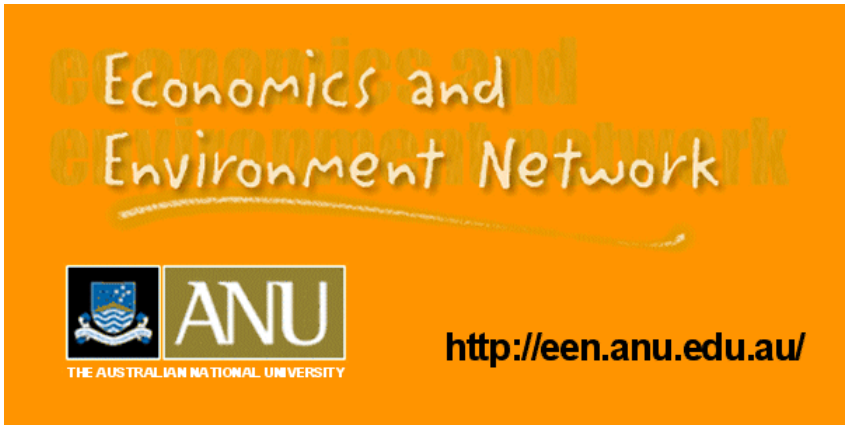

Climate policy in Australia and globally: where to and how?

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1. Introduction

Climate change policy has become headline news and a key policy concern in Australia. Several factors have combined to elevate the issue, including the message from the Stern Review that climate change is a risk to future economic growth, firmer science on climate change and growing realisation of grave risks from climate change. Al Gore's movie 'An Inconvenient Truth' has undoubtedly played a role to elevate climate change in the public perception, and the ongoing drought has given immediacy to environmental issues generally. Media reporting on climate change issues is pervasive, opinion polls show

support for policy measures to address climate change, and industry increasingly voices support for greenhouse gas policy.

The Australian federal government places strong emphasis on protecting the economic benefit from abundant fossil fuels along with industries that heavily use them. This has translated into a preference for technology policy over emissions pricing, and was a factor in rejecting the Kyoto Protocol. Recently however, the government has responded to mounting political pressure with a Prime Ministerial task group on options for emissions trading, and an apparent revision of its opposition against using price mechanisms. Nevertheless, policy to limit greenhouse gas emissions remains politically problematic because of the costs it may impose on industries and consumers, especially in the absence of broad-based international action.

At the time of writing in February 2007, there is no clear roadmap for climate policy internationally. The nature of greenhouse gases as a global externality arising from most aspects of economic activity means that the international policy dimension is crucial. Emissions will need to be reduced all over the world to limit the extent of future climate change, but strong incentives for free-riding and thorny issues of international equity make cooperation difficult. Countries have differing interests according to their endowments, circumstances and stage of development, and views diverge on what are the right instruments for greenhouse gas control.

This article is a backgrounder to the climate policy debate as it is unfolding in Australia, in the global context. It gives a perspective on current policy discussions, and attempts to draw out the reasons for some of the heatedness in the current debate. The paper first lays out the broad picture on climate change, policy and economics; next, developments in international climate policy are reviewed; then Australia's circumstances and policy options are discussed, including aspects of emissions trading that are likely to figure in the policy debate in the immediate future.

2. Climate change, policy and economics

Climate science

The scientific basis for human-induced climate change is beyond doubt. The latest report of the Intergovernmental Panel on Climate Change (IPCC 2007) finds that the atmospheric concentration of carbon dioxide, the main greenhouse gas released from human activities, has increased from a pre-industrial value of about 280 to 379 parts per million in 2005, by far exceeding the natural range over the last 650,000 years (180 to 300 ppm). Based on current science, there is now very high confidence that the net effect of human activities has resulted and will continue to result in global warming.[1]

Global average temperature has increased by 0.76°C over the 20th century, and the last twelve years contained eleven of the warmest years on record. The warming trend is confirmed by observations such as retreating glaciers, reduced snow cover, losses of ice sheets, and sea-level rise. The IPCC's (2007) central projections for further warming are 1.8 to 4.0°C over the course of the 21st century, depending on what path future global greenhouse gas emissions take, with a 'likely' range of 1.1 to 6.4°C when taking into account other uncertainties.

Warming causes sea level rise through thermal expansion of the oceans, and changes in rain patterns and ocean flows. Warming increases the incidence of extreme heat events, and is expected to lead to more frequent and intense tropical storms, as well as more floods and droughts. Australian society is particularly vulnerable to reduced rainfall and increased prevalence of drought (Steffen 2006a). Health impacts from greater incidence of heat waves and wider spread of vector-borne diseases may also be significant.

Large-scale changes in the Earth's climate have occurred in the past, the crucial difference now is that humans are an active force in planetary change. Changes will generally be adverse, as they interfere with the basis of established natural and human systems. At moderate temperature increases, some areas of the world may benefit, but the

[1] At the time of writing, the 'summary for policymakers' of the IPCC Fourth Assessment Report of the physical science of climate change is available. The detailed report, as well as reports on climate change impacts and adaptation, and mitigation, are to be released later in 2007. The IPCC Third Assessment Report provides a summary of the science as to around the year 2000. See also Steffen (2006b) for a concise overview of recent scientific findings.

expected net effect is clearly negative, especially at higher levels of warming. Adapting human systems will in many cases be difficult or costly, and ecosystems will experience major change, with many species poised for extinction.

There is increasing concern about the risk of abrupt climate change. Changes in the earth system can be nonlinear as the system flips to a different equilibrium, and paleoclimatic information shows that major changes happened quickly in the past. The climate system is thought to be subject to positive feedback mechanisms such as polar ice melt leading to greater absorption of solar radiation, or the potential release of carbon stored in plants at higher temperatures. Risks of abrupt changes include a slowing of the Gulf stream which would cool northwestern Europe, changing monsoonal patterns affecting rainfall patterns in the Asia-Pacific region, and a small risk of polar ice shelfs collapsing and raising sea levels by several metres.

The Stern Review on the economics of climate change

The Stern Review (Stern 2006) brought the debate about how to respond to the threat posed by climate change to the mainstream of economic policymaking. It is a comprehensive review of economic aspects of climate change, looking at both the potential future economic impacts of climate change (and the 'costs of inaction') and the economics of greenhouse gas control.

Stern argues for strong action to reduce greenhouse gas emissions, taken soon. The Review argues that climate change could have serious impacts on future growth and development, that the worst of the expected impacts and risks can still be avoided if action is taken soon, and that the long-term damages from climate change would be far greater than the costs of taking economies to a low-emissions path. Waiting or restricting action to only some countries will increase the costs, or make it impossible to limit warming to acceptable levels. The Review finds that in any event, adaptation will be necessary to climatic changes that the world is already committed to.

It is worth noting that similar conclusions were drawn in the Australian context, in a report by the Energy Futures Forum, prepared by CSIRO and with some of Australia's

largest energy companies as well as non-government organizations involved (Energy Futures Forum 2006).

The Stern Review has been criticized for overstating the economic costs of climate change, and much of the discussion among economists focuses on discounting of the future. The key findings under debate are that

> […] if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of GDP or more. In contrast, the costs of action – reducing greenhouse gas emissions to avoid the worst impacts of climate change – can be limited to around 1% of global GDP each year. (Stern 2006, Executive Summary)

Damage cost estimates of 5–20% of GDP are much higher than in the mainstream of the literature. Part of the reason is that the modelling takes into account small risks of very bad outcomes, and that some non-market impacts are valued. But the bigger issue is that the analysis is done over the relatively long time span of two centuries, with an effective discount rate lower than in many established analyses. Thus the longer-term costs from climate change are taken into account to a greater degree than in many other studies.

The overall discount rate has two components: the rate of pure time preference as a measure of giving more weight to the present than to the future; and the elasticity of marginal utility, describing how utility per extra dollar decreases as people grow richer. The rate of pure time preference used in the Stern report is close to zero, thus rejecting the notion that future generations should be given less weight purely because they will live in the future (a small positive value allows for the possibility of extinction). This ethical judgement can be justified in considering an issue where current actions carry consequences many generations into the future. The overall dollar discount rate used by Stern however is positive, as the analysis takes into account that future generations will be richer and thus have a lower marginal utility of wealth. The parameter value for this component of discounting has also been criticized as too low (Dasgupta 2006), while others have argued that it is justifiable (Quiggin 2006).

Stern has also been criticized for overstating climate impacts and damages (Byatt et al. 2006), while others have criticized the damage cost estimates as too low and failing to adequately account for the risk of catastrophic future climate change (Baer 2007).

The report's findings on the costs of global action to drastically reduce greenhouse gas emissions have been much less under discussion. The headline cost estimate in the Review is 1% of GDP over the next 50 years, with a range from –1 per cent (net gains) to 3.5 per cent, derived from a large range of models. This is for emissions paths consistent with atmospheric stabilisation at 500 to 550 ppm CO_2-equivalent, implying strong reductions below business as usual.

Juxtaposition of the estimates of '5–20% climate change damage costs' versus '1% greenhouse gas reduction costs' is used in the Stern Review to support the case for strong action to reduce greenhouse gas emissions. Any impression created that this is a cost-benefit-analysis however is wrong, as the two sets of numbers refer to different timescales and have different premises. In fact, it can be argued that the extremely long time horizons and uncertainties involved in climate change push cost-benefit analysis beyond its limits. Stern's core argument, that strong action to reduce greenhouse gas emissions is warranted as a precaution against future economic risks from climate change, could equally have been made without resort to numerical estimates – but then it would not have been nearly as prominent in the public debate.

Global greenhouse gas pathways

In order to slow and ultimately halt global warming, the concentration of greenhouse gases in the atmosphere needs to be stabilised. Current atmospheric concentration is around 430 parts per million carbon dioxide equivalent (ppm CO_2-eq.), and rising around 2.5 ppm per year. There remains much uncertainty about what temperature increases particular levels of atmospheric concentration will translate to. As a point of reference, the mean from a broad range of models is for an eventual 2°C increase above current mean temperature for stabilisation at 450 ppm, and 3°C increase at 550 ppm (Stern 2006, Ch. 13). Impacts from climate change are expected to become rapidly more severe above 2–3°C warming.

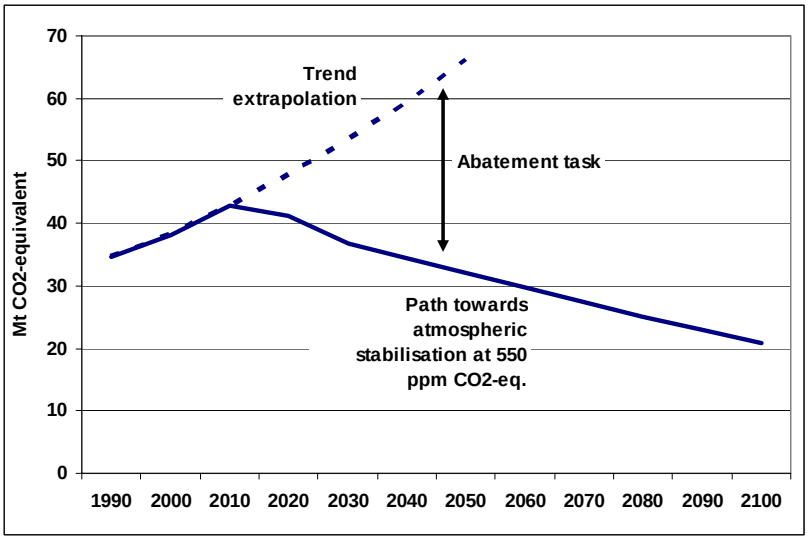
The task implicit in limiting greenhouse gas concentration to such levels is staggering. Stabilisation at 450 ppm it would require global emissions to peak around 2010 and thereafter fall by 7 per cent per year, or peaking around 2020 followed by 5 per cent reductions per year with temporary 'overshooting' to 500 ppm (Stern 2006, Ch. 8, based on Meinshausen et al. 2006). Stabilisation at 550 ppm could be achieved with global emissions peaking around 2020, then falling by around 2 per cent per year; or a peak around 2030 followed by annual reductions of around 3 per cent. Thus delaying action means that future policies would have to be much more aggressive. Either path to stabilisation at 550 ppm requires current emissions to be reduced by one quarter by the middle of the century, and halved by 2100.

Actual global emissions have steadily grown since industrialisation, and continuation of this trend in the absence of climate policy implies a huge abatement task (Figure 1).[2] Addressing climate change will require a drastic change in the nature of economic growth: 'de-carbonisation' is needed, so that more economic activity is compatible with lower emissions. This will require pervasive changes to energy and production systems, as well as changes in consumption patterns – but who should act, when and how is contentious.

Emissions are growing fastest in industrialising economies such as China and India, which are set to drive global emissions growth into the future, even if emissions from developed countries were to remain constant or fall (see indicators in Table 1). Most developing countries are still at low levels of emissions per capita, and this forms the basis for many poorer countries' claim to development without greenhouse gas constraints. Yet if developing countries were to reach the same levels of per-capital emissions as now prevail in rich countries, unacceptably high levels of global warming would result.

Figure 1: A pathway to stabilising atmospheric greenhouse gas concentrations

[2] There is a large literature on (and plenty of argument about) what future global emissions trajectories might look like, in the absence of climate policies. Extrapolation of past emissions growth in the Figure is merely meant for illustration of the principle.



Data from SiMCaP EQW model (as in Meinshausen et al. 2006). All greenhouse gas emissions.

Table 1: Some international indicators

	Share in global CO_2 emissions, 2003	Emissions growth, average annual 1990–2003 (CO_2)	Emissions per capita, 2003 (t CO_2/person)	GDP per capita, 2003 ($1000s/person, purchasing power adjusted in 2000)
World	100%	1.5%	4.1	7.9
China	17.3%	4.5%	3.5	5.0
India	4.4%	4.5%	1.1	2.7
Europe (EU-25)	15.4%	–1.2%	8.7	23.8
United States	22.3%	1.3%	19.9	35.4
Australia	1.3%	2.0%	17.2	27.2

Source: WRI (2007). Data excludes emissions from land-use change and non-CO_2 greenhouse gases.

Note: Negative emissions growth since 1990 in the EU is to a large extent due to the inclusion of Eastern European countries which experienced industrial collapse and restructuring in the 1990s.

3. International climate policy

Climate change is a global externality, so policy needs international cooperation to avoid a 'tragedy of the commons' outcome, but struggles to achieve it. The difficulty is exemplified by the stalemate between the United States (and other rich countries including Australia) and developing countries over who should limit emissions. The Bush administration has pointed to future emissions growth being concentrated in China, India and other developing countries, while they in turn point to industrialised nations' greater historical responsibility for greenhouse gas emissions, and greater ability to pay.

The Kyoto Protocol

Practically all countries have signed and ratified the 1992 United Nations Framework Convention on Climate Change (UNFCCC). The Convention's objective is 'stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system', and it includes the principle of 'common but differentiated responsibilities', that is the notion that industrialized nations should lead the way in addressing global climate change.

The UNFCCC is the framework for most international climate policy to date. The 1997 Kyoto Protocol as an instrument to the UNFCCC stipulates that industrialised countries (Europe, Russia, North America, Japan, Australia and New Zealand) collectively are to reduce their emissions by 5 per cent below 1990 levels, over the Protocol's first 'commitment period' 2008–12. Targets are differentiated between countries. To make compliance easier, the Kyoto Protocol allows trading of permits between countries (emissions trading), as well as using offset credits from emissions reduction projects in developing countries (under the Clean Development Mechanism, CDM).

The Kyoto Protocol entered into force in 2005, and has been ratified by 168 countries, including all major nations except the United States and Australia, who cited potential adverse economic effects (discussed below) and the lack of developing country targets as reasons for their withdrawal. Indeed, by 2012 the Protocol is expected to reduce global emissions by only 1 or 2 per cent below what they otherwise would have been, a far cry from the required future turnaround in global emissions paths. The main reason for this

modest impact is that developing countries including China and India do not have targets, and the United States have withdrawn.

However, proponents argue that the Protocol's first period is only a first step on the way to more ambitious commitments, for a wider range of countries. The European Union is the driving force in the implementation of the Kyoto Protocol, and has committed to the targets approach by instituting emissions targets and trading for its domestic power and industrial sector. The scheme has suffered from political maneuvering and overallocation of permits by national governments which has resulted in great permit price volatility, and a greater compliance task to be fulfilled outside the emissions trading scheme. Nevertheless, the scheme has sent a strong signal to industry and established the infrastructure for future policy.

Most Kyoto parties will not comply with their targets through domestic action alone and will need to rely on CDM offset credits for compliance, or ultimately on permit purchases from Russia or some Eastern European countries that may have excess permits. The CDM has seen strong interest and investment, predominantly from Western European governments and companies, and Japan. As of January 2007, around 1,500 projects in developing countries were in the pipeline, with combined expected emissions reductions of 1.7 billion tonnes of CO_2-equivalent by 2012 (UNEP Risoe Centre 2007). For comparison, Australia's total emissions are around 0.5 billion tonnes per year. Most developing countries are pushing for expansion of the CDM post-2012.

A post-2012 international climate treaty?

Talks on a post-2012 agreement have got underway in the UN climate negotiations, but progress has been slow. Australia and the United States have merely observer status in the negotiations on the future of the Kyoto Protocol, but are involved in a dialogue on broader options under the UNFCCC. Many players are waiting to see the stance of the next US administration, to come into power in 2009.

Political forums outside of the UNFCCC could facilitate progress, in particular the G8 process. The 2005 Gleneagles summit put climate change on the G8 agenda and sent a strong political message about its importance. An ongoing dialogue also includes the

major energy users outside the G8 group (including China, India, South Korea, Indonesia and Australia in the Asia-Pacific region).

The EU has made it clear that it is prepared to consider more stringent reduction targets for itself, that it expects newly industrialized countries to take on targets, and that it is seeking other forms of commitments from less advanced countries. Whether and to what extent other rich countries will be prepared to take on post-2012 emissions targets is still unclear. Middle-income countries including South Korea and Mexico (both members of OECD but without Kyoto targets) might be drawn into a post-2012 scheme.

Most developing country governments however oppose the suggestion of future emissions targets for them. India has taken a particularly strong stance, describing calls for developing country commitments as 'shrill' and 'surreal'.[3] China is predisposed toward domestic measures to improve energy efficiency in the context of energy security and for more cost-effective manufacturing (Lu et al. 2006), and has adopted a goal of reducing energy intensity of its economy (units of energy per unit of GDP) by 20 per cent over the period 2006-10. With rapid GDP growth, absolute emissions will nevertheless continue rising.

Many lower-income developing countries meanwhile are putting the spotlight on expected adverse climate change impacts and the vulnerability of their societies, and are calling for assistance from the developed world to help adapt to climate change.

One option for an effective future international climate policy framework that revolves around quantitative commitments may be to break down the dichotomy between countries with targets and those without, create a menu of different types of commitments, and allow for more flexibility in meeting them. Various options have emerged from international initiatives and dialogues outside the negotiations. Recent examples are the 'Pocantico Dialogue' (Pew Center 2005), which brought together high-level representatives from governments, multinational businesses, and civil society from a number of countries including the United States and Australia; and the 'Sao Paulo proposal', a collaborative project between Brazil, China, India and South Africa, supported principally by the European Union (BASIC 2006).

[3] *Earth Negotiations Bulletin*, 20 Nov 2006, vol.12, no.318, p.17.

Many such post-2012 proposals have emissions targets and trading at their core, but with a sliding scale of the type and degree of commitments, according to countries' stage of development and national circumstances. This makes for a broad spectrum of commitments, from highly flexible ones that apply to only parts of the economy at one end, to Kyoto-style national targets at the other (for an overview see Jotzo and Pezzey 2006). Elements proposed include

- intensity targets, where target levels are linked to future GDP, to compensate for activity-linked fluctuations;
- non-binding targets as entry-level commitments for risk-averse developing countries;
- sectoral targets to cover specific industries in the largest producing countries for each industry;
- price caps in permit trading to protect permit buying countries from the risk of overly high compliance costs;
- policy-based commitments without fixed emission limits; and
- recognition of funding provided for technology development or for climate change adaptation in poorer countries.

Alternative post-2012 climate policy architectures

Various alternative proposals to the targets and timetables approach exist. In the Australian discussion, the most prominent proposal is the 'blueprint' by McKibbin and Wilcoxen (2002). Each national government would issue short-term permits and thus control the maximum permit price, while emitters would own long-term permits. This would create a hybrid system of emissions control by quantity and price, without international emissions trading.

Economic theory suggests that emissions control by price (taxation) would be the most efficient instrument, as it promises lower cost uncertainty, but the huge revenues generated by emissions taxes have proved to be politically unacceptable. Opposition by emitters could be defused through taxation thresholds held by emitters as property rights (Pezzey 2003), but political momentum remains with emissions targets and trading.

Other proposed schemes would directly support actions that may result in lower emissions. For example, Schelling (2002) suggested that rich countries should make

large-scale financial contributions to help finance energy-efficient and de-carbonised technologies in the developing world, in a collaborative effort akin to the Marshall Plan, or NATO during the cold war.

Technology policy and the Asia-Pacific Partnership

The Asia-Pacific Partnership on Clean Development and Climate (AP6) is an initiative by Australia, China, India, Japan, Republic of Korea and the United States for addressing climate change through technology development, outside of the UNFCCC framework. Australia has been a driving force behind the initiative. The stated purpose of AP6 is to

> "create a voluntary, non-legally binding framework for international cooperation to facilitate the development, diffusion, deployment, and transfer of existing, emerging and longer term cost-effective, cleaner, more efficient technologies and practices" (Asia-Pacific Partnership 2006).

AP6 was announced in January 2006. Sector-specific task forces have been formed, and action plans formulated for improvements in the use of existing energy and industrial technologies. Funding for APP projects so far has been for too limited to expect progress on any 'breakthrough' technologies, or on widespread uptake of best practice technology. Australia has committed A$100 million (and a further A$500 million for clean energy projects in Australia, outside of AP6), and the US administration pledged US$ 52 million (subsequently blocked by the House of Representatives). This compares to energy sector investment needs of hundreds of billion of dollars annually in the AP6 economies (IEA 2003).

Australia is particularly interested in developing 'clean coal' technology. The key technology is capture and underground storage ('geosequestration') of carbon dioxide, which could drastically reduce emissions from coal-fired power stations, but would drive up the price of electricity generated (Metz et al. 2005). Carbon capture and storage will need large-scale investment to prove it at a commercial scale, and to bring down costs. Even then, it is likely to remain significantly more expensive than many other abatement options.

For policy, the question is whether technology development needs direct government intervention, or whether it can be induced through market price signals for example under

emissions trading. The dominant view in the current debate is that both price signals and government-sponsored technology policy are needed for an effective and efficient outcome. Externalities in technology development create a need for government support, but emission pricing can also induce significant amounts of innovation – and crucially, price signals are needed to for take up of new, cleaner technologies, and for demand-side substitution (see Pezzey et al. 2006).

Movement in the United States?

Developments in the United States could be the pivotal factor for global climate policy in the near to medium term.

The Bush administration took a famously hard line on climate change in its first term in office, rejecting the Kyoto Protocol, refusing any policies that might reduce energy consumption, and casting doubt on climate change science. That position has gradually softened, in the context of a growing sense in society that climate change is a serious threat. The Bush administration now acknowledges that climate change is important, the President calling it a 'serious challenge' in the 2007 State of the Union address. Policies so far however have been limited to fuel standards and ethanol subsidies (in large part to reduce oil dependence), and funding for selected technology initiatives.

American greenhouse gas policy in recent years has been driven by the States. An agreement for emissions targets and trading is in place among Northeastern and Mid-Atlantic states (the 'Regional Greenhouse Gas Initiative', or RGGI), and California in late 2006 followed suit. Possible links to the EU emissions trading system are under discussion.

In the US Senate, several bills on climate change were introduced in recent years, most notably by presidential candidate McCain. Adoption of federal climate policy has become much more plausible after the Republican defeat in the mid-term elections (Pew Center 2006). And importantly, pressure from business and civil society groups is mounting. In January 2007, a group of major energy and manufacturing companies and environmental organisations called for 'strong national legislation to require significant reductions of greenhouse gas emissions' (United States Climate Action Partnership 2007). Major

church groups have also begun to use their political influence to lobby for action against climate change.

The next US President, whoever it may be, could make her or his mark by a bold move on global climate policy, and that could transform international climate policy.

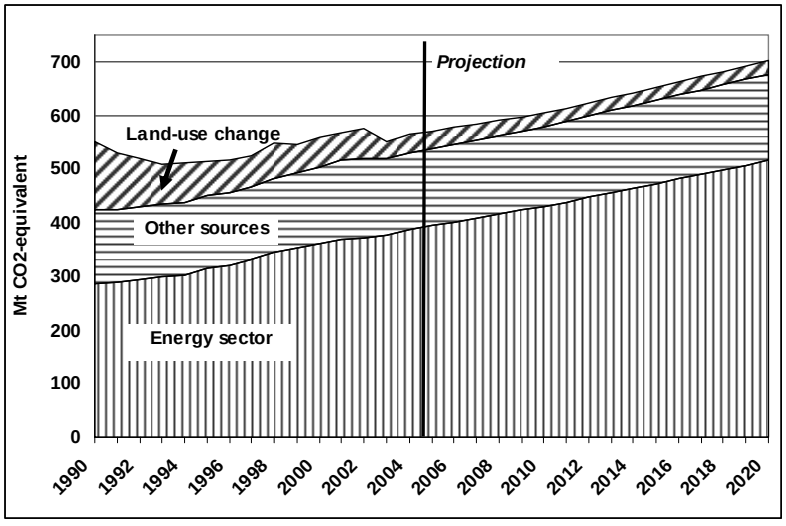
4. Australia's policy options

Important policy choices are coming up for Australia. High reliance on greenhouse-intensive fossil fuels creates special challenges, but taking a leadership role in reducing emissions could be in Australia's long-term public interest. An opening may exist in 2007 to prepare the ground for sensible and forward-looking greenhouse gas policy.

Australia's emissions and the Kyoto target

Australia is likely to come in close to the Kyoto target of 108% of 1990 emissions. This is because under accounting rules secured by Australia in the Kyoto negotiations, reductions in emissions from land-use change over time were included in computing national total emissions. Annual land clearing in Queensland, and carbon released as a consequence, was much higher in 1990 than it is now and than it will be in future. These reductions largely outweigh strong increases in emissions from the power sector and other sources, when using 1990 as the base year; but they are now largely exhausted. Emissions from the energy sector are already up by 35 per cent from 1990 levels, as a result of increased energy (in particular electricity) demand. The energy sector is expected to drive a continued rise in total emissions (AGO 2006, and see Figure 2).

Figure 2: Australia's greenhouse gas emissions



Data to 2004: AGO 2005; projection ('with measures') from 2005: AGO 2006.

It is somewhat ironic that Australia, having rejected the Protocol, is going to be one of the few countries close to complying with its target, without resorting to the Protocol's flexibility mechanisms. This also implies that ratification for Australia would come at no or low net cost, and quite possibly a net gain, in the first Kyoto period to 2012. Modelling commissioned by the Australian Greenhouse Office (McKibbin 2002, and ABARE 2002) suggested impacts on Australia's GDP or GNP from the Kyoto Protocol at 2010 between 0.1 and 0.4 per cent if Australia ratified the Protocol, and between zero and 0.4 per cent without ratification. In one scenario, Australia was better off at 2010 ratifying than not.

Ratifying the Kyoto Protocol would strengthen Australia's position in the UNFCCC negotiations, help counteract perceptions of Australia being obstructionist, and get a seat at negotiations on a possible second commitment period. That said, if the same Kyoto cap or a tighter target were to apply into the future, then compliance could be a real challenge. Longer-term policy choices are clearly more important than Australia's position on the Kyoto Protocol until 2012.

Cost of greenhouse gas reductions

Modelling of the economic impact of greenhouse gas reduction policies has traditionally been an important factor in the Australian climate policy debate, going back to the time before the Kyoto Protocol. The moderate cost estimates for Kyoto compliance have not been widely publicised, with recent emphasis on long-run scenarios. For example, a report by the ABARE (2006) models greenhouse gas reduction scenarios at 2050. Impacts on Australia's GDP in the main scenarios are in the range of 2 to 3 per cent at 2050, close to the global average. There is however one scenario where Australia suffers a 10.7 per cent GDP loss, derived from the highly unrealistic assumption that Australia

implements a carbon tax eight times higher than the rest of the world. In a sign of how politicized the debate is, it is this latter number that has been most often cited, often taken out of context.[4]

Recent international analyses show costs of greenhouse gas mitigation to be manageable, even for large reductions of global emissions – see the Stern Review's central cost estimate of around 1 per cent of global GDP by 2050, for significantly greater reductions than in the ABARE scenarios. Assumptions about future technologies are crucial, with many newer models allowing for faster technical progress induced by greenhouse gas policy (Grubb et al. 2006).

Further, these global cost estimates presume that effective mitigation action is taken in all or most countries, and on most sources of greenhouse gas emissions. If the same level of global emissions reductions is to be achieved with a narrower base, then costs are higher.

The economic cost borne by each country depends principally on their endowment, and on any policies for international burden sharing, such as differentiated targets under emissions trading. As a high-income country, Australia would likely be expected to shoulder greater costs relative to the global average, and as a fossil fuel exporter may suffer from a decline in global energy demand.

Perspective is needed in interpreting economic cost impacts over half-century time spans. A 3 per cent GDP loss at 2050 implies that achieving the same level of material well-being (a trebling of GDP at annual average growth rates of 2.5 per cent) will be postponed from 2050 to 2051 – by itself hardly a compelling factor for the making of public policy.

What is Australia's public interest?

The Howard government has made it clear that it sees Australia's key interest in greenhouse gas policy in protecting the wealth bestowed by abundant fossil fuel

[4] For example, Prime Minister Howard in the House of Representatives on 16 August 2006: "According to ABARE, a 50 per cent cut in Australian emissions by 2050 would lead to a 10 per cent fall in GDP, a 20 per cent fall in real wages, a carbon price equivalent to a doubling of petrol prices, and a staggering 600 per cent rise in electricity and gas prices." (Hansard No. 11 of 2006, p.66)

reserves.[5] As the Prime Minister put it at his 2006 address to the Business Council of Australia:

> [Ratifying Kyoto] could have damaged the comparative advantage this country enjoyed as a result of our abundance of fossil fuels and the importance of that abundance to Australia's export and general performance. […] I do not intend to preside over policy changes in this area that are going to rob Australia of her competitive advantage in the industries that are so important to us. (Howard 2006)

Australia has large and easily accessible reserves of coal, the most CO_2-intensive fuel. Coal accounts for around half of Australia's energy production, and at current rates of extraction, Australia's known recoverable coal reserves would last several hundred years. Around three quarters of coal mined is exported, and a significant share of domestic coal use is for energy-intensive export products such as aluminium and steel (ABS 2006). Substituting away from coal is one of the most obvious greenhouse gas reduction measures globally, and reductions in coal export demand and penalties on CO_2 emissions could devalue Australia's resource stock.

Yet the importance of coal for the Australian economy can be overstated. Coal accounts for less than a quarter of value added in the mining industry, and the mining sector overall contributes around 4 per cent of Australia's GDP (ABS 2006). In any event, in a future carbon constrained world, coal will be competitive only if and where there are economical ways of removing CO_2 emissions. Alternative energy sources by contrast will benefit from emissions constraints, especially nuclear and renewable energy sources. Australia has large uranium reserves, and great potential for renewable energy sources such as wind and solar. More broadly, the very notion that energy must be at the heart of Australia's national economic interest can be challenged. History has shown that natural resource wealth is not necessarily a recipe for long-term economic prosperity (World Bank 2006).

The other national interest consideration is of course climate change itself. Australia is vulnerable, in particular to changes in rainfall patterns. If the drying trend in South-East Australia were to be amplified, it would have major consequences not just for agriculture but for water supply to the majority of Australia's population. To what extent water

[5] See for example the government energy White Paper (Department of the Prime Minister and Cabinet 2004).

shortages during drought can be addressed through improved water management and pricing remains to be seen. Reducing the extent of climate impacts, and lowering the risk of abrupt change, is clearly in the long-term public interest. Heightened community expectations on climate change policy can be seen in this context.

The effect of Australian emissions on Australia's climate is of course very small, due to the global nature of the greenhouse effect, and the long time lags in the climate system. Arguably, the value in Australian greenhouse gas reductions is first and foremost in setting an example and showing good faith, to help induce action globally.

Domestic policy

A less contentious aspect of climate policy, though one subject to large uncertainties, is adaptation to climate change. Governments clearly have a role to play in helping generate and make available the best available information about expected future changes, and in 'mainstreaming' climate change into other policy and planning processes. To name but a few, water resource management, agriculture, urban planning, public health, transport and energy infrastructure all will need to take account of expected future climatic changes.

Greenhouse gas policy is the more difficult issue politically. Cost-effective greenhouse gas policy (that is, achieving a given outcome at lowest possible cost) would require abatement action on all or most emissions sources, to a similar marginal cost of action. This includes not just power generation technologies, but demand-side energy efficiency improvements which constitute a large share of the low-cost emissions reduction potential in Australia (Allen Consulting Group 2004). A further important plank, often overlooked, is changes in consumption patterns. A cost-effective strategy requires that consumers be exposed to higher relative prices for greenhouse gas intensive goods and services, which is of course politically sensitive.

Australian policy to date has been heavily focused on the supply side, using subsidies to induce the development of low-emissions technologies. As argued above, there is a role for such policy where specific technologies can be identified that show promise and that would not receive adequate investment under market conditions. But government

spending would need to be very large in order to bring significant technological advance; and price signals or direct regulation will be needed for uptake of cleaner technologies.

Nuclear power has recently put on the agenda. The Prime Minister's nuclear energy review (Commonwealth of Australia 2006) raised the spectre of 25 reactors replacing up to 17 per cent of Australia's emissions in 2050 (compared to a business-as-usual scenario of emissions doubling compared to 1990 levels), but highlighted that nuclear power would not be competitive with coal-fired generation unless carbon emissions are priced. Nuclear power is a low-emissions electricity source, but invariably raises safety concerns and is unattractive for private investors because of huge capital outlays and uncertainty (Owen 2006).

There is no compelling reason that governments will necessarily pick the 'right' technologies. The current government clearly favours 'clean coal' and nuclear energy over renewable energy sources such as solar thermal, wind and other technologies. Yet all of these are more expensive than conventional fossil fuel based energy, and any of them could become competitive with further R&D and/or emissions pricing.

Market mechanisms are generally seen as the best way to create broad-based and consistent incentives throughout the economy, necessary to achieve emissions reductions at least cost. As elsewhere in the world, permit trading appears the most acceptable way of creating a carbon price signal.

The Australian States have put forth a blueprint for a state-run national trading system (National Emissions Trading Taskforce 2006), but achieving agreement between States on implementation would be difficult, and it appears that the initiative may well be superseded by a federal scheme.

From federal government statements in early 2007, it appears that emissions trading is under consideration, and national emissions trading is also opposition policy. A 'Prime Ministerial Task Group on Emissions Trading' was formed late in 2006, to advise on a global emissions trading system in which Australia could take part, while preserving its advantage in fossil fuels.[6] Task group members comprise five government officials, five

[6] Full terms of reference: "Australia enjoys major competitive advantages through the possession of large reserves of fossil fuels and uranium. In assessing Australia's further contribution to reducing greenhouse

representatives from energy and mining companies, and two representatives from financial and services industries. Given the narrow terms of reference and the composition of the group, it would be unsurprising if the recommendations (due in May 2007) turned out to be fairly defensive. However, the task group 'issues paper' calling for public comment (Department of Prime Minister and Cabinet 2007) canvasses a wide range of options, and appears to open the door for the possible introduction of a domestic scheme even while there is no global scheme in place.

Some reflections on emissions trading

Emissions trading may well be in the interest of large parts of Australian industry, depending on the design of the scheme. Industry has a strong interest in a stable policy environment, and many businesses are probably already pricing in the possibility of future carbon constraints in their investment decisions, but suffer uncertainty about what form or magnitude such constraints might take. Business groups such as the Australian Business Roundtable on Climate Change are lobbying for long-term carbon price signals to be established. Rio Tinto recently made headlines by publicly supporting emissions trading 'because it provides for a least cost method of abatement and allows market forces, rather than government decision-making, to determine outcomes', and stating that the ambition of international cooperation 'should not be used as an excuse for inaction on the domestic front' (Rio Tinto 2006).

A crucial design issue is allocation of permits. Polluters can be compensated by giving them a share of permits freely. If all or almost all permits are given away to existing emitters ('grandfathering'), this can result in large windfall gains to industries that can pass on production cost increases – as experienced in the EU (Grubb and Neuhoff 2006). Indeed, positioning to secure free permits likely is a factor in recent industry support for emissions trading. A balance needs to be struck between the political necessity to compensate industry, and the interests of consumers and taxpayers. Permit allocation and

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gas emissions, these advantages must be preserved. Against this background the Task Group will be asked to advise on the nature and design of a workable global emissions trading system in which Australia would be able to participate. The Task Group will advise and report on additional steps that might be taken, in Australia, consistent with the goal of establishing such a system."
(http://www.dpmc.gov.au/emissionstrading/reference.cfm)

other technical aspects of emissions trading were investigated already in the late 1990s, by the Australian Greenhouse Office (AGO 1999).

Avoiding negative trade impacts on energy intensive industries such as steel or aluminium production is another sticking point. Australian producers might experience a competitive disadvantage from the increase in production cost under emissions trading, and some production might be shifted to countries where they are not penalised ('carbon leakage'). Border tax adjustments may provide an interim solution to this problem (Saddler et al. 2006). In terms of overall effectiveness of the scheme, they are preferable to exempting whole industries from emissions trading. Sectoral targets for energy-intensive industries under a post-2012 international treaty may also reduce the problem of carbon leakage, if they encompass the major producing countries. Regarding energy industries and in particular coal, it is important to recognize that challenges arise more from importers than domestic policies, and fossil fuel exports cannot be protected through domestic policy.

There are a range of other important aspects of emissions trading design. Broad coverage is needed for emissions pricing to yield cost-effective outcomes. Permit allocations should be defined over longer-term periods to provide robust investment incentives. Safeguards against overly large compliance costs may be needed, such as activity-linked allocations ('intensity targets') and a guaranteed price cap. Many of these options were canvassed by the state-based initiative (National Emissions Trading Taskforce 2006).

The McKibbin-Wilcoxen proposal mentioned above has a number of features that may be attractive to Australian policymakers. If adopted in Australia, it would be interesting to see whether this would increase its appeal to other countries, in the context of negotiations and policies for the post-Kyoto period.

On the other hand, 'conventional' emissions trading can be designed much better than the EU scheme, and would be more readily compatible with existing and emerging schemes internationally.

5. Concluding remarks

In late 2006, the ground started shifting on climate policy in Australia. The Stern Review has made a strong argument that addressing climate change is an economic necessity: the risk that future climate change could undermine the physical basis for prosperity, and large-scale action to reduce greenhouse gas emissions should be taken soon. There is growing consensus that it is worth reducing climate risks, based on firmer scientific evidence, bolstered by greater public awareness, and with business increasingly prepared to face the issue. Yet international cooperation to curb emissions faces formidable hurdles, and it is doubtful that comprehensive global action can be achieved quickly. Measures to adapt to climate change will be much more readily taken, as they yield local and national benefits.

As a major exporter and user of fossil fuels, Australia faces particular pressures, and to date this has translated into a defensive policy position. But pressure from civil society and increasingly business is mounting for meaningful policy. The current political setting might allow for the creation of a forward-looking and broad-based greenhouse gas policy that goes beyond government subsidies for selected technologies, and that includes carbon pricing. The winds of change in the United States should help this process along.

Australia's national interest on climate change transcends concerns about the profitability of existing energy industries. As the debate evolves, the argument that 'Australia should do nothing unless China and India cut their emissions' will likely hold less and less sway. Societies concerned about climate change will need to lead by example, and the principle that rich countries should act first goes right back to the UN Convention on Climate Change. Implementing meaningful greenhouse gas policies at home would put Australia in a much stronger position from which to help work toward meaningful post-Kyoto international climate policy.

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