

PRIME MINISTER'S SCIENCE, ENGINEERING AND INNOVATION COUNCIL

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AGENDA ITEM 2

FROM DEFENCE TO ATTACK: AUSTRALIA'S RESPONSE TO THE GREENHOUSE EFFECT

A paper prepared by a Working Group for consideration by PMSEIC¹

Introduction

Scientists have provided clear evidence that industrial and agricultural activities over the last century have contributed to a change in the composition of the atmosphere. The levels of concentration of greenhouse gases, which contribute to atmospheric warming, have increased. As a result, a significant change in global climate is predicted with a range of impacts, some of them adverse, on natural ecosystems and physical structures.

That the greenhouse phenomenon is cause for global concern has been endorsed by a number of international fora over the last decade. These include the 1992 United Nations Framework Convention on Climate Change which obliged nations, including Australia, to focus on climate change. Atmospheric carbon dioxide concentrations and mean global temperature are increasing. Climate will change further in the future – with an expected rise of between 0.3 and 1.4 degrees in some parts of Australia in the next 30 years¹. Regional rainfall patterns are expected to change: more severe and frequent storm events may occur; there are implications for erosion control, pest and disease spread, irrigation and drainage system management, changing cropping patterns, and health and urban and rural infrastructure. We need to both mitigate greenhouse emissions and live with the effects of climate change.

Because climate change will affect environmental, social and economic systems of present and future generations, greenhouse response simultaneously links strongly to Australia's commitment to sustainability to meet developmental and environmental needs and achieve sustainability goals.

It was not until the 1997 meeting of the Conference of Parties to the Framework Convention on Climate Change in Kyoto that developed countries agreed to a Protocol establishing targets for

¹ Professor Don Nicklin AO (Chair)
Dr Tom Connor AO, Kinhill Pty Ltd
Dr John White, Chairman, Systems Engineering Consortium of Australia
Dr John Wright, Chief, CSIRO Energy Technology

the reduction in emission of greenhouse gases and provide for other ameliorating strategies. The Kyoto Protocol has presented Australia, and other countries, with a considerable challenge - how to reduce greenhouse gas emissions while retaining global economic competitiveness.

The Kyoto Protocol

Developed countries are striving to reduce their collective greenhouse emissions from 1990 levels by at least 5 per cent by 2008-2012. These commitments will become legally binding on countries that have ratified once the Protocol enters into force. Developing countries have no such obligation and there is little doubt that greenhouse gases will continue to accumulate in the decades ahead.

Australia's contribution to total global greenhouse gas emissions is relatively small, at about 1.4 per cent, but its per capita emissions are among the highest in the world. This reflects, for the most part, particular national circumstances: a high dependence on fossil fuels for energy production; a high proportion of energy intensive industries; major exports based on energy intensive products; and a high dependence on fossil fuels for transport, exacerbated by a high degree of decentralisation and a preponderance of road over rail transport. Nevertheless this high per capita figure will focus the attention of other players.

Australian emissions of greenhouse gases increased from 385 megatonnes of carbon dioxide equivalents (Mt CO_{2e})ⁱⁱ in 1990, to 419 Mt CO_{2e} in 1996. Three large sector emitters were energy, agriculture and transport (see Figure 1).

Not included in the table are the net emissions figure for land clearing at 90 Mt CO_{2e} in 1990 and 63 Mt CO_{2e} in 1996ⁱⁱⁱ.

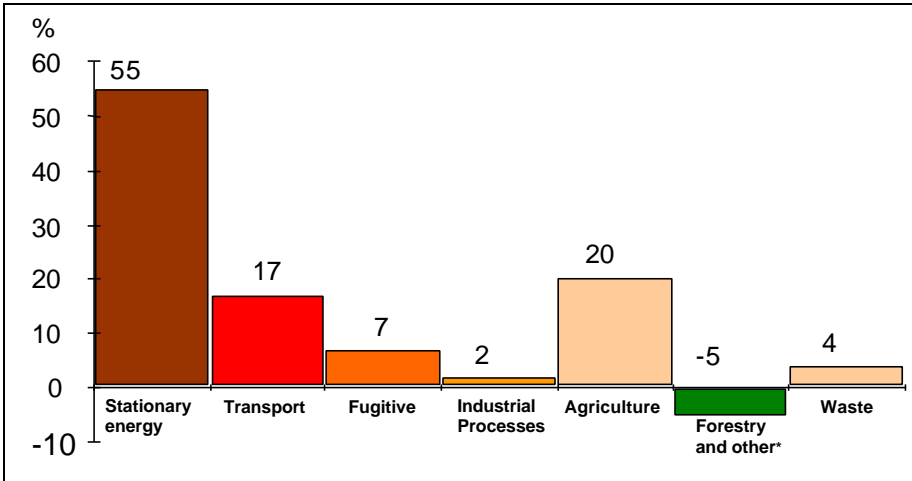


Figure 1. Australia's contribution to total CO_{2e} emissions by sector 1996 (excluding landclearing)

Australia was among the first developed nations to sign the Kyoto Protocol on 29 April 1998 accepting a negotiated target of an 8 per cent growth in greenhouse emissions over the 1990 baseline as a realistic target. However, even this will be a formidable challenge, requiring a cut of about 35 per cent, or some 135 million tonnes of carbon dioxide equivalent, from expected 'business as usual' growth by 2010. To put this into perspective, eliminating all Australian road transport, including private cars, would achieve a cut of 60 million tonnes of CO₂ equivalent^{iv}.

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The Australian target, however, is perceived internationally, and by some in Australia, as a generous target. It is not. It will be difficult to achieve, and will set real challenges for industry, government and society. On the other hand, action on greenhouse abatement offers Australia opportunities to show global leadership and innovation in meeting the new and emerging markets through the commercialisation of intellectual property and making use of it in new projects overseas.

Significance of the Kyoto Protocol

Importance of Kyoto to the world

Kyoto is a watershed in the global greenhouse debate.

It established a single measure of environmental performance - a measure to drive economic and industry performance, to be a trigger for innovation and perhaps to be a catalyst for a new brand of knowledge economy.

While still awaiting ratification, the Kyoto Protocol is seen by many governments as a first step in a collective response to climate change. The Protocol has already become an instrument of change. There is an interesting analogy with the General Agreement on Tariffs and Trade and the World Trade Organization, which similarly evolved from idea to reality. Countries not willing to join at the beginning eventually became drawn in by global processes, and paid the price for their delaying tactics.

The analogy extends to the evolution to reality of other, earlier industrial and social movements such as workplace safety, quality control, pollution abatement, and the 'Clean Up Australia' campaign. In each, attitudes changed from defence and denial, to recognition of opportunities, and ultimately to the realisation that what is right for the community in the long term can be good for the growth and profits of industry, from major corporations to small business operators. Increasingly the world's major corporations now accept this transition, and the acceptance of the so-called 'triple bottom line'^v, combining economic, social and environmental considerations, is one manifestation.

As a result, industry has already begun the process of 'decarbonising'. The profiles of many businesses, and their processes and products, are changing. Some will adapt well; others will resist or postpone change. The working group believes, however, that those industries and countries which choose to do nothing may well in the long run be severely disadvantaged, in terms of both their growth and their impact on the environment. The working group identifies this to be a fundamental issue.

Importance of Kyoto to Australia

While targets set at Kyoto are not yet legally binding the working group notes the expressed intention of the Australian government to act as if they were^{vi}. If we wait for ratification while other countries act, Australia runs the risk of missing out on global opportunities, and may be left behind in terms of greenhouse compliance. The working group considers this to be a fundamental point.

As yet the business sector has had little compulsion to become involved. Government, in the *National Greenhouse Strategy 1998*, has the challenge of encouraging the private sector to become closely involved, recognising the importance of partnerships between governments, industry and the community in delivering an effective greenhouse response.

Importance of Kyoto to the Marketplace

Kyoto created a potential market in greenhouse emissions.

An emissions trading system creates the potential to minimise the costs of achieving a given level of greenhouse gas abatement^{vii} and its utility in meeting emissions targets.

Carbon credits are an important element within a possible emissions trading system. Carbon sinks, such as forestry plantations, could be incorporated into an emissions trading system by allocating credits for the amount of carbon sequestered (eg stored in plants). Such an exchange is predicated on the ability of science to determine a sound basis for the measurement of carbon sinks and of countries to devise a global system. This creates the connection between greenhouse emissions, preservation of habitat and other sustainability issues such as salinity abatement and biodiversity.

The Australian government has yet to take decisions on whether to introduce a domestic emissions trading regime. Prior to this decision, stakeholders, including industry, the transport and energy sectors and the agricultural community will be invited to comment, recognising that, while emissions trading will benefit some sectors, it will offer considerable challenges to others.

Pending such a system, any action taken by business is purely speculative. Equally, however, businesses that are not already moving to incorporate the concept in their strategic plans are in danger of being left behind. Some companies which produce greenhouse emissions have begun pilot programs to establish carbon sinks (for example, Pacific Power and NSW State Forests are now collaborating in a pilot scheme).

Predictions of a permit price are highly uncertain. If the initial price is around \$30 per tonne equivalent of carbon dioxide as some argue, Australia's five year permits allocation would total some \$60 billion. Notably the net cost of abatement to the economy is likely to be only a fraction (10-30 per cent)^{viii} of that figure. The working group notes that it would be less expensive to adopt abatement measures necessary to meet the Kyoto targets than to purchase quotas covering all Australian emissions.

The Response to Kyoto

The Kyoto Protocol was a distinct watershed in the world's, and Australia's, perception of the greenhouse effect and the need for a response. It is a symbol of change for both governments and industry.

Kyoto has created a new business environment in which new industries, markets and technologies can flourish.

Seizing these opportunities in response to Kyoto is just one example of broader opportunities to be seized by business, technology and innovation to the emerging goal of sustainability.

Australian Government Action

In 1997 the Australian government established the Australian Greenhouse Office as the lead Commonwealth agency on greenhouse matters. In his statement in November 1997, *Safeguarding the Future: Australia's response to Climate Change*, the Prime Minister provided

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details of actions which demonstrated the government's commitment to an effective national greenhouse response. In November 1998 Governments released the National Greenhouse Strategy which provides the strategic framework for action to tackle greenhouse issues. With the most recent initiatives arising from the ANTS reform package announced by the Government in May 1999, Australia is now one of the world's leaders in combating Greenhouse.

Industry Response

Some leading international companies regard greenhouse gas response as a key driver for future economic opportunities and development. They are creating a position from which to take advantage of changing global policy, and forecast shifts in markets and consumer demand. Company boards and managers increasingly see the greenhouse world and climate change as serious business in terms of both profitability and image. Some global businesses are actively pushing beyond minimum activity ahead of policy makers, with reduction targets more ambitious than national reductions agreed at Kyoto. Examples include:

- Corporations are setting ambitious targets for greenhouse emission reductions, and adopting other ambitious agendas such as zero waste programs, development of pilot internal carbon-trading systems, use of existing and innovative technologies to reduce energy consumption and are diversifying their energy sources and products. BP-Amoco ARCO, Shell, Honeywell and Rank-Xerox are examples. *[see case study no.1(at the end of the paper) - international business]*
- The World Business Council on Sustainable Development^{ix} and the US based Pew Center^x are facilitating collaborative and co-operative consideration by big businesses.
- Automotive, energy and insurance industries are investing in greenhouse abatement through projects to promote photovoltaics, new vehicle technologies, other greenhouse emissions reducing industries and cheaper renewable energy, and policy initiatives such as the United Nations Environmental Program (UNEP) Insurance Initiative and Statement of Environmental Commitment by the Insurance Industry^{xi,xii}.

The reaction by the Australian business sector to the Kyoto Protocol has been mixed. Some sectors of industry have adopted, or even developed, international best practice, *[see case study no.2 - Visy's new pulp and paper mill]*. They have accepted the challenge to innovate in response to anticipated regulatory measures and to take advantage of opportunities created as businesses seek to reduce levels of waste, recycle and 'decarbonise'. More than 200 small and large businesses have joined the Greenhouse Challenge, Managing Energy for Profits and Greenhouse Allies under the aegis of the Australian Greenhouse Office and cleaner production and eco-efficiency programs run by Environment Australia – in many cases gaining business efficiencies with improved environmental performance, reduced energy consumption and lower greenhouse emissions.

The working group has identified a wide range of innovative activities developed by Australian industry in response to the greenhouse effect. Many have significant export potential for the emerging greenhouse abatement, or remote area markets. Others are still under development or at the pilot stage, or need help with commercialisation to break into export markets. Examples include projects in waste minimisation, recycling, efficient waste water treatment, improved agricultural practices and a reduced reliance on chemicals.

Other Australian businesses are hesitating in making positive commitments on greenhouse emissions. They see little incentive for early action, while the future recognition of early action, such as through credits under an emissions trading scheme, is uncertain. They have adopted a

'wait and see' approach, hoping others will move first. Land clearing has continued, and road transport has continued to gain public investment over the more greenhouse advantageous rail sector. The working group emphasises the urgency of making progress.

Moreover, true industry adoption of the greenhouse goals can only be claimed when there exists broad commitment to those goals by individuals and organisations. There is a sense that, at this stage of greenhouse action, an industry commitment may not always flow through to effective action by all employees. Such a transition can occur, in the future, as the community acknowledges the gains from sustainability which can be secured as the rate of increase in greenhouse emissions is reduced.

Opportunities for science, engineering and innovation

The process of reducing greenhouse gas emissions is not an end in itself. The working group believes that the Australian response to greenhouse should be the trigger for moving towards a broader, and more important end point: sustainability, that is, economic development which meets the needs of the present without compromising the ability of future generations to meet their own needs [*see case study no.3 - aXcess Australia*]. There is, in the working group's view a strong imperative for Australia's industry, and its land use, to move towards sustainability.

As Australia develops new ideas it will create new job opportunities. In making a response to abatement targets, there is an opportunity to stimulate new technologies in the related areas of energy, agriculture, transportation, recycling, land and water resources management (including salinity management), construction, biodiversity, tourism and physical infrastructure. In the renewable energy sector alone the new market opportunities in Australia are estimated to be in the range of \$2-4 billion^{xiii} over the period to 2010 [*see case study no.4 - solid waste recycling facility*]. The working group noted these opportunities could be developed at the expense of existing industries with lower supply costs.

Linking greenhouse abatement and sustainability offers new opportunities for business, in both regional and urban areas. Sustainability industries and technologies, as drivers of economic growth, competitiveness and increased levels of good environmental management, can lift their performance and further develop the clean, green image of 'brand Australia'.

The new opportunities will lead to technological advances. To the 'brand Australia' image can be added a more efficient use of our resources, generation of new intellectual property and new markets [*see case studies 5 - fossil fuel power generation and 6 - livestock methane reduction*].

If government establishes the right settings in taxation and incentives to foster research and development, and its uptake and commercialisation, business can partner government in a win-win situation [*see case study no.7 - Transcom 'better buses'*]. In such a close partnership, industry and government can establish the means to stimulate new consumption. As government takes action to ensure greenhouse emission targets are met industry can develop new products and services and gain benefits in other sectors.

By planting more trees Australia can reduce greenhouse gas emissions, can reduce the spreading impact of salinity and erosion, and can improve agricultural productivity [*see case study no.8 - forestry and land use, creating opportunities in dryland salinity management for increased biodiversity*]. There are new opportunities in the Australian energy sector, both that based on

Australia's extensive fossil fuel reserves [see case study no. 9 - MIM computer network] and new energy sources which will provide new employment opportunities in the 21st century.

Government programs in response to greenhouse, both implemented and foreshadowed to date, total some \$1 billion. The working group believes that some of these resources should be used for initiatives targeted to promote new industries, and create new investment and jobs. There is some progress in this direction (see Attachment A) but with continued innovation and the adoption of new technology industry and government have the opportunity to maintain economic growth without environmental degradation.

Timeliness is critical for market penetration. There is a risk that if those businesses which can succeed globally are not identified early, and assisted with strategies for success, economic and export opportunities for Australia may be lost.

In an holistic approach to meet the market needs, industry and government can balance public and private benefits by creating linkages and synergies. At issue is how the Australian government can best integrate its policies to meet the Kyoto target while enhancing innovation and contributing to sustainable economic growth and job creation. The working group supports the need to take a broad view of programs such as those offered within the National Land and Water Resources Audit, *Investing for Growth*, and others. Individual programs operating in isolation can miss the opportunity for broadly beneficial linkages. We need to recognise and seize the value added opportunities of integration and common goals.

Among the mechanisms proposed by the working group to foster closer government-industry cooperation are a high level business-government leaders group, a concerted outreach and rewards program and an opportunity for leaders to explore the role of innovation and technology in sustainable development.

Global Market Opportunities

Abatement of greenhouse gas emissions is a global problem requiring global solutions. An estimate of the Australian market is US\$7 billion, growing at 4.1 per cent annually^{xiv}. The world market for environmental improvement has been estimated at US\$500 billion, growing at 3.2 per cent annually^{xv}.

Australia is a world leader in greenhouse science. The US has made use of Australian expertise in greenhouse gas emission monitoring and measurement. According to a recent paper presented to the 1999 *Forum on Sustainable Development*:

... Australia has developed arguably the best integrated national database framework in the world for evaluating biological change on a local, regional, and continental level Few other countries have similar opportunities for research, disaster prevention, cost reduction, and economic gain from a well-constructed environmental policy'.^{xvi}

Furthermore, the broad range of national environmental problems facing Australia are found internationally providing a ready market for our scientific expertise, in among others measurement, monitoring and amelioration.

Australia can now move from a defensive position to one of attack, to take advantage of the opportunities created by new markets, as its trading partners work towards greenhouse emission targets and identify related opportunities enhancing sustainable development.

A visionary goal for Australia

The working group considers Australia should adopt the following steps that can lead us towards a more visionary goal for Australia.

Number one: Australia accepts Kyoto as the watershed in world greenhouse attitudes

In accepting Kyoto as the watershed both government and business move to change their approach to identify the means to create entirely new markets, both at home and overseas.

Number two: Australia's policies should reflect that watershed

Australia's traditional industries in minerals and energy, mining and processing, transportation and elsewhere now have the opportunity to examine the potential to trade emission credits overseas so as to enable them to compete in the new global marketplace.

Number three: Australia will seek to be a significant player in the greenhouse industry

Australia should seek to be a significant player in the greenhouse industry as we move towards sustainability. First, the **energy intensive industries** are under pressure to further improve energy efficiency, and to maintain their position against more greenhouse friendly alternatives, both nationally and internationally. Second, industries including those associated **with land care, forestry, transport, and resource processing** can take the opportunity of a greenhouse-induced change to create new concepts of 'best industry practice'. A third, essentially **new industry** will flourish - the delivery of services, technology, processes and equipment to satisfy new greenhouse priorities.

In businesses in the first two groups, the working group expects that response to greenhouse will largely be in the name of continued viability and growth. Timing is an important issue. Much of the theme of this paper has been towards encouraging industry to move quickly rather than slowly; to be pro-active rather than reactive; and to use feed-forward control rather than feedback control. But appropriate technological change is not automatic; rather it occurs in response to market factors such as consumption trends and government regulation. Yet conventional wisdom is that greenhouse abatement will be industry led - not legislation led. Where will Australian industry be in the field?

The third group, the provision of services, technologies, ideas for new intellectual property and processes and equipment in response to greenhouse, is a new global industry and opportunity. As a nation we should ask ourselves the question, "What share of this new industry should Australia strive to capture?"

In coalition, government and business should consider Australia's available options:

1. We could do nothing. It is not axiomatic that Australia should be involved in every industry. The very essence of international trade is that both trading partners can be better off by specialising in a somewhat limited range of activities, and Australia can always satisfy even ambitious greenhouse standards by importing the technology.

2. Another option is to make a modest response to the greenhouse effect at a level concomitant with our population. This would have us contribute less than one per cent of the global greenhouse market.
3. Australia could adopt a break even position and aim for just over two per cent of the global market, reflecting Australia's share of the world's gross domestic product.
4. Or, confident in our ability to create leverage from our research and development Australia can aim to double its opportunity and seek to capture more than its "share" of the new greenhouse industry and aim for five per cent.

The working group recommends option 4 as Australia's objective. Australia is strong in the basic sciences of greenhouse abatement. Many areas of the new industries are free of domination by any existing multinational company. Much of the new market can be satisfied by relatively small and often new enterprises. Because this is an excellent example of a global industry, the advantages of a large home market are not as crucial. Australian industry and Australia can benefit from the first user advantage. Greenhouse science excellence can offer Australia a foothold into broader issues of sustainability, and undoubted returns on its investment.

Australia is in a unique position. Our landscape and our climate are less affected by mature investment. Our country offers a location to develop new approaches to sustainability and to create markets for our success both locally and overseas. The domestic market is too small a base from which to build large multinationals, but Australia has much that is positive. With high levels of education, a wealth of natural resources and a multilingual community Australia offers a firm basis from which to demonstrate its widespread capabilities. While growing the economy and encouraging new investment, Australia can reduce its emissions, improve transportation, water quality, and resource use, ameliorate salinity, and enhance levels of biodiversity. The working group considers this to be a central issue.

At the same time, it is recognised that moving to capture these growth opportunities brings with it the potential for significant structural adjustment costs in the economy. Many Australian industries such as aluminium production, are operating at the best practice end of the spectrum, and have limited, if any, cheap opportunities for emissions abatement. The extent and pace of structural change imposed as a consequence of acceptance of the Kyoto protocol watershed will therefore have significant implications for economic growth over the transition period.

Nonetheless, the working group proposes an ambitious goal for Australia:

Capture and maintain at least 5 per cent of the world greenhouse market using the Australian market as a prototype.

This will require a concerted effort by all parties, and it is unlikely to be achieved without a greater level of commitment to commercialising Australian technology and nurturing the emerging firms which will be the medium through which success is achieved.

Number four: Greenhouse and sustainability issues and goals are inextricably intertwined

In the course of preparing this paper, the working group became increasingly exposed to the inextricable link between greenhouse and sustainability and the inevitability that sustainability will quickly follow greenhouse as a powerful economic driver in the 21st century.

Number five: Australia will integrate its greenhouse thrust with sustainability issues: Greenhouse is a world issue. Sustainability has greater Australian significance.

By acknowledging the link, at Kyoto, between land clearing and greenhouse issues Australia created the base from which to build and move into attack. Together with land clearing there are the issues of habitat destruction and loss of biodiversity, of tree planting, of recycling and of the state of our rivers. It is not difficult to make the further connection to the salinity problem facing Australia, the preservation of our fertile soil, and the spread of destructive nutrients into the Great Barrier Reef.

Concurrently Australia can contribute to setting the standards that define another emerging knowledge based industry - that of sustainability. If Australia is to succeed in the global economy it must adopt global rules. One way is to more closely align Australia's investment and regulatory framework with that of our major trading partners.

There are opportunities for Australia to integrate its greenhouse response with sustainability issues. While sustainability has great Australian significance, greenhouse is a global issue. As Australia responds to greenhouse through the programs delivered through the Australian Greenhouse Office, industry is also investing in the development of a more sustainable Australian economy.

Number six: Australia will advance its greenhouse/sustainability effort through an integrated centenary sustainability project

The working group believes that Australia should advance its greenhouse/sustainability effort through an integrated centenary sustainability initiative. Such a prototype could offer benefits to all Australians and add to 'brand Australia'. By bringing together the right mechanisms, across government and with industry, Australia can respond to a vision - to work towards a sustainable economy where development meets the needs of the present without compromising the ability of future generations to meet theirs. The working group urges the government to support this drive towards sustainability and its potential new markets, while continuing to work with industry to reduce the level of greenhouse emissions.

The working group therefore proposes a concept of a **centenary sustainability project** nominated as ***Innovate 21 - Turning the tide on greenhouse***. Should such a program be initiated as part of the centenary the working group is ambitious enough to see it as a fundamental driver throughout the next century.

Such a centenary sustainability project could cover:

Greenhouse abatement integral to sustainability

An appropriate response by Australia to reduce greenhouse emissions can contribute to the goals of sustainability. The existing measures including the Prime Minister's 1997 package and the *National Greenhouse Strategy* provide the starting point. The projected injection of funds under

the initiatives announced in May 1999, particularly the \$100 million per annum greenhouse gas abatement program to be delivered by the Australian Greenhouse Office, offer opportunities, among others, to develop effective linkages.

Improved land use and enhanced biodiversity

Inappropriate land use and management, with the resultant vegetation loss and soil disturbance contribute to biodiversity loss and dryland salinity problems. The sequestration of carbon dioxide by trees and vegetation and improved land use offers both significant challenges and opportunities.

Salinity amelioration, improvements to land and water use management and conservation of biodiversity can alleviate land degradation. In association, the enhancement of forestry and farm sinks and developing bio-energy technology can lead to efficient, cost effective energy supply for rural regions while reducing greenhouse gas emissions.

A more efficient transport sector

Possible approaches include:

- Enhancement of the use of low emission technologies and smart systems to service the region linking Melbourne, Canberra, Sydney and Brisbane; and the removal of regional impediments to the efficient movement of people, goods and services. A very fast passenger train corridor can divert travellers to a more greenhouse friendly mode of transport as can a more user friendly freight rail corridor divert carriage of goods away from road transport;
- As urban emissions contribute significantly to total transport sector emissions seek significant improvements in urban transport and planning.

Supporting the energy generation sector towards new, more efficient technology

Energy generation can be supported in several ways to enhance greenhouse emissions abatement. Approaches include:

1. Provide targeted incentives for traditional energy producers to invest in greenhouse abatement opportunities.
2. Support strategic innovation in renewable energy sources.
3. Support economic use of waste stream resources.
4. Strategic innovation in end-use energy efficiency.

Promote Australia's new ideas, its knowledge-based industries and exports

Australia can build on the science, engineering and innovation base by supporting business tax reform, and exploring opportunities in programs such as *Investing for Growth*. Business and government can use the forthcoming National Innovation Summit in early 2000 to achieve consensus on directions and roles. Business is likely to remain the primary generator of innovation and the introduction of new product and process technologies.

Encourage the use of recycling

The aim is to provide the world's best recycling solutions derived from developments in Australia by using state-of-the-art technology, innovation and service to transform waste from

the urban environment into valuable, desirable products which have a competitive advantage over virgin materials.

Renew/enhance industry commitment and collaboration with Government

It is clear that industry/government interaction must be effective. The working group notes the strengths of the Business Environment Leadership Council fostered by the US Pew Center^{xvii} and the Canadian approach through GLOBE (Global Opportunities for Business and the Environment)^{xviii}. The working group supports the Australian government's initiatives to date in fostering the development of the Australian 'Business Leaders Forum on Sustainable Development'.

Number seven: The centenary sustainability project will be an important medium for governments' leadership, and the symbol of that leadership

The centenary sustainability project will be an important medium for government leadership, and a symbol of that leadership. The working group acknowledges the value of a vision. The working group acknowledges Australian science and technology develops ideas able to contribute to a more sustainable economy. Yet the working group also acknowledges those ideas are not always adopted so as to benefit Australia.

Governments have a role in encouraging the development and diffusion of technology. The basic research underlying innovation is financed largely by governments. Governments can act to ensure new technologies are more widely used. Governments can gain a cleaner environment and support a more equitable use of its natural resources. With industry, governments are able to discover sustainability as a business driver.

Number eight: Out of this project will emerge a clean, green "brand Australia".

The centenary sustainability project offers government an opportunity to extend its leadership. In such a project Australia can use state-of-the-art technology, innovation and service to create valuable, desirable products which have competitive advantage.

There is no ready solution to the environmental damage Australians have caused in the last 200 years^{xix}. Our scientific understanding has not always been as keen as it is now. We now accept the need to focus differently, and to focus on a combination of growth and sustainability.

The Australian government has already provided ample incentives for an innovative response to greenhouse, and thereby laid the foundation to address broader issues of sustainability. We have in Australia both national and international companies that are showing leadership. By combining their efforts in an industry - government round table, and including consideration of the working group's proposal for a centenary sustainability project, Australia will be well positioned to promote 'brand Australia' in a way that secures new business for Australian firms, and brings 5 per cent of the world greenhouse market well within our reach.

The working group therefore recommends:

- 1. Both government and industry recognise and seize the opportunity provided by our greenhouse response, to respond to the challenge of sustainability. Australia should use its response to greenhouse, to encourage industry to grow and deliver jobs and a more sustainable environment, as it captures a significant part of this new world industry.**
- 2. In meeting greenhouse emission targets, Australian government and industry should consider the achievement of broader national goals, through a centenary sustainability project, *Innovate 21 - Turning the tide on greenhouse*, which could include elements of:**
 - Salinity amelioration, improvements to land and water use management and recycling, and conservation of biodiversity**
 - A more efficient transport sector**
 - Support for the energy generation sectors as they adopt new, more efficient technology, and**
 - Generating a knowledge base that will assist industry to commercialise Australian initiatives.**
- 3 Australia should use the response to greenhouse to promote knowledge based industries and exports. To help achieve this, we can continue to build on our science, engineering and innovation base by supporting business tax reform and developing the agenda and issues for the National Innovation Summit.**
- 4 Recognising that responding to greenhouse is only one part of responding to the challenge of sustainability, government and industry should work towards a business/government round table to develop a coalition of interests.**
- 5 Australia should prepare as early as possible for the new era of trade in carbon credits.**

International business and industry initiatives

[international initiatives]

Business initiatives

- BP – clear commitment to greenhouse reductions, through monitoring and control measures throughout the company (including an internal carbon trading scheme across business groups), funding continuing scientific research, taking initiatives for joint implementation, developing alternative fuels for the long term through major investments in solar and other energy sources, and contributing to the public policy debate in search of wider global answers (BP Chief Executive Statement, 19 May 1997)
- Shell – has developed an action plan addressing climate change as part of its actions addressing sustainable development. The company has recently initiated the US\$500m International Renewables program as one of its five core business activities. Its focus is on biomass and wind. The plan sets out what Shell companies are doing now, plans for the future in response to the challenges arising from Kyoto, actions being undertaken to reduce emissions from Shell operations and support for Shell customers to reduce theirs. The focus is on early action, business decision-making, market-based solutions, improved understanding and measurement and reporting. Shell has recently opened solar service stations in Germany and Holland. Shell is developing a pilot internal trading system to encourage Shell companies to reduce their GHG emissions effectively and gain experience in operating such a trading system.
- DaimlerChrysler - have recently unveiled the first practical fuel cell vehicle by fitting fuel cells to the Mercedes-Benz A-class car and expect to be in limited commercial production by 2004.
- Volvo/Ford (transport) is developing fuel cell powered vehicles.
- Munich Re and Storebrand (insurance) – participating in global research, as investing significantly individually and in consortia in solar and alternative energy to fossil fuels.

Visy's new pulp and paper mill

[an example of world-best environmental practice, in Australia]

The new pulp and paper mill to be built by Visy Industries at Tumut is an example of world-best environmental practice: a major industrial operation that will be more than 65 per cent self-sufficient in energy, use minimal amounts of water and use waste wood as its raw material.

Pulp and paper industries in Australia account for net greenhouse emissions of about 6 Mt CO_{2e}. This figure is low compared to other industries of similar size because of the extensive use of recycling, co-generation, use of biomass-based energy source - primarily waste wood.

Innovation potential

The mill is about to be constructed. It will use new computer control technology to improve its energy efficiency, lower its emissions of NO_x and other gaseous and liquid discharges, and minimise its water use. As the first brand new paper mill of its kind (unbleached softwood Kraft mill) in the world for 20 years, it is the first to have such control technology designed in from inception.

Its main energy source will be biomass from the sustainably managed plantations nearby (which make the operation as a whole a greenhouse sink). It includes a co-generation system fired from the bark and other "waste" material from the plantation.

Although this mill is designed to specifically produce unbleached Kraft brown paper for packaging, the control technologies and the approach taken to maximise efficiency and reduce emissions can be taken up elsewhere in the world-wide pulp and paper industries.

The project includes 10 000ha of new pine plantation. (At 10t CO₂/ha per year this represents an initial carbon sink of around 100 000 tonnes CO_{2e} per year.) The project also draws raw material from about 30 000ha of existing NSW State pine plantations and from up to 60 000t/y recycled paper from the district (include ACT), allowing a paper capacity of 240 000t/y. It uses zero old growth timber, unlike most others. The wood used by the mill is the low grade thinning and litter not suitable for other uses; the prime timber from the plantations continues to go for sawlog. Providing a market for this "waste" timber encourages improved silviculture practices.

Business potential

The mill is virtually self-sufficient in energy but will in fact sell electricity to the grid and buy some back, because it can get a premium price for its "green power".

Projected sales from the Tumut mill will be around \$250m per annum. Turnover of the whole Australian pulp and paper industry is around \$3 000m per annum, so there is scope for diffusion of best practice example.

Capturing the opportunity

The Commonwealth Government has approved an assistance package valued at up to \$40 million for Visy's Tumut mill under the scheme for facilitation of major new projects. It is a \$400 million investment, bringing about 1000 jobs to the region.

This and similar renewable energy based projects will gain under the NGS measure setting a mandatory 2 per cent renewable energy target by 2010 for Australian electricity production, when that measure is implemented. Under the measure, it is proposed that producers of renewable energy will be able to sell certificates of production to retailers who would otherwise be unable to meet their individual targets. This income is additional to that from the sale of the actual electricity as "green power", although implementation details for the 2 per cent measure (including the sale of certificates) are still being worked out in a Commonwealth/ State committee

aXcess Australia Hybrid-Electric Car

[an example of innovation in automotive construction and power use]

Australian automotive component industry has been successful in the international market. The *aXcess Australia* project has been highly successful in raising the awareness of the innovative potential of the Australian automotive component industry. To progress further the components industry needs to convince carmakers that they can support local manufacture of low-emission technology.

Sector Emissions

In 1996, the transport sector accounted for 17 per cent of Australia's total net greenhouse emissions. Between 1990 and 1996, emissions from the transport sector were the fastest growing of any sector in the Australian economy, growing by 15 per cent. In the absence of a reduction strategy, a 38 per cent increase in greenhouse gas from the transport sector is projected by 2010.

In addition to greenhouse emissions, motor vehicles are a major source of carbon monoxide, oxides of nitrogen, hydrocarbons and particulates in the atmosphere, and are therefore a major cause of air pollution in urban areas.

Innovations Potential

There is now consensus that generating electricity on-board with a conventional internal-combustion engine can attain most of the benefits of fuel-cell-powered cars. This technology can be commercially available within 4-5 years while fuel-cell cars are not expected to be affordable for 15-20 years. Toyota is already in production with the Prius - a hybrid-electric engine car. The next generation of hybrids is already on the drawing boards of companies such as GM, Ford, Honda, Daimler-Chrysler, Volvo, Renault and Fiat.

CSIRO has several production-ready technologies for hybrid-electric cars, including motors, rapid-delivery electric storage devices (known as "supercapacitors"), battery technology and mathematical modelling to provide the vital power management systems.

Two cars are under construction. The first, in partnership with Holden, will demonstrate a parallel hybrid configuration (similar to Prius) full-size car incorporating CSIRO and other local innovations. The second is a medium-size *aXcess Australia* car to demonstrate exportable componentry and technologies in series-hybrid configuration. These include a novel Australian engine driving a generator, the wheels driven by an electric motor drawing power from the generator, supercapacitors and batteries as appropriate. More than 80 companies are represented in the car. Based on modelling by CSIRO Mathematics and Information Sciences, it is claimed that fuel consumption will be half of the equivalent conventional car (at around 5 litres/100 km) and emissions will be around 90 per cent less.

Business Potential

The *aXcess Australia* hybrid car will be used to promote exports and to provide data to industry and government on the practicability and benefits of the technologies. The project includes emission testing and a Melbourne-Sydney demonstration is planned.

Many companies have enhanced their export profile through the success of the 1998 *aXcess Australia* Concept Car. According to Air International Pty Ltd, the project was a "key piece of the jigsaw" in winning a \$500 million contract with General Motors USA. VDO Australia Pty Ltd won a \$100 million contract with Hyundai to supply instrument clusters similar to the *aXcess Australia* car. Millard Design Pty Ltd, responsible for the design concept for *aXcess Australia*, has won a significant contract to build concept cars for Honda.

While the total new business resulting from the project could be claimed as approaching \$1 billion, it is not possible to value the broader impact of the raised image in the global marketplace. As well, there is a domestic value arising from the improved confidence in Australian manufacturing industry and the value of innovation in marketing and penetrating new markets.

Capturing the Opportunity

aXcess Australia has shown the benefits of well-planned marketing to the global automotive industry. Both cars will be used to increase awareness in Australia of the value of the automotive industry to the nation and the importance of innovation in maintaining our place in the changing world. The theme "Australia is part of the solution" will be used in relation to environmental issues.

Government can assure the success of the project with adequate support funding for the marketing of the car or cars overseas on the basis that the car itself draws the attention of overseas potential customers, and industry has to convert that interest into business contracts. Support funding is expected to come from the automotive marketing special fund. Current project funding plans do not cover active promotion of the project as a solution to urban pollution problems. Vehicle construction funding for the project (\$1.5 million) is much lower than the first project (\$4.2 million). Additional funding would permit more attention to the engineering credibility of the project.

Where We Stand Internationally

Australia has fallen behind USA, Europe and Japan in reducing automotive emissions, largely because the international companies operating in Australia have relied on overseas technology development. Overseas companies have, in the last decade, spent billions of dollars on researching low-emission vehicle technology. Plius development is said to have cost Toyota more than \$2 billion. Competition in the Australian market has been over features rather than fuel-efficiency or emissions.

This national project aims to address this issue by showing what can be done on a low budget to introduce low-emission technologies in the short term rather than waiting for an overseas corporation to decide the time is right to market such vehicles in Australia. The project technologies are not world leading, but will attract sufficient interest among the many competing projects within overseas car companies to draw attention to Australia's potential to be a supplier of innovative componentry and technologies for the 21st century.

Case study no. 4.

Solid Waste Energy Recycling Facility

[harvesting biomass from waste for green energy]

Energy Developments Ltd is building a solid waste energy recycling facility (SWERF) at Wollongong City Council's Whytes Gully landfill site. This innovative process for separating organic matter from municipal waste and converting it into synthetic fuel gas and then into electricity has been awarded a federal government Renewable Energy Showcase grant of \$2 million.

The SWERF technology comprises a combination of new processes acquired or developed by Energy Developments over the past two to three years and presents a major opportunity for Australian industry both locally and in overseas markets. While the project will provide a cost effective and environmentally sustainable solution for the management of municipal wastes, significant benefits also arise from reductions in greenhouse gas emissions. The SWERF technology provides an abatement level approximately five times that of other mainstream renewable technologies, including wind and solar, per unit of electricity generated.

Fossil Fuel Power Generation

At least one power station in the Hunter Valley is trialing the co-firing of wood waste with coal. Amounts up to 5 per cent of the coal input yield a substantial reduction in GHG emissions and should qualify as a renewable energy source and contribute to the government mandated 2 per cent increase in renewable energy by 2010.

Coal fired power stations are also investigating repowering with natural gas either by co-firing with coal or integrating gas turbines into the plants to use exhaust for additional steam generation.

There are active research programs through the CRC for Black Coal Utilisation and the CRC for New Technologies for Power Generation from Low Rank Coal, examining coal gasification as the first stage to integrated gasification combined cycle power generation with GHG emissions of up to 10-15 per cent lower than conventional power generation.

As a result of the showcase program of the Australian Greenhouse Office solar steam generators are being set up at coal fired power stations in NSW and Queensland to reduce overall plant GHG emissions per unit of power produced.

Advanced Technologies

Ceramic Fuel Cells Limited is well on the way to the development of commercial power generation units that can be adapted to distributed power applications. The solid oxide fuel cell system has electricity generation efficiencies from natural gas in excess of 50 percent for simple systems and up to 70 percent in combined cycle systems, which results in GHG emission reduction of 40-60 percent over conventional systems and up to 80 percent reduction when used in a co-generation mode

A major CSIRO project is examining the feasibility of the combination of solar and fossil fuel power generation. The project involves using solar energy to reform a mixture of natural gas and steam to hydrogen and CO₂. The CO₂ is extracted and the hydrogen used to generate electricity in fuel cells and microturbines. An 80 per cent decrease in GHG emissions over conventional power generation is estimated.

Business Potential

Packaging these innovations would create a valuable export industry as well as having wider domestic application, and add to Australia's acknowledged expertise in mining and power generation technology.

Capturing the Opportunity

In power generation from waste coal mine gas there is the potential to reduce a significant source of methane emissions by employing new carburetted gas turbine technology and other lean burn systems such as regenerative thermal oxidation. This has the potential to considerably boost national power generation from this source.

In coal fired power generation trials of waste co-firing in conventional power stations will increase as the industry becomes familiar with the behaviour of the wide variety of mainly biomass materials available for co-firing. The Australian work on black and brown coal gasification will stand us in good stead for the introduction of this advanced, lower GHG emitting technology in the future.

Where We Stand Internationally

Utilisation of coal seam methane has been practiced for many years in the USA and elsewhere. Some of this extraction technology is being used in Australia in conjunction with US companies. The use of Australian world class directed drilling expertise (developed through the Centre for Mining Technology and Equipment) is assisting uptake.

Australia is a world leader in solid oxide fuel cell technology and a multi-million dollar local and export industry will eventuate in the next 5-10 years. Integration of this technology into hybrid systems and distributed power supplies will place Australia at the leading edge in advanced power generation.

***Agriculture Livestock methane reduction
[recently secured a commercial partner]***

Bacteria produce methane in digestion processes in livestock. CSIRO is developing a vaccine against these bacteria. Removal of these bacteria reduces methane production and increases the availability of nutrients for animal growth.

Sector Emissions

Methane emissions from livestock are relatively static but important, making up 17 per cent of total Australian emissions and 6-7 per cent of total global greenhouse emissions. In Australia livestock emissions are 56.8 Mt CO_{2e}

Innovations Potential

This innovation has the potential to reduce Australian emissions by 7 to 70 per cent (4 – 40 Mt CO_{2e}) depending on the effectiveness of the vaccine and adoption rates by the farming community. For carbon trading purposes, at \$15 per tonne CO₂ credit, this equates to \$60 - \$600 million.

Simultaneously the vaccine is expected to increase sheep liveweight by up to 10 per cent and clean fleece weight by up to 9 per cent. In calves the vaccine is expected to increase liveweight gains by up to 10 per cent over a six-month period.

If successful, the project will be good for both greenhouse and for farmers and will have worldwide application.

Business Potential

The financial return to farmers of vaccination potentially is significant in the first year and may increase over time given the improvements in yield per animal. It is possible that one vaccine application may last several years.

If one vaccine application (two doses) lasts for the life of animals, the annual Australian market potential would be around 40 million doses for sheep and six million doses for cattle. The potential international market is much larger as there are 1.3 billion cattle and 1.2 billion sheep in the world (FAO figures). Thus the international market potential is considerable.

Capturing the Opportunity

Once proof of concept has been established for the methanogen vaccine technologies, there will be opportunities to accelerate their development and to bring forward the commercial release of vaccines for a range of classes of livestock.

Transport: Better buses - Transcom NGVS technology
[a product ready for the 21st century]

Transcom Engine Corporation in Perth has developed world first multi-point sequential electronic fuel injection advanced engine components that offers significantly improved emissions reduction, fuel economy and engine performance for road transport currently using diesel fuels.

Sector Emissions

In 1996 the transport sector accounted for 17 per cent of Australia's total net greenhouse emissions – 71 Mt CO₂ equivalent. Between 1990 and 1996 emissions from the transport sector were the fastest growing of any sector in the Australian economy, growing by 15 per cent in this period. Without a reduction strategy a 38 per cent increase in greenhouse gases from this sector by 2010 is projected.

In addition to greenhouse effects, transport sector emissions degrade air quality through noxious components such as carbon monoxide, oxides of nitrogen, hydrocarbons and particulates. Diesel is categorised by the California Air Resources Board as a toxic air contaminant due to its detrimental effect on respiratory health.

Innovations Potential

Natural gas is currently the cleanest of available transport fuels. Overseas governments are developing legislative controls and financial incentives to encourage the switch to natural gas. Most natural gas engines currently use old carburettor technology - far less efficient than the Transcom innovation.

A recent study of the Canberra ACTION diesel bus fleet concluded that a reduction of 1 500 tonnes of CO₂ per annum on a full cycle basis would be achieved if the 380 buses were fuelled by natural gas. If this is extrapolated to the national fleet of 7 500 city buses the savings are nearly 30 000 tonnes of CO₂ per annum. An extension of this technology to the 500 000 medium and heavy-duty diesel trucks and buses on Australian roads would bring about a potential reduction of about 2 Mt CO₂ per annum.

Business Potential

The Transcom natural gas vehicle technology NGVS-4 is proven on Renault and RABA (Hungary) engined buses, which have covered over 1.1 million kilometres in Perth, Canberra and Hungary. The technology is also proven on a MAN bus engine currently in service in Adelaide.

The business potential of this innovation lies in commercialising it for take up in the world market. The Transcom strategy is to convince mainstream original equipment manufacturers of heavy-duty diesel engines to offer Transcom components as standard equipment on their compressed natural gas engines worldwide. In order to convince the engine manufacturers of the suitability of the product, Transcom is seeking to demonstrate the benefits of the new technology by converting a number of diesel-powered buses of various makes to run on natural gas.

Around 4 million heavy-duty diesel engines are manufactured worldwide each year. An \$8 000 Transcom natural gas kit on each engine equates to an economic benefit of \$32 billion. Given the commitment by several countries to move to natural gas, it is expected that 50 per cent of heavy transport could be gas engined within a decade.

Capturing the Opportunity

Fleet operators can save almost 50 per cent on fuel costs by switching from diesel to natural gas. On this basis a proposal was submitted to the ACT Government to convert 100 existing Renault buses and for the purchase of 50 new Renault/Transcom buses, with attendant fuel savings of \$970 000 per annum.

The overseas market for this technology could grow significantly if potential customers could see the technology more widely 'tested as true' and used in Australia. Continued lack of market uptake in Australia may hinder future markets. A successful trial with Canberra buses may open the domestic market.

There are several specific measures related to the operation of an CNG bus fleet operation in the May 1999 proposed tax package.

Where We Stand Internationally

Transcom has developed proven, world class, environmentally friendly engine technology for the world heavy-duty engine market. 13 patents in 116 countries worldwide protect Transcom technology. The feature making the Transcom NGVS-4 unique is a microprocessor-controlled multi-point sequential electronic fuel injection system able to handle more data and provide faster and more precise responses than traditional gas carburettor or valve-chest technology on offer by overseas competitors.

Forestry and land use management
[creating opportunities in dryland salinity management for
increased biodiversity and investment in carbon sinks]

Dryland salinity currently affects 2.5 million hectares of agricultural land, with a further 13 million hectares likely to be salt affected before new hydrological equilibria are established. It affects land resources (via waterlogging and salinisation), and surface water resources (via increasing salt flows) and infrastructure. Dryland salinity control will require extensive revegetation, and it has been suggested that tree planting within a carbon credit trading system could help address the problem (Prime Minister's Science, Engineering and Innovation Council 1998).

Current efforts at managing dryland salinity rely on substituting higher water using plants for commonly used crop and pasture species. This usually means reversing the impacts of land clearing through replacing annuals with perennial species, changing cropping rotations to minimise loss of soil moisture and introducing trees back into the landscape. These approaches are not working. Dryland salinity is still expanding in most affected areas, few are showing a fall in the underlying groundwater trends.

Sector emissions

Greenhouse gas emissions from forest harvesting make up 16 percent (54.4 Mt CO₂e) of Australia's total emissions, but these emissions are offset by sequestration in growing forests of 74.3 Mt of CO₂ (National Greenhouse Gas Inventory Committee 1996) giving a net sink of 19.9Mt CO₂. This includes growth in 1 million ha of plantations and a large area of managed native forests.

Innovations Potential

Commonwealth and State governments and industry have committed to a policy aimed at trebling the area of forest plantations by 2020, primarily to balance imports of wood products. If this is successful, carbon sequestration in plantations could increase considerably. This sequestration will be offset by emissions due to harvest, and the extent to which it can contribute to national targets will depend on the outcome of negotiations on precisely which sinks can be counted towards the Kyoto target. Plantation establishment could be facilitated by the creation of an emissions trading system that allows carbon emissions to be offset in vegetation sinks. This will depend on the capacity to accurately measure stored carbon and account for any emissions associated with forest establishment and management.

Business Potential

The cost of vegetation sinks, such as plantations, compares favourably with other emission reduction options. Many carbon emitters are anticipating the introduction of emissions trading by purchasing 'options' on carbon in timber plantations. Analyses in Western Australia suggest that, if carbon is valued at A\$20/tonne, the financial return over a 30 year cycle on maritime pine plantations could double, and the return on bluegum plantations could increase by 50 percent.

Potential returns to rural landowners depend on the value of carbon, cost of establishment, plantation growth rates, the value of other plantation products and the way carbon in products is accounted for. Owners could establish plantations themselves and sell the carbon rights, or they could obtain a leasing fee from a managing agent or company in return for the right to grow trees on their land. Annuity payments for bluegum plantations in Western Australia can be up to \$150/ha/yr. The achievement of financial benefits from tree growing for small landowners will depend on cooperative marketing and efficient measurement systems.

Capturing the Opportunity

Technical analysis of catchments affected by dryland salinity suggests that the level of revegetation needed to minimise the quantities of excess water in the landscape will have to be significantly higher than is possible under current land management approaches. To determine the optimum locations and extent of planting for dryland salinity control, the incremental increase in recharge between pre-development and current vegetation communities, and the quantity of water that needs to be used will need to be established. Trees appear to be the only reliable option to achieve the level of plant water use required, although they may not be the sole response.

Tree planting for dryland salinity control is needed predominantly in the 500 – 800 mm rainfall zone. This is generally at the lower end of that suitable for tree crops, depending on evaporation rates. Impediments to extensive tree plantings include low prices and uncertain markets for many forest products, the time frame associated with returns on investment, and uncertainties over growth rates and management of species planted in drier areas. Expanding the area of timber plantations and their incorporation in farming enterprises will also require cultural change and managerial changes in farming styles, and general acceptance of a non-traditional enterprise.

If the greenhouse benefits (through carbon sequestration) that accrue to the tree grower can be realised in monetary terms, then the tree has a market value in addition to its value for timber. This increase in returns to the farmer is likely to provide the extra margin needed to make tree farming an economically viable option. If there was a mechanism to realise the value to the tree grower of the environmental benefit due to better dryland salinity management, then this margin would be even greater. However, provision of industry infrastructure to support tree farming in areas of lower productivity may still need to be addressed.

Mining: MIM Computer Network Manages Energy Needs
[maintaining competitiveness in traditional industries]

An innovative energy management program at Mount Isa Mines (MIM) Holdings Limited's at the Mt Isa operations has enabled the company to open a new mine and add new electricity-using activities while cutting total annual electricity use and CO₂ emissions.

Sector emissions

Mining accounts for about 4 per cent of Australia's greenhouse emissions. With significant growth, emissions are forecast to grow by around 70 per cent by 2010 without persistent focus to reduce greenhouse gas emissions.

Innovations potential

This energy management system (EMS) is based on an existing network of personal computers in all plant areas, and allows plant operators to download data onto a central energy management database. The EMS enables plant operators to forecast energy demand in half-hour increments, up to one week ahead. Forecast accuracy of 7 per cent of actual energy consumption is achieved. Energy demand forecasts are checked against available generating capacity, enables audit progress on greenhouse gas emission reductions and compares energy budgets with actual expenditure.

MIM estimates that EMS will reduce energy use by 16 per cent and reduce emissions by 300 000 tonnes of CO₂ equivalent per year.

Business potential

To date, energy improvements have cut MIM's costs by \$4.5 million a year. Capital expenditure of many times that amount has also been deferred by delaying expansion of the existing coal-fired electricity generating capacity, to take advantage of a gas turbine plant.

Capturing the Opportunity

Establishment of energy management systems is a key tool in reducing total annual energy costs and CO₂ emissions. Investigation of whether this innovation can be packaged for sale is required.

Where We Stand Internationally

This is groundbreaking work within Australia. Similar work is being done internationally.

Source: "MIM: Computer Network manages energy needs" Greenhouse Challenge Case Study, 1997, AGO.

Attachment A

A range of Commonwealth government policies, funding and activities contributing to greenhouse gas abatement

Australian Greenhouse Office

The Minister for Industry, Science and Resources, the Minister for Environment and Heritage and the Minister for Agriculture, Fisheries and Forestry are members of the Ministerial Council that oversees the Australian Greenhouse Office. The AGO is responsible for coordination of domestic climate change policy and the delivery of related Commonwealth programs encompassing the *Greenhouse Challenge*, both renewable and non-renewable energy, sustainable transport and local government action.

Renewable Energy Commercialisation Program

RECP is a 5 year \$30 million competitive grants program that supports the demonstration and commercialisation of innovative renewable energy equipment, technologies, systems and processes, so fostering the development of the Australian renewable energy industry. Applications for Round 3 will open in September 1999.

Renewable Energy Showcase

The Showcase grants program is now closed to new applicants. The \$10 million program is supporting and promoting several leading edge and strategically important renewable energy projects in Queensland, New South Wales, and Western Australia.

Energy Efficiency Best Practice Program

Sector-specific strategies will be developed with industry associations including: benchmarking information; extension services; good practice guides; site visits; workshops; and support for training. The program will also provide information on energy efficient technologies used across a range of industry sectors and will promote good practice energy management practice.

Energy Efficiency in Government Operations Program

Aims to reduce emissions from the Government's own operations by improving energy efficiency through performance targets, some mandatory requirements, additional information and contracting tools, and annual energy reports.

Environmental Industries and Renewable Energy Action Agenda

The Action Agenda is a collaborative approach between government and industry to address market impediments which prevent the renewable energy industry from developing its full potential in domestic and off-shore markets. This Agenda works to assist the growth of the environmental management industry, through identifying and facilitating opportunities for building business capacity through investment, technology diffusion and process improvement strategies.

The 'Eco-efficiency and Cleaner Production Home Page' found at:

<http://www.environment.gov.au/eecp.html> provides industry and the community with information about all the eco-efficiency and cleaner production tools. A major feature of the site is its extensive and comprehensive cleaner production case studies database that illustrates the financial and environmental savings that can be achieved through implementing eco-efficiency and cleaner production.

Comprehensive strategy to improve energy efficiency in buildings

In response to the Kyoto Protocol, the Government has agreed on a comprehensive strategy in relation to building energy efficiency. This includes incorporating minimum standards for energy efficiency into the

Building Code of Australia. In addition, industry will implement and commit to voluntary codes of practice and other measures to improve the energy efficiency of new and existing buildings.

In recognition of the impact of the building and construction sector on the environment, the Government has engaged the Productivity Commission to undertake a study of the building procurement process and associated investment drivers to determine whether it creates incentives for, or mitigates against, maximising investment by developers and owners in relation to energy efficiency and durability.

Energy and Environment Technology Information Centres (EETIC)

EETIC is the collective title for the international energy technology exchange programs: CADDET Energy Efficiency; CADDET Renewable Energy; and GREENTIE. CADDET collects and disseminates information on proven energy efficient and energy related environmental technologies. GREENTIE is a worldwide directory list of companies that provides greenhouse gas abatement technologies. The objective is to encourage the adoption of energy efficient and greenhouse gas abatement technologies. The Australian program also aims to maximise the economic benefits to domestic companies through the uptake of Australian products and services.

International Greenhouse Partnerships Program

Is a cooperative effort by Australian industry and government to reduce greenhouse gas emissions through projects overseas. It will ensure Australia and Australian industry gains experience in the operation of the project-based flexibility mechanisms outlined under the Kyoto Protocol.

Targetting Research Alliances Program

This element of the Technology Diffusion Program supports collaboration between Australian and international scientists in scientific and technological research. For example two recent projects were between Australian and Indian scientists on environmental technology R&D and with China on water and waste water technologies.

Greenhouse Challenge Program

Greenhouse Challenge is a partnership effort between the Commonwealth Government and Australian industry to reduce greenhouse gas emissions. Enterprises sign voluntary cooperative agreements in which they commit to undertake actions to reduce greenhouse gas emissions. The Greenhouse Challenge program aims to achieve greenhouse gas emissions, while at the same time enhancing the competitive advantage of Australian industry.

Cooperative Research Centres (CRC) Program

CRCs bring together outstanding researchers, private industry and other users of research with an emphasis on developing internationally competitive industry sectors. The strong collaborative links between researchers and industry in CRCs provide industry with access to highly skilled personnel and leading edge research results.

Examples of CRCs covering eco-efficiency issues:

Waste Management and Pollution Control; International Food Manufacture and Packaging Science; AJ Parker CRC for Hydrometallurgy; Sustainable Tourism; Renewable Energy and Greenhouse Gas Abatement; and New Technologies for Power Generation from Low-Rank Coal

National Ecotourism Program

Provides funding support for the development of nature based tourism and ecotourism and promotes best environmental practice to the tourism industry generally.

Industry Research and Development Board (IR&D)

Aims to increase the level and commercial success of industrial research and development undertaken in Australia. An independent statutory body that provides advice to government on national industry-based

This paper was prepared by an independent working group for PMSEIC. Its views are those of the Working Group, not necessarily those of the Commonwealth

R&D strategies and priorities, and administers specific Federal government programs including *R&D Start* in support of industry-based innovation.

Australian Government Analytical Laboratories (AGAL)

Provides analytical and consulting services in the food, drug, environmental and materials science areas. AGAL contributes to eco-efficiency by providing expert analyses on a fee-for-service basis and advice to relevant stakeholders including Government and the private sector.

Australian Geological Survey Organisation

AGSO delivers geological research and surveys for the public good and to help Australia's resource based industries increase their international competitiveness, whilst observing the principles of sustainable development.

EnviroNET Australia

A comprehensive environment management website with more than 1000 entries of Australian suppliers and hundreds of case studies in three directories and three databases at <http://environment.gov.au/epg/environment/environment.html>

Environment Technology and Best Practice Program

Environment Australia, in cooperation with industry, other government and the NGO sector, promotes the adoption of best practice environmental management practices in a range of industry sectors. Environment Australia also aims to facilitate the uptake of environmentally friendly technologies in Australia and to promote leading edge Australian environment technology capacities overseas.

Towards Sustainability - Achieving Cleaner Production in Australia

The Australian and New Zealand Environment and Conservation Council (ANZECC) recently completed its National Strategy on Cleaner Production. Entitled 'Towards Sustainability - Achieving Cleaner Production in Australia' the document proposes 74 measures for governments, industry and the community which will assist firms in reducing their environmental impacts caused by production processes. A copy is available at: <http://www.environment.gov.au/epg/environet/eecp/publications.html>.

Eco-efficiency Information Kit for Australian Industry

Environment Australia has recently published an eco-efficiency kit, *Profiting from Environmental Improvement in Business*. The document demonstrates the financial benefits that accrue to industry from adopting eco-efficiency 'tools', such as environmental auditing, environmental management systems, life cycle assessment, environment reporting, environmental accounting, design for the environment, supply chain management and performance based contracting.

National Guidelines for Public Environment Reporting

Public Environment Reporting is an important eco-efficiency tool. By publicly reporting its environmental impacts a firm is better able to manage its production processes, because it has a better understanding of where the inefficiencies lie. The Government has announced that Environment Australia will be developing national guidelines for firms that wish to undertake Public Environment Reporting. A draft will be completed by the end of 1999.

Eco-efficiency Consultative Committee

A high level 'Eco-efficiency Consultative Committee' is being established with representatives from major industry associations, large corporations, the Department of Industry, Science and Resources and Environment Australia to further the eco-efficiency agenda in Australia.

The Renewable Energy Equity Fund

Renewable Energy Equity Fund (REEF) will facilitate the commercialisation and application of renewable energy technologies. Government funding will be provided through licences to a REEF fund manager on a competitive basis and invested along with private sector funding on a 2:1 basis. REEF is based on the broader Innovation Investment Fund program model, which is administered by the Industry Research and Development (IR&D) Board. It has a specific focus on facilitating the commercialisation and application of renewable energy technologies through the provision of equity finance.

Renewable Energy Internet Site

The Government will soon launch an Internet site dedicated to the Australian renewable energy industry. This will provide an on-line database covering all organisations in the Australian renewable energy industry. Our intention is that this will provide a way for customers to find suppliers and facilitate networking within the industry. The site will also include a searchable database of all Australian renewable energy installations over 5kw, descriptions of renewable energy technologies and how to use them, and information on government support for the industry.

Efficiency Standards for Power Generation

Efficiency Standards for Power Generation encourages businesses that use fossil fuels to produce energy to achieve best practice performance in their power plants. It will also ensure that all new Australian power projects are at the leading edge, embracing best practice technologies. Where appropriate, the program will rate and label the energy performance of appliances and equipment to encourage the production and sale of energy efficient products. The labelling scheme will help consumers in choosing an energy efficient product and allow them to play their part in reducing greenhouse gas emissions. Publicity campaigns will be conducted to ensure retailers and consumers understand the energy rating scheme and know how to get the most energy efficient use out of their product.

Mandatory Targets for the Uptake of Renewable Energy in Power Supplies

Electricity retailers and other large buyers of electricity will be legally required to source an additional 2% of their electricity from renewable sources by 2010. This represents an additional 9,000 GWh of renewables-based electricity in 2010. Specific objectives of the renewable energy target are:

- to accelerate the uptake of renewable energy in grid-based applications, so as to reduce greenhouse gas emissions;
- as part of the broader strategic package to stimulate renewables, provide an on-going base for the development of commercially competitive renewable energy; and
- to contribute to the development of internationally competitive industries which could participate effectively in the burgeoning Asian energy market.

It is expected that the measure will commence in 2001, subject to the passage of legislation.

Accelerating and Monitoring Energy Market Reform

The intention is to lower the rate of growth of emissions by improving the economic efficiency of energy supply. This measure aims to deliver integrated and compatible national frameworks for gas and electricity by 2002 and with the States develop the means to identify greenhouse intensity of energy sources in energy market trading pools by 2001.

Appliances and Equipment

This is a joint program involving all Australian governments working together to reduce greenhouse gas emissions by encouraging the manufacture and purchase of energy efficient appliances and commercial and industrial equipment. Governments are working with manufacturers to develop minimum energy

performance standards for appropriate appliances and equipment to eliminate the least efficient products from the market.

Endnotes

- i Intergovernmental Panel on Climate Change, 1999. 'Australasian Impacts of Climate Change - an assessment of vulnerability' from *The Regional Impacts of Climate Change*, Eds: Watson, RT, Zinyowera, MC, Moss, RH and Dokken, DJ. A Special Report of IPCC Working Group II. p.31
- ii Greenhouse gas emissions (GHG) are frequently referred to as "carbon dioxide equivalent" (CO_{2e}) since CO₂ is the most abundant GHG (followed by methane). Key units are tonnes (t) and million or megatonnes (Mt).
- iii National Greenhouse Gas Inventory Committee, *1990-1996 National Greenhouse Gas Inventory Land Use Change and Forestry Sector*, 1998 (Based on Workbook 4.2 and Supplementary Methodology), p.xxv.
- iv Brian J O'Brien FTSE, 'Australian Greenhouse Governance: the Twilight zone', supplement to *ATSE Focus*, Australian Academy of Technological Sciences and Engineering, December 1998.
- v John Elkington, *Cannibals with forks - the triple bottom line of 21st century business*, Capstone, UK, 1997. See also *Engaging Stakeholders*, a two-volume report published in 1996 by the United Nations Environment Program in conjunction with SustainAbility (UK). "Businesses and governments striving for sustainable development must abandon the traditional view that their bottom line is purely financial. Instead they must attempt to combine financial considerations with the social and environmental responsibilities thereby focussing on the triple bottom line of economic prosperity, environmental quality and social justice."
- vi Senator the Hon Robert Hill, Minister for the Environment and Heritage and Senator the Hon Nick Minchin, Minister for Industry, Science and Resources, at the release of the National Greenhouse Strategy, 'There is now a broader understanding ... that Australia is taking urgent domestic action to limit the growth of our emissions'.
- vii The net levels of greenhouse gases are determined by a balance between 'sources' (processes or activities that release greenhouse gases) and 'sinks' (processes or activities that remove greenhouse gases). Human activities generally tend to increase greenhouse gas levels by introducing new sources or by interfering with natural sinks.
- viii Derived from analysis within the Australian Greenhouse Office, based on model comparisons.
- ix The World Business Council on Sustainable Development is a coalition of 125 international companies united by a shared commitment to the environment and to the principles of economic growth and sustainable development. See <http://www.wbcsd.ch/>.
- x The Pew Center on Global Climate Change was established in 1998 in the US. Under its direction major companies and other organisations are working to educate the public on the risks, challenges and solutions to climate change. See <http://pewclimate.org/home.htm>. The Business Council comprises a group of leading companies worldwide that are exploring how to contribute to solutions through their own products, practices and technologies.
- xi Storebrand report, March 1999
- xii Anon, 1997. *Insurance Farms, Banks will invest funds in solar energy. Climate Alert*, 10(3).
- xiii Based on informal advice to the Working Group
- xiv *US Industry and Trade Outlook '99*, (McGraw Hill Co. and the US Department of Commerce, Washington DC) 1999, as quoted in a paper 'Growth opportunities from environmental management' by James Brian Quinn and James F Quinn presented to the *1999 Forum on Sustainable Development*, 27 May 1999, Canberra..
- xv Standard and Poor's Industry Survey, *Environmental and Waste Management*, 29 April 1999 as quoted in a paper 'Growth opportunities from environmental management' by James Brian Quinn and James F Quinn presented to the *1999 Forum on Sustainable Development*, 27 May 1999, Canberra.
- xvi James Brian Quinn and James F Quinn, 'Growth opportunities from environmental improvement' presented to the *1999 Forum on Sustainable Development*, 27 May 1999, Canberra, p. 34.
- xvii Refer to endnote xii.
- xviii For further details see GLOBE Foundation of Canada at <http://www.globe.ca>.
- xix Senator the Hon Robert Hill, Minister for the Environment and Heritage in his address to the *1999 Forum on Sustainable Development*, 27 May 1999, in Canberra.

This paper was prepared by an independent working group for PMSEIC. Its views are those of the Working Group, not necessarily those of the Commonwealth

