sustainability, while more specialized training is offered through the Water Operations Training Package, aligned with qualifications ranging from Certificate I to Diploma and Vocational Graduate Certificate. The industry skills council is currently collaborating with national and industry bodies to review the curriculum, due to be completed at the end of 2010. Specific areas of focus have been units including to hydrography, water treatment, waste water treatment.

At a higher education level, four leading universities (University of Queensland, Griffith University, Monash University and the University of Western Australia) have formed a joint venture in designing and delivering post-graduate programmes in Integrated Water Management. This programme integrates a scientific, economic, environmental and regulatory understanding of managing water systems, and is delivered (at a full time Masters level) via the following modules:

#### Masters in Integrated Water Management

WATR7001 Science of water

WATR7002 Water, sustainability and development

WATR7003 Water governance and policy

WATR7100 Catchment and aquatic ecosystem health

WATR7200 Community development and capacity building for integrated water management

WATR7300 Water planning and economics

WATR7400 Water supply and sanitation

WATR7500 Individual Research Project

Enrolments in this course during its two years of operation have numbered 12 and 26, with the first graduates seeking opportunities as broad as water sanitation systems in developing countries and management of river ecosystem health in Australian waterways. While the course is in its infancy, it is supported by a strong network of Australian universities, and delivers specialized training within a practical, problem-solving based framework.

Clearmake stands to benefit from both an increased emphasis on delivering on the sustainability agenda, and Australia's longstanding priority and expertise in optimizing water management and consumption. Enhanced regulation of wastewater treatment and efficiency level, and protection of waterways, will provide increased need for Clearmake's services, and therefore more comprehensive education and training courses to deliver the green skills required.

### 3.2.6 Case studies – Greening existing occupations

#### Case Study F. Consultant, Ernst & Young (E&Y)

The professional, technical and scientific services sector comprises of over 779,000 jobs in Australia, representing about 7 per cent of the national workforce (ABS 2009a, cat. No. 6291.0.55.003). Growth in this sector, as well as in sectors such as health care, has contributed strongly to the trend towards services employment in the Australian economy.

E&Y is a private professional services firm which has built a specialized Climate Change and Sustainability Services team based in offices around Australia.

In so far as climate change and sustainability represents a significant business challenge, the clients of E&Y require related advisory, accounting and assurance, transaction and taxation services. The business community's ability to adapt to a carbon constrained future will demand professional services from firms such as E&Y relating to for example:

- Climate change strategy, including modelling risks and opportunities under a range of regulatory scenarios
- Carbon markets financial and accounting advice, relating to the impact of carbon costs on asset values, carbon permits or credits
- Greenhouse gas inventory development and reporting
- Greenhouse gas and sustainability report assurance
- Sustainability management
- Cleantech, involving the provision of assurance and advisory services to businesses growing clean technologies, including commercialization and feasibility studies, and accessing private investment and government grants.

Current team members within the E&Y Climate Change and Sustainability Services team in Australia number 40, and are specialized professionals within their field and firm. They are evenly balanced between male and female members, and are multidisciplinary in their expertise, with qualifications spanning engineering, science, law, accounting, economics, social science and business. All team members possess a minimum bachelor's degree qualification, many with additional postgraduate qualifications, and their titles range from Consultant to Partners.

The questionnaire responses indicated that one of its priorities meeting market demands is staying abreast of regulatory changes and policy initiatives, such as the National Greenhouse and Energy Reporting Act 2007, the now deferred Carbon Pollution Reduction Scheme (CPRS), and the Carbon Capture and Storage Institute (of which E&Y are a founding member). Indeed, regulatory certainty is necessary for any business to implement a strategic direction, and with the changing regulatory environment come changing stakeholder expectations and strategic opportunities and risks. The need to meet these challenges drives demand for the professional services provided by firms like E&Y, whose consultants require a detailed understanding of both the technical elements of regulations, as well as how they impact on clients in a practical manner.

While general skills and competencies, such as project management, budgeting and time management, form a basis of skill requirements within the Climate Change and Sustainability Services team, their expertise lies overwhelmingly in specific technical skills sets. These include, for example:

- The ability to understand and examine greenhouse gas emissions, sources, calculation methodologies and assumptions
- A detailed understanding of climate change and sustainability policy, regulation, legislation and standards, such as the National Greenhouse and Energy Reporting Act 2007, the Renewable Energy Target, the now deferred CPRS legislation, and reporting standards such as the AA1000
- The ability to identify and model climate change and sustainability risks and opportunities as they relate to individual businesses
- The ability to understand and model the cost of carbon, particularly in relation to the acquisition and surrender of carbon permits, and its impact on financial accounts and asset valuation
- The ability to assess commercialisation options and financial feasibility of renewable energy projects, including access to private and public investment
- Clear understanding of global climate change regimes and emerging national policies (e.g. Brazil, China, European Union, India, Indonesia, Japan, USA) as they directly impact on carbon markets and will be very relevant for Australian clients in terms of risk and opportunity assessments, investment decisions and relative international competitiveness.

Clearly these skill requirements are dynamic, uncertain and relatively new, but as a carbon constrained future becomes embedded in the regulatory framework, demand for such services will continue to grow. The current situation however, in Australia and abroad, is still open to significant debate, and as such it is difficult for enterprises, industry groups and educators to either recruit or train to fill these dynamic skill requirements. Responses from E&Y indicate that there are skills gaps at the more senior level of recruitment, reflecting the developmental stage of expertise in the sector.

In terms of professional development and training, skills are acquired substantially on the job. While emerging university courses contain sustainability and climate change content, these are regarded as being too broad in scope, and E&Y acknowledges the absence of training courses advanced enough in demonstrating the knowledge required of the firm's consultants. As such, training is mostly delivered internally by experienced employees in the form of lectures, in structured and often mandatory sessions. External training is often used when it is mandatory for a certain service, for example, the NSW Greenhouse Gas Abatement Scheme Auditor training.

While E&Y acknowledge that training organizations, regulatory programmes or educational institutions may provide useful training and skills development options, at present the primary method of upskilling their workforce used remains internal training sessions.

E&Y therefore suggested the following points as contributing to likely ongoing skills gaps:

- Lack of regulatory certainty – the changing composition of demand for such professional services affects enterprise and industry willingness to invest in skills development
- Complexity of business decisions and in particular, the impact of climate change and sustainability on business strategy and execution – the depth and complexity of the expertise required to meet these challenges spans fields such as science, economics and engineering, and is still in developmental stages. Professional services firms such as E&Y must draw on all these areas to meet market demands.
- Lack of education and training courses – owing to the changing regulatory environment and the complexity of skills needs, industry or educational institutions have been unable to coordinate programmes to meet these needs. As such, professional training and development is delivered at an enterprise level.

E&Y regard the potential for the education and training system to support greening the professional services industry as limited yet important. As with many professional services firms, much of the training and development is delivered on the job, with senior employees mentoring and teaching more junior employees in both structured sessions and project-based environments. Nonetheless, E&Y's responses have indicated that a broad based understanding of climate change and sustainability issues, delivered most likely via university courses, are also valuable. Additionally, the importance of understanding and interpreting changes in the regulatory and legislative framework, as with tax and other regulatory change, creates a need for training programmes to facilitate this understanding.

The policy response to the greening of the professional services industry has been very limited, and extends mostly to creating measurement, reporting and auditing standards as they relate to energy usage and greenhouse emissions. The skills policy response to developing the workforce necessary to administer these standards has been limited to training programmes which teach these standards, but do not specifically address the complexity of the relationship between business decisions and climate change and sustainability in so far as they extend to the fields of economics, engineering, law and science. Given the breadth of expertise required within the professional services firm, it is difficult to envisage a comprehensive skills framework that would adequately meet all skills needs.

### **Case Study G: WPC Group GreenSkills Initiative**

WPC Group is a not-for-profit group training organisation (GTO) which employs apprentices and trainees, and then places them with 'host employers', including business, industry and government. The WPC Group GreenSkills initiative aims to address skill shortages and skills deficiencies facing business and government agencies that are providing environmental goods or services, or to meet government policy. WPC Group GreenSkills programme is the first group training programme targeting the green economy.

WPC Group aims to build networks of employers, training providers and apprentices and trainees in order to maximise opportunities for all. Their GreenSkills Program commenced in Victoria in February 2009 and in New South Wales in April 2009, and is now supported by both the Victorian and the NSW governments. It aims to provide apprentices and trainees with relevant skills for the areas of renewable energy, energy efficiency, water management, green buildings, recycling, horticulture and revegetation. As part of the programme, WPC seeks to develop an understanding of the skills needs of the green economy, and to link these to training providers.

WPC Group currently employs more than 500 apprentices, working with over 200 host employers across numerous industries. WPC's GreenSkills initiative aims to create opportunities for apprentices and trainees in the green economy where they can develop the skills necessary to understand what impacts they are having on the environment and to give them the capacity to work more sustainably.

The goals of the project are as follows:

- creating more opportunities for employers in the green economy to take on apprentices and trainees;
- developing knowledge and understanding of the skills needs of the green economy and linking those needs with

training providers;

- building networks of green employers, training providers and potential apprentices and trainees to provide linkages that maximize opportunities for all involved;
- ensuring people who face employment disadvantages also have access to jobs in the green economy by setting and meeting training and employment targets;
- working with small as well as larger businesses;
- promoting quality career opportunities for young people; and
- sharing learning from the project.

Additional project targets include the placement of apprentices and trainees into green jobs and building a panel of 60 employers who participate in the project by providing an apprentice or trainee with the opportunity to gain experience on the job.

WPC are targeting areas with a high visibility in the green economy, such as those with an active sustainability policy and a professional/public commitment to sustainability by way of, for example, industry standards or supply chain initiatives.

The GreenSkills apprentices programme began with a target of 30 placements in each of the two states in the first year of operation. In the 2009 calendar year it successfully placed 76 trainees and apprentices. These apprentices generally have vocational qualifications at a Certificate III level, relating mostly to business services, waste management, construction and horticulture, with further focus required for the electrical and engineering fields. Current and planned host employers so far range from renewable energy providers to construction firms, water authorities and landscaping designers.

A recent development within TAFE NSW (responsible for delivering vocational education courses) means that at least one unit of sustainability education can be included in all traineeships and apprenticeships. This will help overcome the difficulty of not having customized green versions of traditional traineeships and apprenticeships, as well as welcome the integration of sustainability modules into broader scopes of learning.

### **Case Study H – Green Plumbing Initiative**

It is estimated that up to 70 per cent of the environmental water and energy savings achievable within new and existing buildings is affected by plumbing related work. Heating, cooling, hot water, water efficiency and the harvesting and use of alternative water sources all require a sustainable plumbing solution that ensures reliable service and protects public and environmental health and safety. Australia is also the driest habitable country in the world, and per person is one of the highest consumers of water in the world. The average family in Australia uses 19 per cent of their total water use on toilet flushing with a further 35 per cent for garden watering.

GreenPlumbers® is a joint initiative developed by the Master Plumbers and Mechanical Services Association of Australia (MPMSAA) and the Plumbing Trades Employees Union (PETU). The GreenPlumbers® programme was developed out of an initial project in 2000/01 "The plumber householder interface in appliance purchase decisions". This project involved a number of partners such as local council and manufacturers, and had significant financial sponsorship from within the plumbing industry (including manufacturers) and the Australian Greenhouse Office (AGO). Since then a series of training and accreditation programmes have been developed by MPMSAA to enhance plumbers skills and knowledge about the environmental considerations of their work - the new generation of plumber - the GreenPlumber®.

The Green plumbing programme is a post-trade training programme, delivered by a joint employer-union training enterprise, through a series of workshops and designed to enhance plumbers' skills and knowledge about the environmental considerations of their work. These training opportunities place plumbers in a better position to advise and inform consumers on topics such as: the benefits of energy efficiency; water conservation or the most appropriate and cost effective appliances to suit individual needs.

In particular, GreenPlumbers® training programmes are designed to assist plumbers in understanding their role in relation to environmental and public health, and to provide their customers with up to date information and advise on:

- latest technology and energy saving appliances
- practical appliances & installation knowledge
- environmental impacts of plumbing services, appliances and household practices
- consumer information
- energy/water/cost savings (short term and long term cost comparisons and environmental benefits)
- Nationally Accredited Training / Qualifications.

To date there are more than 7,300 plumbers representing over 3,700 plumbing businesses that have completed one or more GreenPlumbers® training sessions. Successful completion of the training enables a plumbing tradesperson to be certified as

a GreenPlumber™. The key attributes of a Green Plumber are that as a post trade trained plumber they are able to act as a sort of environmental consultant/advisor in many areas of residential and commercial water and energy systems.

In Victoria, a new training centre, costing \$9 million, and badged as the Plumbing Industry Climate Action Centre, has recently been opened, with the running of the centre being jointly funded by the employers, union, and state government.

The programme has also recently been expanded into New Zealand and North America, as Governments there realize the important role the plumbing industry can play in creating a more environmentally sustainable future. For instance, the California Plumbing, Heating, Cooling Contractors (CAPHCC) has signed a 15-year deal with the MPMSAA to implement the Green Plumbing programme. Under the agreement up to 40,000 California plumbers will receive training in water and energy saving methods, developed under the programme. MPMSAA GreenPlumbers® - International Training & Accreditation There is also a National Business Directory that lists businesses that employ plumbers who have achieved the above qualifications.

The GreenPlumbers Environmental Solutions courses include five separate nationally accredited units with recognized certification and qualifications.

- VBP187 - Climate Care
- VBP188 - Caring for our Water
- VBP189 - Solar Hot Water
- VBP190 - Water Efficient Technology
- VBP191 - Inspection Reports

Here we provide an overview of the first two of these five units of training.

### **Climate care**

- The climate care component of the programme focuses on:
- Hot Water Heating
- Heating & Cooling
- Greenhouse Gas Reduction
- Customer Service
- Energy Star Ratings (electric and gas)

The GreenPlumbers® - Climate Care programme has seen the involvement of over 50 councils throughout rural and metropolitan Victoria and interstate (Queensland and Tasmania) with over 600 plumbers accredited. The programme looks at how plumbers can assist householders in the decision process when replacing/purchasing hot water heating units and domestic heating and cooling appliances.

For example in Victoria, Tasmania and South Australia hot water heating accounts for 28 per cent of total household greenhouse gas (GHG), emissions and 27 per cent of total energy use, while home heating and cooling appliances contribute a further 14 per cent GHG and 39 per cent of home energy costs. This programme has highlighted that many consumers have a limited understanding about these products, as they only become an issue when the existing appliance needs servicing or replacement. Many consumers rely on the advice or recommendations of the plumber.

Plumbers are trained over seven hours on a number of issues/topics, which include:

- Global warming/greenhouse science - appliances that impact on GHG emissions
- energy star labelling systems
- alternative energy sources - overview
- minimum of three manufacturers presentations including solar hot water heating
- customer service/customer behaviour - case studies

### **Caring for our water**

In water conservation and efficiency of usage, Green plumbing training can assist householders in developing and implementing a plan for water and energy sustainability including:

- rain water harvesting considerations
- size, location and use for rain water tanks
- rain water flushing toilet systems
- gravity feed systems/pump systems
- domestic greywater use (do's and don'ts)

- greywater treatment systems
- environmental and public health issues
- potential water savings planned for now or the future
- sewage treatment systems and septic tanks
- state government water rebates
- local water restrictions information

### **Case Study I – Ecotourism operator, Hidden Valley Cabins**

The Australian tourism industry is worth about \$40.6 billion to the Australian economy as at 2008, or around 3.6 per cent of GDP (ABS, 2009c), and employs almost 498,000 people. This represents around 4.7 per cent of total employment in Australia, and is an even higher proportion in the state of Queensland. It is widely recognized that given the nation's stock of natural attractions, ecotourism is a pocket of growth within the broader industry.

Established in 1982, Hidden Valley Cabins is a family-run resort based about 100 km from Townsville, Queensland. The area does not use grid power, and as such must operate from self-generated electricity. In 2007, the resort commissioned a self-sufficient solar energy system to replace its diesel generators, and has further undertaken carbon audits and the purchase of carbon credits to attain a carbon-neutral accreditation.

Hidden Valley Cabins, in conjunction with Tropical Energy Solutions (a firm which provides engineering, marketing and sales services for clean energy solutions), are also leveraging their own experience to deliver training workshops on-site to other tourism operators. Their leadership in creating sustainability solutions for similar businesses is a result of both recognizing the demand for green tourism, and working to meet that demand with the appropriate technical and business skills. It is also recognition that there was a lot of learning they had to go through to successfully green their tourism operations, and a desire to make it easier for other operators to undertake similar transitions.

The workshops encourage renewable energy usage, particularly for remote operators generating off-grid power, by providing a platform of working knowledge demonstrated through their own operating energy system. It is marketed through Tourism Queensland, and the Queensland Tourism Industry Council. The components of the workshop include:

- Energy load auditing and profiling,
- Load management opportunities,
- Principles of operation in off-grid power supply systems,
- Types of renewable energy generation technologies,
- Review of component technologies, including types of photovoltaic solar panels, battery banks, inverter and charger Systems, data logging options,
- Examples of system configurations for typical applications,
- Practical system operation and maintenance
- Examples of solar yield and system cost calculations
- Overview of available funding programmes and government assistance

Responses from Hidden Valley Cabins indicate that Australia possesses strong comparative advantages, owing to the levels of solar radiation and natural resources, particularly compared to other developed economies. However, the greatest impediments to growth are perceived as regulatory and policy settings, in terms of the incentives and certainty that is provided to the industry. For example, the abolishment of the Renewable Remote Power Generation Program (RRPGP), which committed \$300 million in renewable energy projects in remote areas, largely by providing up to 50 per cent rebates on the capital cost of renewable energy system installation, has removed a significant incentive for remote operators to convert diesel generators to renewable energy systems. Other examples of disincentives for growing the solar energy market relates to the feed-in tariffs paid to for electricity fed back, for example, into an electricity grid. In Australia, there is currently no national feed-in tariff regime, although state-based regimes exist. There are large gaps for larger solar energy systems (greater than say 30KW), and the duration of the tariff programmes (between ten and twenty years) are in fact less than the typical 25-year lifetime advertised on many solar energy systems.

While the primary concern here is supporting the renewable energy sector, and, by association, the businesses who bring the products and technologies to market, the supply of green skills to meet this market is also critical. The experience at Hidden Valley indicates a lack of experienced installers (and in fact the final system was provided by a NSW solar installer), and a huge dispersion in costing quotes. While the vocational and higher education sectors have been active in designing courses in renewable energy training, particularly in relating the electrical trades and engineering to the installation of solar and wind energy systems, little data is available on the uptake of these courses. An example of the course of study within

one of these relatively new courses, offered at the Swinburne University of Technology, delivers a Certificate IV vocational qualification, and is detailed below:

Certificate IV Electrotechnology Renewable Energy

- UEENEEE017B Implement and monitor OHS policies and procedures
- UEENEEE024B Compile and produce an electrotechnology report
- UEENEEE038B Participate in development and follow a personal competency development plan
- UEENEEK023B Carry out repairs to renewable energy apparatus by replacement of components
- UEENEEK025B Solve basic problems in photovoltaic energy apparatus
- UEENECC002B Source and purchase materials/parts for installation or service jobs
- UEENECC010B Deliver a service to customers
- UEENEEE020B Provide basic instruction in the use of electrotechnology apparatus
- UEENEEK028B Solve problems in standalone renewable energy systems
- UEENEEK026B Install and set up grid connect photovoltaic power systems
- UEENEEK027B Diagnose faults in renewable energy control systems
- UEENEEK030B Solve problems in wind energy conversion systems
- UEENEEK034B Install stand alone photovoltaic power systems
- UEENEEK038B Design micro hydro systems
- UEENEEG071B Install and set up interval metering
- UEENEEK035B Design grid connected power supply systems
- UEENEEK039B Design stand-alone RE systems

The emergence of courses such as this one across Australia will gradually increase the supply of quality solar installers, and ultimately reduce the problems experienced at Hidden Valley – lack of availability of trained solar energy system installers at a predictable price.

The Hidden Valley workshop provides targeted training to a niche market – those not connected to grid power, and hence largely using diesel generators. According to the Clean Energy Council, over 70 per cent of all solar photovoltaic installations are off-grid. The advantage of the Hidden Valley workshop is that it demonstrates a functional, commercial scale, self-sufficient tourism operation, whose success can be translated across the tourism industry. The Hidden Valley operators believe that they, and others based in the industry, are better positioned to deliver practical training to such a niche market than government delivered courses. The workshop attendees are a mix of engineers and tourism operators, seeking knowledge of commercial opportunities and limitations related to installing renewable energy systems.

In summary, the Hidden Valley experience highlights the importance of industry-situated, and/or industry-collaborative training, particularly for specialized training needs. The operators strongly emphasize, however, the critical role of the government in providing stable regulatory settings and stronger incentives (particularly an attractive feed-in tariff and rebate regime) in driving changes to business practices towards more sustainable options.



## **4. Conclusions**

### **4.1 Key shifts**

Our conclusions, informed by the analysis of Australia's emissions reduction policy trajectory, the evolving economic and regulatory structures, and the responses from key informants and case studies, highlight the following key issues:

- Australia is currently a relatively energy and emissions-intensive economy, with the highest emissions per capita in the OECD, embedded in a history of strength in commodity markets, and particularly coal. As such, the move to a carbon constrained future herald potentially severe adjustment costs, both economic and social, if mitigation planning is not undertaken comprehensively. The country's energy consumption profile does however present many short-term opportunities for abatement around the use of existing energy efficiency technologies and practices.
- Australia, like many countries, is on the cusp of significant regulatory reform, with a suite of policies, aiming to drive the transition to a sustainable, low carbon Australian economy. These reforms will have significant implications for emissions-intensive, trade-exposed industries, which are currently seeking assistance in the imminent adjustment process, as well as newly emerging industries such as solar energy installation.
- The policy direction, however, on climate change abatement in Australia is currently the subject of considerable political debate, especially around the question of early legislative action ahead of comparable reform by other OECD countries, and the size and distribution of any adjustment and compensation scheme for climate change abatement.
- Australia is well positioned to take advantage of growth in demand for lower-emissions goods and services, particularly in the renewable energy sector and the management of natural resources, owing to a relative abundance of solar radiation and wind resources, as well as strong traditions in land and water management systems.

### **4.2 Skills implications and development**

In terms of the implications on both the demand and supply of green skills and workforce development, our analysis underlines the following issues:

- Regulatory reforms and policy settings will be a key driver across all industries affected by the rise of the green economy, be it emissions-intensive industries such as mining, or emerging industries such as wind and solar energy, as well as those whose occupations will be reshaped by green skill requirements such as plumbing. In this context, the incentives put in place to drive behavioural and business change, and the creation of certainty around policy and regulatory requirements, will be increasingly important
- Insofar as regulatory and policy settings will help determine the level of market demand and growth, they will also determine the demand for green skills. This can be seen across many of our case studies, from plumbers to professional services, and is certainly an evolving and dynamic space of expertise. Many case study respondents highlighted the importance of government investment in research and development (and even demand) in order to support the development and commercialization of the best technologies.

- The supply of green skills, in response to fragmented support for the markets which they feed, has likewise been fragmented along state and institutional lines. While this is becoming more streamlined at a design level, there is little data available on the uptake and completion of green skills education and training courses. This remains a matter for ongoing research.

#### **4.2.1 Anticipation and identification of skill needs**

The paper has discussed how over recent years there has been both a growing awareness that firms, industries and governments need to think about how work is changing (and changing future skills needs) in meeting the emissions abatement challenge, there has also been some very far-sighted work done to identify the sorts of skills that this might entail. What has been lacking is not the leadership per se, but the fact that it has tended to be fragmented. Nevertheless, some of the case studies presented in the report, document quite considerable leadership, and this is reflected in the fact for instance that internationally the coal mining union is contributing to leadership on the debates and policies adopted, that the Green plumbing initiative is being exported to New Zealand and the United States, and the Cotton BMP is providing an important template for the international Better Cotton initiative.

#### **4.2.2 Response policies and programmes**

As we noted earlier in the paper, it is possible to observe an important evolution in the skills response to the challenge of climate change in Australia. The initial phase of green skills training was the preserve of a small group of occupations, firms and industries (often led by the initiative of a few progressive leaders in industry or training bodies), mostly at State level, and treated for a time as a sort of optional add-on to existing skill training. In recent years, it is possible to identify a shift toward a more comprehensive agenda across many occupations and industries, with sustainability increasingly becoming embedded in training especially on-the-job, but also in more formal training, and most recently, in more holistic government policy frameworks. This change clearly shows that there are many in industry and the training sector that have understood the long-term significance of climate change abatement and increasing global, national and local concerns about environmental sustainability for the nature of work.

What remains ahead perhaps is that as the demands of climate change abatement continues to grow, the development of more nationally coordinated (or national scale) systems of skill formation and training will emerge or consolidate. The institutional structures (and the leadership with a commitment to accept the challenges of climate change abatement) for taking that next step already exist. Once the current political debate about the scale of the wider regulatory response needed, and its timing, is settled, we would anticipate that there is a capacity to quickly take the next step in green skilling the Australian workforce.

#### **4.2.3 Effective delivery mechanisms**

The paper noted that in Australia the initial response to emerging need for green skills was met mostly by on-the-job training, but with an increasing but variable role played by State-based formal (mostly post-trade) training delivered through the vocational education and training sector, as well as through universities. This meant that training capacity initially developed very much at the firm and local level, without much wider coordination. As recognition of the link between the challenge of climate change abatement and new skill needs has grown, we have seen a broadening and deepening of capacity, and as the case studies of plumbing and cotton have shown, in several industries Australian delivery mechanisms are providing a model for international comparison and adoption. Education institutions, both vocational and higher education, have identified the need to embed sustainability issues within existing, as well as the creation of new, courses. Similarly, the Australian and state governments have been moving rapidly to meet the current and expected future skill demands associated with greening the economy, and the Green Skills Agreement represents a coordinated effort by governments to

build the capacity of the VET sector to deliver high quality, industry relevant skills for sustainability. Key challenges to future provision include building the capacity of RTOs to deliver this training, and creating certainty on the types of broader regulatory changes that will drive demand for these skills.

## **5. Policy recommendations**

### **5.1 Climate and skills policy**

- It is clear that the key policy issue facing Australia relates to the introduction of legislation that will drive the future pace and scale of emissions reduction. While rapid progress in policy thinking, in industrial consciousness of the issue and even adaptation and innovation can be seen, regulatory change is generally acknowledged as the key driver of all changes relating to environmental sustainability.
- There is a need to continue harnessing innovations at the industry and State government level and streamlining industry and state-based initiatives into national equivalents
- It is clear that the institutional mechanisms that link industries, firms and workers will be critical in the success of green skilling the Australian economy. In Australia, ISCs play a pivotal role in that regard. Current funding arrangements may need to be better targeted, or made conditional on embedding green skills into industry training and developing vocational training to meet changing industry demand. By this, we mean that much assistance to ISCs and funding for training at the industry and enterprise level is targeted at areas of projected future skill demand and skill shortage, but then tends to be tied to outputs of trainees or apprentices. It may be that green skill components need to be made explicit in future funding arrangements for existing industries, and some scope for new industries to access such funding be included.
- In the context of an emerging national green skills policy agenda, it may be time to develop formal evaluation of existing funding for green skills and its relationship with skill development. Clearly, the evaluation of the existing role of skills funding in promoting green skills should be part of any broader evaluation process.

### **5.2 Education and training**

- We have seen that where significant progress has been made in green skilling (such as the green plumbing initiative, or the coal mining union's lead in tackling climate change) leadership has been shared between employers and unions. Greater industry collaboration will be required, especially in new green industries as technologies are continually changing.
- We have also seen that much of the initial training demand was met by on-the-job training. Formal training systems are now picking up the demand and evolving course design and curricula needs to be mapped to qualification frameworks, accreditation schemes and industry quality standards.

### **5.3 Further research and data collection**

- The concept of green jobs is complex and will continue to evolve. Once some certainty emerges in our understanding of the historic changes to work that is entailed there is a need to standardize some definition and taxonomy of green jobs, as well as allocate the resources to enable data collection in line with this taxonomy. Some of this work can begin already, especially in industries or occupations that have already begun to respond to the skill needs of climate change abatement.
- Considerable training capacity is being built around green skills. What remains unmeasured is the numbers of employees using these skills effectively in the workplace, the numbers of

employees likely to use these skills in the future, and the effect that these skills will have on promoting sustainable outcomes in the workplace. Further analysis on the uptake and appropriateness of green skills courses currently available would be very useful in guiding training policy.

- The story of skills for climate change abatement in Australia is one of both top-down and bottom-up initiatives. However the collapse of the Copenhagen negotiations internationally and carbon trading legislation nationally suggests that current bottom-up initiatives are leading the way in Australia. More research is needed on how to promote these current initiatives, and create space for more of these. In the absence of co-ordinated international leadership, this is a finding with potential for many other democratic countries as well.

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