SKILLS FOR GREEN JOBS IN AUSTRALIA

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Acknowledgements

This paper to the International Labour Organisation (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, at the University of Sydney, was commissioned by the ILO to co-ordinate the research, and to prepare the Australian contribution to the report.

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CONTENTS

1. Introduction 5
2. Policy Context 6
   2.1 The Challenge Ahead 6
   2.2 The Current Response 8
      2.2.1 Green Shoots? 8
      2.2.2 Issues of Data Collection and Classification 9
      2.2.3 Response to the current crisis 10
   2.3 Skills Development Strategy 11
      2.3.1 A Work in Progress 11
3. Anticipation and Provision of Skills 15
   3.1 Green Structural Change and Retraining Needs 15
      3.1.1 Impact on the Labour Market 15
      3.1.2 Identification of Training Needs 17
      3.1.3 Skills Response 18
      3.1.4 Case Studies 19
   3.2 New and Changing Skill Needs 25
      3.2.1 New Green Collar Occupations 26
      3.2.2 Greening Existing Occupations 27
      3.2.3 Identification of Training Needs 30
      3.2.4 Skills Response 31
      3.2.5 Case Studies 34
4. Conclusions 55
   4.1 Key Shifts 55
   4.2 Implications for Skills Development 55
5. Recommendations 60
   5.1 Policy Recommendations 60
   5.2 Recommendations for Education and Training 60
   5.3 Recommendations for Further Research and Data Collection 61
1. Introduction

This paper to the International Labour Organisation (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 sponsored project by 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 major 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 likely to become obsolete;
- 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 emphasise 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, transition to 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

<table>
<thead>
<tr>
<th></th>
<th>Electricity (PJ)</th>
<th>Coal (PJ)</th>
<th>Natural gas (PJ)</th>
<th>Petroleum (PJ)</th>
<th>Total (PJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial and services</td>
<td>178.2</td>
<td>3.7</td>
<td>43.8</td>
<td>23.0</td>
<td>255.8</td>
</tr>
<tr>
<td>Residential</td>
<td>230.5</td>
<td>0.2</td>
<td>133.5</td>
<td>1.3</td>
<td>440.2</td>
</tr>
<tr>
<td>All sectors</td>
<td>804.8</td>
<td>214.3</td>
<td>823.0</td>
<td>1738.2</td>
<td>3894.8</td>
</tr>
<tr>
<td>Commercial+Residential</td>
<td>50.8%</td>
<td>1.8%</td>
<td>21.5%</td>
<td>1.4%</td>
<td>17.9%</td>
</tr>
</tbody>
</table>

Source: ABARE (2008b), Energy Supply and Disposal

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 the United Nations Environment Programme (UNEP), greenhouse emissions per capita in Australia have grown steadily from 16.5 mega tons (Mt) to over 19Mt between 1990 and 2004, compared to a relatively stable average of 10Mt across the OECD countries.

Aside from providing a standardised 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.


Source: Department of Climate Change (2009)
2.2 Climate Change Policy - The Current Response

2.2.1 Green Shoots?

In Australia, the last decade or more has been characterised by a lack of a coherent and nationally co-ordinated climate change policy agenda. There has however been a proliferation of responses at the State levels, and this has produced a fragmented system of different State government and industry-led initiatives targeting emissions-reductions, improved energy efficiency, and promotion of renewable energy alternatives.

The previous government’s failure to ratify the Kyoto Protocol and its reluctance to consider the use of a carbon pricing mechanism underscored a lack of national commitment to the challenge at hand. The lack of coordination at the Federal level has underpinned years of often innovative but poorly integrated State and private sector initiatives, a system that has resulted in overlapping programs, fragmented objectives, and unclear signals for students, consumers, businesses and industries considering the ‘green skills’ imperative.

The current environmental sustainability agenda is undergoing a period of transition, which might be thought as ‘green shoots’ rather than a fully fledged policy transformation. Since the election of the Rudd government in 2007 and its ratification of the Kyoto Protocol, a process of consolidation and streamlining of programs has been underway, culminating in draft legislation for the Carbon Pollution Reduction Scheme (CPRS) being introduced into Parliament in 2009. The CPRS is a national cap and trade emissions trading scheme, and will, if passed by parliament, be the primary mechanism for delivering on Australia’s commitment to facing the climate change challenge, and is currently due to commence in 2011. Its key target is the reduction of carbon pollution by 25 percent from 2000 levels by 2020. It bears noting however, that the passing of legislation through parliament is not complete, and while a carbon pricing arrangement is likely to emerge, implementation dates and targets remain matters of considerable dispute.

The Australian and State governments have agreed that initiatives across the different levels of government be complementary to the CPRS, according to a set of criteria set forth by the Council of Australian Governments (COAG). This ‘complementarity’ criteria relates to market failures inadequately addressed by the CPRS, or to sectors which will not be covered by the CPRS. These criteria underpinned the review (2009) by the NSW Independent Pricing and Regulatory Tribunal (IPART) of climate change mitigation measures, and drive the recommended retention, redesign or termination of programs in NSW. Other State governments are in the process of addressing these complementarity criteria of existing programs. In addition, State renewable energy target schemes have been replaced by an expanded national Renewable Energy Target Scheme that requires 20 per cent of electricity be sourced from renewable energy sources by 2020.

In addition to the CPRS, the Australian government passed legislation in August 2009 which commits Australia to deriving 20 percent of its electricity
from renewable energy sources by 2020, up from current levels of around 5 percent. The Renewable Energy Target legislation is one step toward a more extensive set of policies supporting the renewable energy sectors, and should help drive growth in those markets.

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 IT. The United Nations Environment Programme’s current definition of ‘green jobs’ is:

“...work in agriculture, industry, services and administration that contributes to preserving or restoring the quality of the environment while also meeting requirements of decent work – adequate wages, safe conditions, workers rights, social dialogue and social protection.” (UNEP, ILO, IOE, ITUC 2008).

As soon as we move to accept this (or indeed almost any) definition, however, we are confronted with an immediate issue of measurement. It is broadly acknowledged that there is a paucity of data on the classification and incidence of green jobs in Australia. What data does exist tends to be snapshots of estimates, particularly in the renewable energy sector, rather than time series of rigorously collected observations across industries.

The dynamic nature of the green jobs concept makes classification/measurement extremely difficult. Given the pace of technological change, for example, is today’s standard of efficiency for changes in business practices, occupations and production methods likely to be adequate for tomorrow? How do we disaggregate the ‘green’ from the traditional components of manufacturing, plumbing or the electrical trades? How do we capture the nature of green jobs which focus increasingly on whole-of-process environmental protection, rather than an historical focus on the end-of-process clean up of waste and pollutants, or the recent focus on the renewable energy sector?

In terms of Australian efforts, a recent report by Ehmcke et al (2009) proposed an Australian taxonomy for ‘green jobs’, based on existing occupational (ANZSCO), industry (ANZSIC), and skill (VET Certificate I through to university degree) classifications, and introducing distinctions between the environmental and/or sustainable nature of ‘green’ work. The format of this proposal is given in Figures 1 and 2:
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 July 30 2009, the Prime Minister announced the ‘Clean Sustainable Skills Package’ which provides opportunities for 50,000 young or disadvantaged Australians to acquire the skills and training they will need for emerging green. The Clean Sustainable Skills Package includes the following elements:

- 30,000 apprentices will graduate over the next two years with qualifications that include clean and green skills;
- 10,000 unemployed 17 to 24 year olds will be able to access a 26-week environmental work experience and training program through the National Green Jobs Corps initiative;
- 4,000 training opportunities will be made available for insulation installers upon completion of their employment in this field;
- 6,000 new local green jobs are allowing unemployed Australians to contribute to environmental sustainability in priority local communities.

The Australian Government is also negotiating a new National Green Skills Agreement with the states and territories to ensure that Australia’s vocational education and training (VET) system delivers the skills for sustainability that will enable individuals and businesses to contribute to a sustainable, low carbon economy. This will be achieved by:

- embedding skills for sustainability practice and teaching in vocational education and training, within the requirements of the national regulatory framework;
- up-skilling VET instructors and teachers to deliver skills for sustainability;
- the strategic review of Training Packages to embed sustainability knowledge, skills and principles;
- implementing a transition strategy to re-skill vulnerable workers.

The draft Agreement will be submitted to the Ministerial Council on Training, Education and Employment (MCTEE) in early November 2009, with a recommendation that it be endorsed at COAG in December 2009.

The Australian Government will work with state and territory governments to implement the Agreement in 2010. In early 2010, a National Action Group will be convened, with a view to developing a National Green Skills Action Plan by June 2010. This Action Plan will present a consolidated, forward-looking framework for the training sector, business and the community as we move towards a sustainable, low carbon emission future.
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 characterised 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 analysed 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 programs 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. The case studies 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 National Green Skills Agreement will ensure that training in, and the delivery of, skills for sustainability are an integral part of all vocational education and training and are relevant to the needs of industry. Under the Agreement, the Australian and state and territory governments will work collaboratively with employer and employee representatives, the VET sector and community organisations 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. The Plan seeks to coordinate and support ‘green’ workforce development initiatives in place at the state and industry levels (Ministerial Council for Vocational and Technical Education, 2009). 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 of RTOs and articulation paths between education and training sectors. Importantly, the Action Plan emphasises 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 prioritised ‘green’ workforce development and business opportunities, amongst numerous other sustainability programs. Key among these NSW environmental programs is the $340m 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.
Focus Box I - Emerging Green Skills Policy in Queensland

Context

Queensland is the state most at 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 decentralised 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 continues 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, recognising that traditional processes of supplying skills to the economy were flawed and had resulted in considerable wastage of public resources. A 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 formalised 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,
utilisation 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 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 utilisation 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 programs 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 utilisation 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 programs of each agency cover sustainable business development programs; 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 programs 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 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 coordination at a national level is being greatly assisted by the work of 11 Industry Skills Councils (ISC), which are mandated with identifying and responding to the skills needs of their respective industries. They work with educators, industry groups and other stakeholders to meet the changing industry landscape with an adequately skilled workforce via the vocational education 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 and implemented a range of initiatives to address current and emerging priorities. The ISCs will have a significant role in the implementation of the National 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 underpin all VET activity in skills for sustainability:\footnote{Industry Skills Councils (2009), Environmental Sustainability – An Industry Response}:

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 co-ordinated 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, 2008).

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

The Treasury modelling recognises 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 minimise 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 GNP per capita growth averaging 1.1% between 2010 and 2050 in the policy scenarios when compared to a rate of 1.2% 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 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) to be created, driven by high growth sectors such as transport and construction. High-level sector 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$_2$ emissions stabilisation 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%) and neutral to positive outcomes for employment in Australia.

### 3.1.2 Identification of Training Needs

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% to 55% of total employment since 1984 (ABS Detailed Labour Force), 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. The government’s proposed Carbon Pollution Reduction Scheme (CPRS) seeks to mitigate the structural adjustment which moving to a carbon regulated economy entails by providing assistance to emissions-intensive, trade-exposed (EITE) industries, although the exact nature of this assistance is yet to be finalised. These industries so far include the likes of carbon black, glass, methanol and silicon production, as well as newsprint manufacturing.

Following from the macro-economic modelling by such organisations as Treasury and the CSIRO, there has also been an increasing number of attempts to identify the skill needs of climate change abatement at industry and State level. These are discussed in more detail in subsequent sections of the report. Suffice to say here that the close institutional association between industry and training agencies, such as Industry Skills Councils, has enabled this issue to be recognised as an emerging agenda several years ago in some of
the more forward thinking industries and States, and is now the growing focus of national policymakers.

Chart 2. Employment by Industry, 1984-2008
3.1.3 Skills Response

The skills response to the emission abatement challenge has proceeded along several paths, and these are elaborated in more detail in the remainder of the report. 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, we show how important and iterative solutions involving especially on-the-job training have been to increasing the supply of green skills.

At the industry level, and especially via some of the leading tripartite industry institutional forms, such as skills councils, we can observe some very innovative approaches to skills formation with a general move to not just recognising green skills as an important add-on to existing skills training, but to integrating green skills into all areas of training. The report also discusses some important areas where supply and quality challenges remain.
Case Study A: Coal Miner, Australian Coal Mining Industry

Australia is the world’s largest exporter of coal, shipping about 260Mt of coal each year, or about 30% 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 Japan, South Korea, Taiwan and India 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 defend or protect industry conditions, including operating conditions. 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 of this 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:

- recognise 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.

It also attended the 1992 Earth Summit in Rio de Janiero, 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 wouldn’t 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, titled, “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-unionise 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 commercialising 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% by 2020
- A Carbon Capture and Storage (CCS) Target of 5% by 2020
- A greenhouse emissions trading scheme
- The establishment of a CCS Taskforce in order to champion the effort and investment required to commercialise 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, while CCS represents a new industry stream, with new skills demands. 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. CCS plants are going to be vastly more sophisticated than a conventional coal-fired power station. Even to build these first new 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. 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.”

For example, it has been estimated that the CCS Zerogen project will cost $4.3 billion and involve 2,000 construction jobs².

And significantly, most heavy manufacturing that use fossil fuels as a feedstock (eg steelmaking and all chemical plants) will have to practice CCS rather than dumping the CO2 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.

Just the pipeline construction task associated with CCS will involve new skills and 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.

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.

Case Study B: Cotton Farming, Australian Cotton Industry 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 2008). 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.

One emerging international program in development is the Better Cotton Initiative, which aims to link improvements in environmental practices in cotton growing with buyer and other value chain actor commitments to sourcing ‘better (environmentally managed) cotton’.

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 1,792kg/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) (Source: ICAC, 2007).

In 1996 the cotton industry began an environmental focused stewardship program called Cotton BMP (best management practices). Initially, this was to implement the industry 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 Best Management Program (BMP) is an example of a continuous improvement program 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
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 program 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 program is that it is comprehensive, emphasises continuous improvement, and is readily auditable either at the firm/industry level and/or by a third party.

In 2007, the Australian government 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 summarised 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 programs.
- In NSW, the Diploma has been endorsed by the Registered Training Organisation, Tocal College. In Qld, the program has been taken up by the Australian Agricultural College Corporation.
- Innovations to the training program 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 recognised 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 program continues to evolve. More recently, the BMP program 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 program 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 program 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 in 2007 (Ernst and 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 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 regulatory environment will be underpinned by both a Renewable Energy Target (20 percent of energy consumption to be derived from renewable sources by 2020), and the impending Carbon Pollution Reduction Scheme (a commitment to reduce Australia’s carbon emissions by 25 percent from 2000 levels by 2020, via a carbon emissions trading scheme). These two key pieces of legislation will foster structural change throughout the Australian economy, but in particular support the renewable energy sector.

Research by the Climate Institute (2009) indicates that around 8 gigawatts of commercial scale renewable energy capacity is currently installed, compared to the 2020 target of 45 gigawatts. Over 1200 people are currently permanently employed in the operation and maintenance of clean energy facilities, in addition to supporting over 7300 indirect jobs. Their analysis further indicates that, in relation to existing, committed and planned clean energy projects, over 2400 direct permanent jobs are likely to be created, with a further 25,000 construction and indirect jobs being generated. This compares to global estimates in the wind energy sector alone of 85,000 direct jobs in the US 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 commercialisation 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 been 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 help provide indicative results.

The key result from a study by the Washington State Employment Security Department (2009) was that ‘green jobs’ are concentrated in a small number of industry classifications and occupational titles. The study obtained responses from 9500 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.

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

<table>
<thead>
<tr>
<th>NAICS**</th>
<th>NAICS TITLES</th>
<th>ENERGY EFFICIENCY</th>
<th>RENEWABLE ENERGY</th>
<th>REDUCING POLLUTION</th>
<th>MITIGATION OR POLLUTION CLEANUP</th>
<th>TOTAL EMPLOYMENT</th>
<th>GREEN JOBS AS A PERCENT OF INDUSTRY EMPLOYMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>230</td>
<td>Specialty Trade Contractors</td>
<td>12,215</td>
<td>218</td>
<td>1,152</td>
<td>341</td>
<td>12,955</td>
<td>1,810</td>
</tr>
<tr>
<td>240</td>
<td>Professional and Technical Services</td>
<td>3,622</td>
<td>462</td>
<td>1,249</td>
<td>1,604</td>
<td>1,806</td>
<td>1,622</td>
</tr>
<tr>
<td>231</td>
<td>Crop Production</td>
<td>829</td>
<td>180</td>
<td>6,321</td>
<td>169</td>
<td>7,207</td>
<td>20,540</td>
</tr>
<tr>
<td>236</td>
<td>Construction of Buildings</td>
<td>5,397</td>
<td>311</td>
<td>1,045</td>
<td>300</td>
<td>6,781</td>
<td>5,031</td>
</tr>
<tr>
<td>492</td>
<td>Waste Mgmt. and Remediation Services</td>
<td>270</td>
<td>60</td>
<td>1,262</td>
<td>1,368</td>
<td>2,999</td>
<td>14,198</td>
</tr>
<tr>
<td>115</td>
<td>Agriculture and Forestry Support Activities</td>
<td>140</td>
<td>160</td>
<td>1,049</td>
<td>134</td>
<td>2,364</td>
<td>10,293</td>
</tr>
<tr>
<td>423</td>
<td>Merchant Wholesalers, Durable Goods</td>
<td>334</td>
<td>10</td>
<td>661</td>
<td>97</td>
<td>332</td>
<td>80,099</td>
</tr>
<tr>
<td>327</td>
<td>Nonmetallic Mineral Products Manufacturing</td>
<td>140</td>
<td>1</td>
<td>215</td>
<td>53</td>
<td>190</td>
<td>10,865</td>
</tr>
<tr>
<td>355</td>
<td>Electrical Equip. and Appliance Repair</td>
<td>360</td>
<td>200</td>
<td>34</td>
<td>-</td>
<td>264</td>
<td>4,285</td>
</tr>
<tr>
<td>221</td>
<td>Utilities</td>
<td>622</td>
<td>56</td>
<td>1</td>
<td>1</td>
<td>679</td>
<td>4,069</td>
</tr>
<tr>
<td>237</td>
<td>Heavy and Civil Engineering Construction</td>
<td>201</td>
<td>55</td>
<td>102</td>
<td>26</td>
<td>222</td>
<td>23,094</td>
</tr>
<tr>
<td>111</td>
<td>Animal Production</td>
<td>40</td>
<td>42</td>
<td>225</td>
<td>154</td>
<td>409</td>
<td>1,170</td>
</tr>
<tr>
<td>522</td>
<td>Credit Intermediation and Related Activities</td>
<td>400</td>
<td>2</td>
<td>3</td>
<td>412</td>
<td>522</td>
<td>0.9%</td>
</tr>
<tr>
<td>234</td>
<td>Forestry and Logging</td>
<td>2</td>
<td>60</td>
<td>205</td>
<td>59</td>
<td>404</td>
<td>3,096</td>
</tr>
<tr>
<td>325</td>
<td>Plastics and Rubber Products Manufacture</td>
<td>299</td>
<td>2</td>
<td>105</td>
<td>64</td>
<td>374</td>
<td>10,639</td>
</tr>
<tr>
<td>413</td>
<td>Membership Assoc., and Organization</td>
<td>11</td>
<td>0</td>
<td>261</td>
<td>55</td>
<td>314</td>
<td>26,599</td>
</tr>
<tr>
<td>321</td>
<td>Wood Products Manufacturing</td>
<td>114</td>
<td>65</td>
<td>0</td>
<td>391</td>
<td>19,035</td>
<td>1.0%</td>
</tr>
<tr>
<td>332</td>
<td>Fabricated Metal Products Manufacturing</td>
<td>94</td>
<td>34</td>
<td>155</td>
<td>25</td>
<td>169</td>
<td>11,712</td>
</tr>
<tr>
<td>311</td>
<td>Repair and Maintenance</td>
<td>46</td>
<td>3</td>
<td>13</td>
<td>4</td>
<td>136</td>
<td>26,663</td>
</tr>
<tr>
<td>454</td>
<td>Nurseries and Related Businesses</td>
<td>43</td>
<td>1</td>
<td>29</td>
<td>6</td>
<td>78</td>
<td>18,915</td>
</tr>
<tr>
<td>321</td>
<td>Real Estate</td>
<td>46</td>
<td>-</td>
<td>5</td>
<td>3</td>
<td>55</td>
<td>37,097</td>
</tr>
<tr>
<td>334</td>
<td>Computer and Electronic Products Manufacture</td>
<td>1</td>
<td>48</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>22,873</td>
</tr>
<tr>
<td>325</td>
<td>Chemical Manufacturing</td>
<td>2</td>
<td>7</td>
<td>-</td>
<td>1</td>
<td>14</td>
<td>6,003</td>
</tr>
<tr>
<td>322</td>
<td>Paper Manufacturing</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>1</td>
<td>12</td>
<td>11,171</td>
</tr>
<tr>
<td>144</td>
<td>Fishing, Hunting and Trapping</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>10</td>
<td>1,004</td>
</tr>
<tr>
<td>336</td>
<td>Transportation Equipment Manufacturing</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6</td>
<td>6</td>
<td>62,731</td>
</tr>
<tr>
<td>523</td>
<td>Securities, Commodity Contracts, Investments</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>10,882</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>24,070</td>
<td>2,027</td>
<td>15,676</td>
<td>2,483</td>
<td>47,194*</td>
<td>914,211</td>
</tr>
</tbody>
</table>

| Source: Lee et. al. (2009) |

Moreover, the top twenty-five 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. Together these accounted for around 30 per cent of total green employment.

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

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.

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 specialised 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 Green Plumbers training program 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 noted earlier (Section 2.3.2), Australia’s eleven Industry Skills Councils are responsible for identifying and responding to the skills needs of their respective industries, namely through the delivery of training in the vocational education sector. Some of the key ISCs in relation to the ‘greening’ of existing occupations include the Construction and Property Services, Agri-foods, Electrocomms and Energy Utilities, Government Skills Australia, and Service Skills ISCs.

Each of these industry skills councils 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 packages to target more sustainable waste management and building design and construction.

- In Agri-foods, several important initiatives are underway, including for instance the Cotton BMP case study later in the paper. Another such initiative seeks to embed environmental and social sustainability into all training programs. 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 recognise 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 of 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.

• 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 recognise that in such workplaces, organisational 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, Technical and Further Education (TAFE) institutes in different states, together with Registered Training Organisations (RTOs) now offer courses covering areas as broad as sustainable building design, electrotechnology, conservation and land management, and waste management. These courses provide nationally recognised qualifications ranging from Certificate I to Advanced Diplomas, and have been designed in collaboration with the Industry Skill Councils 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.

### 3.2.4 Skills Response

While a fragmentation of skills policies by State and industry has been a feature of Australia’s advancement of the 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 recognise that the supply of green skills is in some respects secondary to establishing stable and supportive policy settings for the growth in 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.

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, and its timing, is settled, we anticipate that there is capacity to quickly take the next step in green skilling the Australian workforce. The National 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.
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:

- Prioritise availability and uptake of training related to environmental sustainability, through the provision of subsidies for accredited training;
- Build training capacity of trainers and training organisations;
- 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 programs.

The implementation plan identifies nine priority industries, based on their contribution to carbon emissions and potential for the vocational education and training (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 by registered training organisations (RTO). 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
- 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
- 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 programs, 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.
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 1100 waste management services firms, contributing $2.7 billion (or 0.2% of GDP) to the Australian economy.

The Victorian Advanced Resource Recovery Initiative (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 fertilisers.

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 specialised 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 commercialisation 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 council’s 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 minimisation strategies and/or alternative waste processing options.

The introduction of the CPRS will apply additional cost to the landfill gate fee and/or any process of solid waste management disposal which generates greenhouse emissions. The amount of additional cost will vary depending on the relative level of greenhouse gases produced, although the solid waste sector is currently proposed to be a covered sector under the CPRS. It is unknown how a CPRS will affect the sector over time, but it is assumed that the cost of waste disposal to landfill will increase.

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 specialised 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 recognised 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 Organise 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 specialisations, 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 program 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 (CVEN9892) 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 university course.

“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 percent of global capacity, and a 25 percent 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 specialising 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, vocational education and training (VET) is delivered through a combination of Technical and Further Education (TAFE) institutes and Registered Training Organisations (RTOs), with modularised 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 specialisations. 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 recognises 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 mobilised 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 programs, 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, trialled and commercialised, 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. 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. 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.
Advanced Diploma in Renewable Energy, Skills Tech Australia

TPNUER01 Introduction to Renewable Energy
   TPNB02 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
   TPVB0297 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
   TPNUE213 OHS Implementation and Monitoring
   TPEA071 Planning Estimating & Costing
   TPRET008 Small Business Management
   TPEB079 Introduction to Marketing
TPNCS011 Client Interaction
TPEA070 Engineering Organisations
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 specialisation 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% of the water industry workforce. Engineer professionals comprise 13% of the workforce, the majority (70%) of these are Civil Engineers.³

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 twenty-one 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 mobilised.

In 2005, the national industry skills council related to government services and administration, and committed to providing training and resources to the sector, 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 specialised 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 programs in Integrated Water Management. This program
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 twelve and twenty-six, 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 specialised 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 optimising 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

The professional, technical and scientific services sector comprises of over 779,000 jobs in Australia, representing about 7 percent of the national workforce (ABS, 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.

Ernst & Young is a private professional services firm which has built a specialised 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 Ernst & Young 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 Ernst & Young 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 commercialisation 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 specialised 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 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 Ernst & Young, 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 impending 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 (eg USA, EU, Japan, China, India Brazil, Indonesia) 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 Ernst & Young 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 Ernst & Young 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 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 Ernst & Young acknowledge that training organisations, regulatory programs 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.

Ernst and Young 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 Ernst & Young 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 programs 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, Ernst & Young’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 programs 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 programs 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 group training organisation which provides apprentices to business, industry and government, and is dedicated to building networks of employers, training providers and apprentices and trainees in order to maximise opportunities for all. Their GreenSkills Program commenced in April 2009, supported by the NSW Department of Education and Training, and 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 program, WPC seeks to develop an understanding of the skills needs of the green economy, and linking these to training providers.

WPC Group currently employs more than 400 apprentices, working with over 200 host employers across numerous industries. As part of the GreenSkills Program, WPC seeks to build a panel of 60 host employers to work with the GreenSkills apprentices. They 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 program is targeting thirty placements in the first year of operation, and has already placed sixteen, with a strong probability of a further twelve in 2009 alone. These apprentices generally have vocational qualifications at a Certificate III level, relating mostly to business services, 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 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 customised ‘green’ versions of traditional traineeships and apprenticeships, as well as welcome the integration of sustainability modules into broader scopes of learning.

Awaiting additional input from company to complete
Case Study H – Green Plumbing Initiative

It is estimated that up to 70% 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% of their total water use on toilet flushing with a further 35% 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® program 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 programs 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 program is a post-trade training program, 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 programs 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™.
In Victoria, a new $9 million training centre, the Plumbing Industry Climate Action Centre, has recently been opened, which was jointly funded by the employers, union, and state government.

The program has also recently been expanded into New Zealand and North America, as Governments there realise 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 program. Under the agreement up to 40,000 California plumbers will receive training in water and energy saving methods, developed under the program. 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 5 separate nationally accredited units with recognised 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 program focuses on:
  - Hot Water Heating
  - Heating & Cooling
  - Greenhouse Gas Reduction
  - Customer Service
  - Energy Star Ratings (electric and gas)

The GreenPlumbers® - Climate Care program has seen the involvement of over 50 councils throughout rural and metropolitan Victoria and interstate (QLD & Tasmania) with over 600 plumbers accredited. The program 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% of total household greenhouse gas (GHG), emissions and 27% of total energy use, while home heating and cooling appliances contribute a further 14% GHG and 39% of home energy costs. This program 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 7 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 3 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 dont\'s)
- greywater treatment systems
- environmental & 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, cat.no.5249), 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 recognised 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 kilometres 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 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 recognising the demand for green tourism, and working to meet that demand with the appropriate technical and business skills. The workshop encourages 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 (RRRPGP), which committed $300 million in renewable energy projects in remote areas, largely by providing up to 50% 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 programs (between ten and twenty years) are in fact less than the typical twenty-five 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 indicated 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**

- UEEENEE017B Implement and monitor OHS policies and procedures
- UEEENEE024B Compile and produce an electrotechnology report
- UEEENEE038B Participate in development and follow a personal competency development plan
- UEEENEEK023B Carry out repairs to renewable energy apparatus by replacement of components
- UEEENEEK025B Solve basic problems in photovoltaic energy apparatus
- UEEENEEG012B Source and purchase materials/parts for installation or service jobs
- UEEENEEG010B Deliver a service to customers
- UEEENEEG020B Provide basic instruction in the use of electrotechnology apparatus
- UEEENEEK028B Solve problems in stand alone renewable energy systems
- UEEENEEK026B Install and set up grid connect photovoltaic power systems
- UEEENEEK027B Diagnose faults in renewable energy control systems
- UEEENEEK030B Solve problems in wind energy conversion systems
- UEEENEEK034B Install stand alone photovoltaic power systems
- UEEENEEG038B Design micro hydro systems
- UEEENEEG071B Install and set up interval metering
- UEEENEEK035B Design grid connected power supply systems
- UEEENEEK039B 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 percent 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 specialised training needs. The operators strongly emphasise, 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 heralds 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 regime change, with the cornerstone pieces of legislation, the Renewable Energy Target and the Carbon Pollution Reduction Scheme, aiming to move Australia quickly to a carbon constrained economy. This will have significant repercussions particularly on 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 role of early legislative action ahead of major international agreements such as Copenhagen, 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 Skill 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:

- A key driver across all industries affected by the rise of the green economy, be it industries such as mining which will be adversely affected by the introduction of an emissions trading scheme, or those newly emerging such as wind and solar energy, as well as those whose occupations will be reshaped by green skill requirements such as plumbing, will be regulatory and policy settings. This extends critically both to the incentives put in place
to drive behavioural and business change, as well as the certainty underpinning these initiatives.

- 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 commercialisation 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 is 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 US, 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 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 co-ordinated (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 economy.

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. 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. Educational 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, several State governments have been moving rapidly to meet the current and expected future skill demands associated with greening the economy, and while there is more to do in building training capacity, an overriding issue is currently the wider regulatory settings that will drive demand for the skills.
5. Policy Recommendations

5.1 Climate and Skills Policy

- It is clear that the key policy issue facing Australia relates to the emissions abatement framework legislation that will drive the future pace and scale of emissions reduction. We are awaiting introduction of RET, CPRS and the implications of upcoming global negotiations at Copenhagen. Currently also, debate in Australia has been stalled partly by the focus taken by the global financial crisis, but also by its politicisation by both party politics, and also by special interest groups. In the meantime, the nature of assistance to EITEs is still to be fleshed out. 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 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 an economy. In Australia, Industry Skills Councils (ISCs) play a pivotal role in that regard. Current funding arrangements may need to be better targeted, or made more conditional on embedding the green skills challenges into industry training and in developing vocational training to meet changing industry demand.

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 in many respects a moving target. Once some certainty emerges in our understanding of the historic changes to work that is entailed there is a need to standardise 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 we don’t know is who is using the skills and going to use the skills that are being generated by these programs and with what effect. Further analysis on the uptake and appropriateness of green skills courses currently available would be very useful in guiding training policy.
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