DUSSELDORP SKILLS FORUM

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Mr Ian de Cruz
Project Director
Garnaut Climate Change Review
Level 2, 1 Treasury Place
Melbourne, Victoria 3002

11 April 2008

Dear Ian

Garnaut Review:
DSF Submission in conjunction with CSIRO Sustainable Ecosystems Division

I have pleasure in attaching ***Skills and labour challenges in moving to a low carbon economy: Summary of the DSF green collar project***.

This summary paper is the first stage of a larger project the Dusseldorp Skills Forum has commissioned from the CSIRO Sustainable Ecosystems Division.

The aim of the project is to

- critically review the possible employment outcomes of various carbon emission reduction scenarios;
- the preparedness of Australia's human capital stock to respond to the challenge of climate change; and
- the adequacy of existing skills and innovation policy settings in relation to climate change.

The project is due for completion by June, and we would like to submit the final paper for consideration by Professor Garnaut and the review team.

Further to my correspondence with you in January this year, we look forward to a positive relationship between the Review and the various pieces of work we have commissioned and have under consideration.

We look forward to further discussion and co-operation, and hope that this work by the team at CSIRO will helpful in informing the Review of possible policy directions and recommendations.

Sincerely

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Skills and labour challenges in moving to a low carbon economy:

Summary of the DSF green collar project

Submission to the Garnaut Review, April 2008

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April 2008

This report summarises results of a continuing research project, and was commissioned by the Dusseldorp Skills Forum. The authors would like to thank The Climate Institute for permission to use and present the data presented in Section 2 of this report.

We suggest this report be cited as follows:

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CONTENTS

SKILLS AND LABOUR CHALLENGES IN MOVING TO A LOW CARBON ECONOMY

Summary of the DSF green collar jobs project

1. INTRODUCTION

This submission summarises research and analysis currently in train for the Dusseldorp Skills Forum on the skills, innovation and workforce dimensions of the transition to a more environmentally sustainable society, with a particular focus on the challenges involved in achieving deep cuts in greenhouse emissions.

The relationship between economic growth and the environment has been a hotly contested issue since the early 1960s. Recent years have seen an emerging consensus around a number of important points, however. First, increases in income per person and the total value of economic activity are strongly associated with increases in various pressures on the environment. Second, changes in policy settings and institutional arrangements can moderate these pressures, acting to buffer the relationship between economic growth and the environment. Third, these changes will not occur automatically through market processes, however, and require attention and action by citizens and policy makers to guide and harness market forces in achieving sustainable development [Arrow et al 1995, Spangenberg and Lorek 2002, Hatfield-Dodds et al 2008, Sachs 2008, OECD 2008]

Human effort, ingenuity and technology underlie most of the environmental challenges of the twenty first century. Human labour, skills and knowledge underpin and drive the extraction and transformation of resources, the production of goods and services, and the generation of waste and emissions – modifying ecosystems through changes in land use (such as agriculture or urban expansion), and through the introduction of pests and pollutants.

Yet these same human resources are central to achieving social and ecological sustainability. Participation in paid work is central to social status, self-image, social integration and security. Human capital is the most valuable component of the economic wealth of nations, accounting for more than 75% of the total asset base of high income nations, and 40-60% in developing nations [Hamilton et al 2006]. Achieving full employment and minimising involuntary unemployment are thus important social and economic goals.

This submission summarises our findings to date. Section 2 presents insights from economic modelling into the scale of the skills and employment challenges presented by the shift to a low carbon economy. Section 3 identifies three key strands of a coherent and systematic response to the skills challenges associated with this transition: establishing incentives for environmental performance; providing green skills and training; and promoting a stronger innovation culture.

2. THE SCALE OF THE CHALLENGE

The Australian Government is committed to reducing greenhouse emissions by 60%, with influential voices suggesting that far deeper cuts could be in our national interest [Garnaut 2008]. Achieving such reductions will require significant changes from current trends in energy use and economic activity.

The research for DSF explores the scale of this challenge by reviewing the employment dimensions of existing national modelling of major economic transitions. This draws on two very different modelling approaches: the CSIRO Australian Stocks and Flows Framework (ASFF), a technology focused physical model of the Australian economy; and the Monash University MMRF-Green model, a computable general equilibrium (CGE) model of the Australian economy with enhanced detail of electricity generation, other energy products, and greenhouse emissions accounting.

Australian environment-employment interactions have been explored by a number of authors [such as Annadale et al 2004, Diesendorf 2004, Lawn 2006]. The scale of likely future employment impacts associated with the introduction of emissions trading has also been explored using CGE models a number of times over recent years. This report uses previously unpublished data from economic modelling undertaken for The Climate Institute [Hatfield-Dodds et al 2007], and released in December 2007. This modelling analysed the impact of Australia achieving emissions reductions of 40%, 60% and 100% by 2050, assuming global action to reduce emissions by around 50%, and allowing Australian emissions reductions to be achieved – in part – through purchase of international emission credits.

Scenario overview

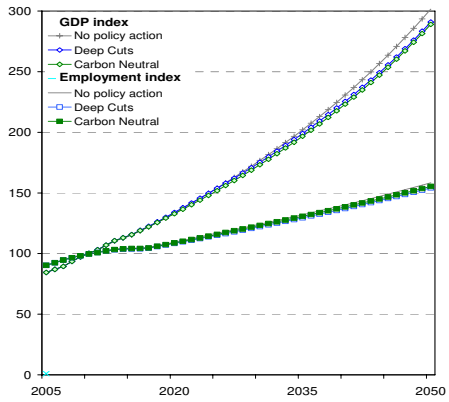
The current analysis focuses on two scenarios from this previous modelling. *Deep Cuts* involves a 60% reduction in emissions without significant tax reform. (This scenario was used for sensitivity analysis, and is a variant of the Follower scenario in the main report [see Hatfield Dodds et al 2007 p.39]). *Carbon Neutral* involves a 100% reduction in net emissions (of which around a third is achieved through purchase of international credits) and one-off tax reform to increase employment and participation. This results in the Carbon Neutral scenario having higher national employment growth and a more rapid reorientation of economic activity than occurs in the Deep Cuts scenario.

The high level findings on economic outcomes are similar for the two scenarios, as shown in the first panel of Figure 1. The value of economic activity increases by 50% from 2010 to 2025 and trebles by 2050: Employment increases around 15% by 2025 and 55% by 2050, in line with population growth. These increases are lower than projected in the absence of policy action (referred to as the base case). Annual employment growth is 0.04% lower, with a cumulative employment gap of 0.1% by 2030. Annual GNP and GDP growth is projected to be 0.02-0.10 lower that it would otherwise be, resulting in a cumulative performance gap of around 2% by 2030.

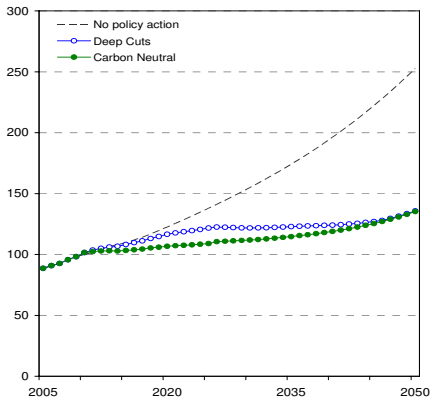
The relatively minor economic impacts of emissions reductions contrast with the dramatic changes in physical flows. Energy use plateaus around 35% higher than 2010 levels, rather than rising 150% by 2050 (as shown in Figure 1). Gross greenhouse emissions (before accounting for international credits) fall by two thirds rather than doubling. The modelling thus suggests that emissions' trading is able to effectively decouple economic activity from energy use and greenhouse emissions, although these scenarios do not address other material flows, such as water use.

Figure 1 Overview of outcomes of emission reduction scenarios
(index 2010 = 100)

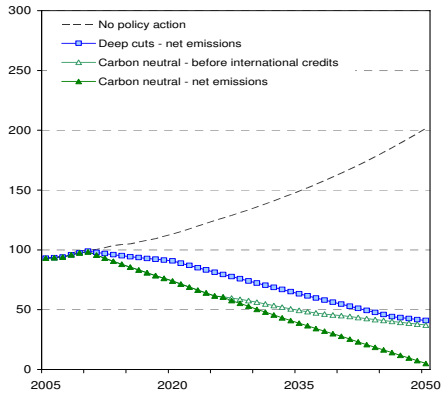
a) Economic growth and employment



(b) Final energy use



(c) Greenhouse gas emissions



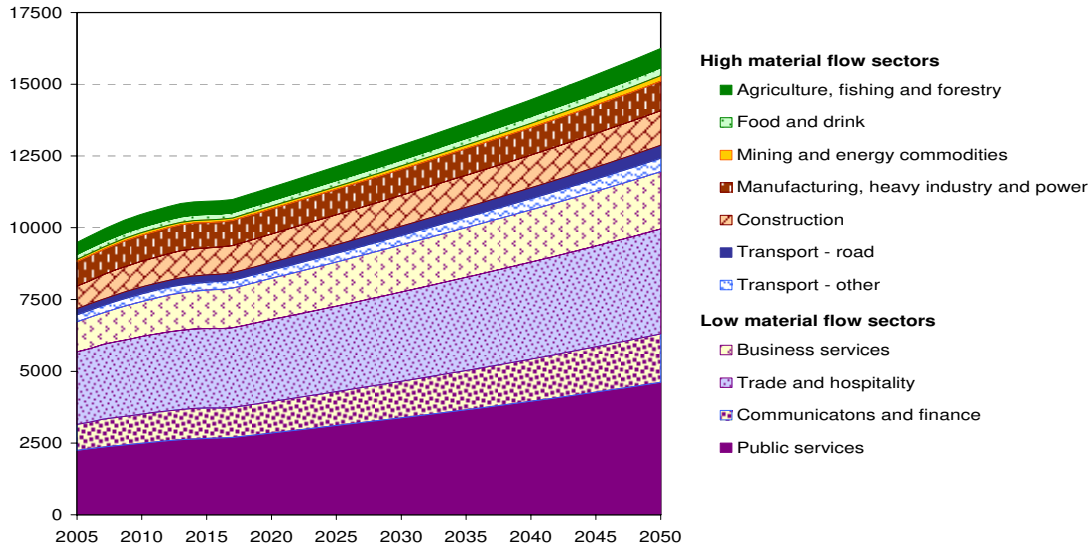
Source: Data from The Climate Institute, see Hatfield-Dodds et al 2007

Projected employment outcomes

The modelling, which is calibrated to match the second Treasury Intergenerational Report, suggests around 2.5 million jobs will be created over the twenty years to 2025. Our analysis groups the 54 product sectors used in the model into eleven major economic sectors, including seven sectors with high potential environmental impacts and four service sectors with relatively low potential environmental impacts. This is consistent with the analysis of other researchers, who have found that construction and housing, food and nutrition and transport and mobility account for nearly 70% of material extraction and energy consumption and more than 90% of land use in industrial economies such as Australia [Spangenberg and Lorek 2002].

We find that sectoral employment shares appear stable over the period, despite the introduction of emissions trading and the adoption of ambitious emissions targets, as shown in Figure 2. The high impact sectors account for around 28% of total employment over the period modelled.

Figure 2 Employment by major sector, Deep Cuts scenario, 2005-2050

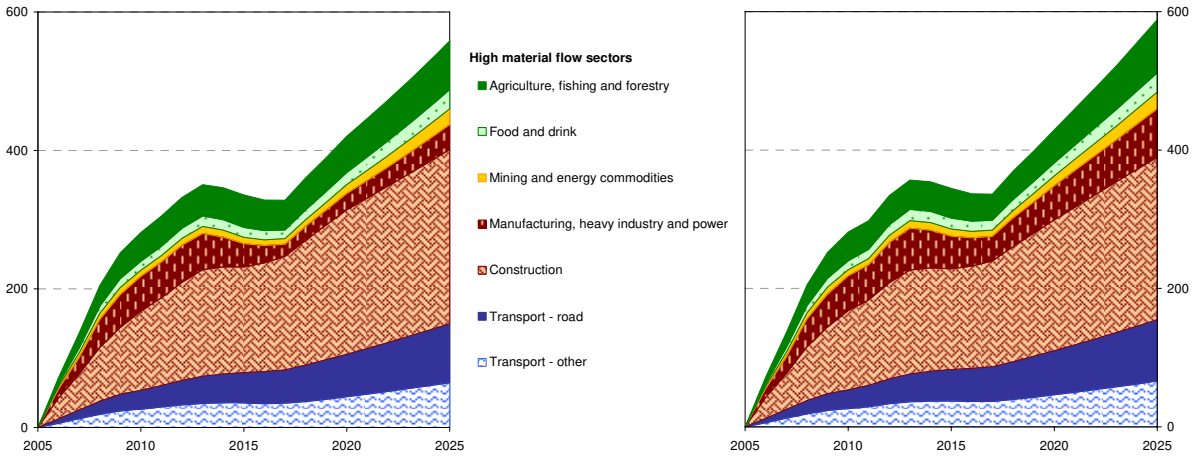


Source: Unpublished data from The Climate Institute, see Hatfield-Dodds et al 2007

Closer examination reveals a more dynamic picture. Data presented in Table 2 (below) indicates that all sectors experience net employment growth from 2005, but that most of the high material flow sectors grow more slowly than the national average. More detail is provided in Figure 3 on increases in sectoral employment from 2005. Employment in construction and road transport sectors grows more rapidly than the national average, with these two sectors accounting for more than half of all new employment in the high material flows sectors. The construction sector makes the largest contribution, accounting for 8% of total employment and 10% of national employment growth from 2005, with a projected increase of 150,000 jobs by 2015 and more than 235,000 jobs by 2025. These increases are in addition to normal labour turnover (such as due to retirement of existing workers).

Figure 3 Change in employment in high material flow sectors, 2005-2025

(a) Deep Cuts scenario *(b) Carbon Neutral scenario*



Source: Unpublished data from The Climate Institute, see Hatfield-Dodds et al 2007

The introduction of emissions trading in 2010 appears to slow the growth of the manufacturing and heavy industry sector, despite the modelling providing full insulation of trade exposed energy intensive industries until 2020, and partial insulation until 2030. The modelling indicates that employment in this sector contracts slightly for several years, while remaining above 2005 levels, and then begins to grow modestly. These contractions are small, even at the more detailed sub-sector level, and are likely to be smaller than annual labour turn-over. Importantly, value added for the manufacturing, heavy industry and power sector grows each year throughout this period, without any contraction, with an average growth rate of 2.5% per annum from 2010 to 2020.

Table 2 Change in employment and sector employment shares, 2005-2025

	Change in Employment				Employment share	
	2005 – 2015		2005 - 2025		2005	2025
High potential environmental impact sectors						
Agriculture, fishing and forestry	43,000 – 47,000	+11%	70,600 – 76,900	+18%	4%	4%
Food and drink	14,100 – 15,800	+9%	27,600 – 27,800	+16%	2%	2%
Mining and energy commodities	9,500 – 10,500	+12%	22,800 – 24,300	+28% to +30%	1%	1%
Manufacturing, heavy industry and power	33,400 – 47,100	+4% to +6%	36,100 – 69,800	+4 to +8%	9%	7%
Transport – road	44,100 – 45,700	+21%	85,200 – 88,600	+40% to +42%	2%	2%
Transport – other	35,200 – 37,200	+15%	64,500 – 66,200	+27%	3%	3%
Construction	145,500 – 152,400	+19%	235,000 – 251,500	+31%	8%	8%
	335,700 – 344,700	**+12%**	**558,200 – 588,500**	**+21%**	**28%**	**27%**
Low potential environmental impact sectors						
Business services	290,100 - 293,500	+28%	489,400 – 494,00	+47%	11%	13%
Communications and finance	148,000 – 153,300	+17%	274,400 – 281,500	+31%	10%	10%
Trade and hospitality	240,700 – 247,400	+10%	449,300 – 458,400	+18%	27%	24%
Public services	420,300 – 429,300	+19%	867,400 – 886,600	+39%	24%	26%
	1,099,200 – 1,123,500	**+17%**	**2,080,500 – 2,120,400**	**+31%**	**72%**	**73%**
Total	**1,434,900 – 1,468,200**	**+15%**	**2,638,700 – 2,708,900**	**+28%**	**100%**	**100%**

Source: Unpublished data from The Climate Institute for the *Deep Cuts* and *Carbon Neutral* scenarios, as described in text. See Hatfield-Dodds et al 2007

3. NATURE OF THE RESPONSE REQUIRED

The modelling reviewed above indicates very significant increases in employment across a range of sectors that are crucial to achieving the transition to a low carbon, and more energy efficient, economy.

Yet these raw numbers – the creation of at least 33,000 new jobs in manufacturing, 77,000 jobs in transport, and 145,000 jobs in construction over ten years – understate the nature and extent of the challenge. The real challenges will lie in providing appropriate skills to these new workers while also supporting the re-skilling of the 2.9 million workers who are currently employed in these high impact sectors.

We consider that a systems approach is required to address these multiple challenges, involving three key strands of effort:

- Improved incentives for environmental performance
- Providing green skills and training
- Promoting a stronger innovation culture

Improved incentives for environmental performance

Public policy settings are an important part of the institutional context of economic activity. These settings, and more general social norms and expectations, act as part of the evolutionary environment of businesses, shaping the selection pressures that reward some ideas and behaviours and penalise others. The introduction of emissions trading will create new market niches, business opportunities, and pressures for change that will continue to evolve and interact with other trends in ways that regulation or government programs would find difficult to emulate.

Emissions trading is also likely to be accompanied, over time, by other changes in policy settings, such as changes to planning and building regulations, disclosure and accreditation standards, and potential changes to water pricing and entitlements.

New information also can have incentive effects, such as by helping to scope social and economic needs and opportunities, providing insight into current performance, or revealing hidden costs or risks associated with existing practices. Well structured and reliable information is particularly important for decisions with long legacy effects, such as the design and construction of buildings and infrastructure, or decisions that shape the future of communities. An increasing number of decisions over coming decades will need to grapple with aspects of adapting to the direct impacts of projected changes in climate, taking account of the resilience and vulnerability of key social groups, as well as working towards reductions in national emissions.

Improved policy settings and information will – if well designed – provide social and economic incentives for continued reductions in environmental pressure, while promoting improved living standards, and enhanced social and economic options.

Providing green skills and training

A flexible and efficient response to emissions trading will place a premium on currently scarce skills, in an economy that is already struggling with high employment demand and skill deficits. Demand will increase for the design and construction of energy and water efficient buildings and infrastructure, renovations and retrofits, and the installation and maintenance of efficient appliances and machinery. Skill needs will include technical and trade skills, design and engineering, assessment and accreditation, reliable product and market knowledge, and supply and post-sale support.

These needs will not be restricted to the construction or manufacturing sectors. Emissions trading is likely to catalyse new attention to supply chain management, building services, transport and logistics. These are core issues for many retail and

wholesale businesses and niche business service providers. Attention from customers and shareholders will reinforce policy signals about efficient energy and resource use, reinforcing normal sound business principles, and draw new attention to the insights from 'corporate social responsibility or 'eco-efficiency' into profitable business opportunities.

Promoting a stronger innovation culture

Making the transition to a low carbon and more resource efficient economy will require ingenuity and innovation across all sectors of society and the economy. Much of this is likely to occur spontaneously as a result of new incentives and information. Experience suggests that significant changes in social and economic organisation require experimentation and innovation, usually outside or at the edges of the dominant regime and associated mainstream structures. These innovative practices can be enabled by encouraging experimentation or learning activities in niches that are protected, for a period, from mainstream pressures or expectations. This strategic niche management is an important aspect of applied sustainability policy in the Netherlands. Innovation can also be supported by nurturing stronger linkages and partnerships between different types of actors within the innovation system – especially entrepreneurs, small and medium enterprises, and business oriented staff within research organisations – in order to help bring commercially relevant innovations to market. Lastly, innovation can be fostered simply by providing tangible signals that critical and imaginative thinking is valued and esteemed within organisations and in the nation as a whole. This might be achieved by initiating 'innovation harvests' where all employees are encouraged to make suggestions on how to improve work practices and productivity, or through initiating deliberate processes to review, evaluate and re-imagine core organisational and operational processes, or by greater public recognition of the contributions of innovators.

Each of these strands has a necessary but not sufficient contribution to meeting the challenges of making deep cuts in greenhouse emissions, and promoting a happier and more sustainable society. This of itself raises serious policy and implementation challenges, as carriage for these different strands are divided between departments and levels of government. While specialisation and focus have important benefits in policy delivery, just as they do in business, extra care will need to be taken to ensure these different arms of policy effort work effectively with each other, rather than each working in isolation from – or even against – the others. For example, implementing a national retrofit program or ambitious energy efficiency and insulation improvements in public housing could make an important contribution to national emissions reductions, but would risk exacerbating green trade skill deficits if action is not also taken to boost skills and workforce capacity. But boosting trade skills alone will not be sufficient without increased attention to design, and the choices and information available to those who specify performance standards for home and building fit-outs.

This implies that systematic attention to human skills and labour will play an important role in implementing worthwhile national action to address climate change. Human skills, passion, and ingenuity are central to each component of a coherent strategy, and to meeting the multiple challenges ahead.

REFERENCES

Annandale, David, Angus Morrison-Saunders, Louise Duxbury 2004. Regional sustainability initiatives: the growth of green jobs in Australia. *Local Environment* 9(1): 81-87.

Arrow, K.J., B. Bolin, R. Costanza, P. Dasgupta, C. Folke, C.S. Holling, B-O Jansson, S. Levin, K-G. Mäler, C. Perrings, D. Pimental, 1995, 'Economic growth, carrying capacity, and the environment', *Science* 268:520-521

Diesendorf, Mark 2004. Comparison of employment potential of the coal and wind power industries. *International Journal of Environment, Workplace and Employment*. 1(1): 82-90.

Garnaut Climate Change Review, 2008, Interim Report to the Commonwealth, State and Territory Governments of Australia, February 2008, Garnaut Climate Change Review, Melbourne.

Hamilton, K., et al, 2006, *Where is the Wealt of nations? Measuring Capital for the 21st Century*, World Bank, Washington DC.

Hatfield-Dodds, S, R Nelson and D Cook (2008) 'Adaptive governance: An introduction, and implications for public policy', under review for *Global Environmental Change*

Hatfield-Dodds, S., Jackson, E.K., Adams, P.D. and Gerardi, W. (2007), Leader, follower or free rider? The economic impacts of different Australian emission targets, The Climate Institute, Sydney, Australia.

Lawn, Philipp 2006. Ecological tax reform and the double dividend of ecological sustainability and low unemployment: an empirical assessment. *International Journal of Environment, Workplace and Employment*. 2(4): 332-358.

OCED, 2008, *OECD Environmental Outlook to 2030*, OCED, Paris

Sachs, J. 2008, *Common Wealth: Economics for a crowded planet*, Penguin Press, New York

Spangenberg, J.H. and S. Lorek, 2002, 'Environmentally sustainable household consumption: from aggregate environmental pressures to priority fields of action', *Ecological Economics* 43 (December 2002) pp.127-140