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SUBMISSION TO THE JOINT STANDING COMMITTEE ON TREATIES – REVIEW INTO THE KYOTO PROTOCOL

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Contact details:

Erwin Jackson,

Director, Policy and Research

The Climate Institute

E: ejackson@climateinstitute.org.au

Summary

Global action

It is in Australia's national interest to ensure global temperatures peak at the lowest possible level. Even a 2°C increase in global temperature above preindustrial levels would see severe impacts in Australia and our region.

Accepting warming at or above this level equates to accepting the risk of large-scale irreversible (and potentially catastrophic) outcomes. For example, defining an objective of stabilising atmospheric greenhouse gas concentrations at 550 ppm-e suggests that Australia is prepared to accept, on behalf of future generations, up to a 3°C (or greater) increase in global temperature. This risks severe droughts, constraining water supplies and farming over large areas of the nation. Globally, the lives and wellbeing of hundreds of millions of people would be put at risk. This objective would also risk catastrophic outcomes such as the collapse of the Greenland and West Antarctic ice sheets and land based sinks of greenhouse gases turning into net sources of greenhouse emissions (e.g. if the Amazon collapses). Known adaptive capacity of Australian natural ecosystems, water security and coastal communities could also be exceeded.

To give a reasonable chance of avoiding a 2°C increase in global temperature, the global mitigation effort needs to ensure greenhouse gas (GHG) concentrations peak well below 500 ppm-e, and then decline to levels below 400ppm-e over the coming centuries. Based on multi-gas emission pathway modelling The Climate Institute believes that:

- Industrialised countries' overall emissions should be around 30 per cent below 1990 levels by 2020*;
- Developing country emissions should peak and begin to decline rapidly over the same time period;
- Global emissions should be less than 50 per cent below 1990 levels by 2050; and
- Firm rules, mechanisms and global action to rapidly reduce emissions from land use change and deforestation is also required.

Australia's posture in the lead up to the Copenhagen conference in 2009 should be one that seeks to ensure that the agreement reached does not foreclose achieving these outcomes.

The post 2012 climate regime

A global solution to climate change will require mitigation and adaptation action – in a fair and equitable way – from all countries. Article 3.1 of the UNFCCC states that such a differentiation should be in accordance with Parties "common but differentiated responsibilities and respective capabilities". This implies:

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* With a range of 25-40 per cent below 1990 levels by 2020.

- Legally binding targets and leadership from developed countries must be the backbone of the global regime. These countries are responsible for the majority of historical emissions and have the highest capacity to undertake and support mitigation.
- An expansion of the number of countries adopting binding targets.
- Measurable, reportable and verifiable commitments for developing countries, recognising that their overall emissions should peak and begin to decline rapidly by no later than 2020.
- Developing countries historic responsibility, capacity and mitigation potential varies greatly. Developing countries are not a homogeneous group. This implies the post-2012 climate regime should differentiate between developing country obligations.
- Developing countries, however, also have lower cost mitigation potential than developed countries, highlighting the importance of global carbon markets or equivalent arrangements in delivering cost effective global abatement.

During the 2007 UN Climate Change Conference in Bali, developing countries for the first time signalled their willingness to take on measurable and verifiable obligations to cut emissions. However, building on this spirit will require strategies to build trust and capacity among developing countries.

Unless the USA and other large emitting developed countries commit to substantial domestic action, large developing countries will continue to resist strong measures themselves. Australia can play an important role here through signalling a strong domestic emission reduction target as part of its Carbon Pollution Reduction Scheme.

Clean technology

International negotiations on a post-2012 climate agreement must pave the way for a large-scale investment to arrest the rapidly growing emissions in developing countries. The size of this investment is uncertain, but is expected to be at least US$20-50 billion annually over the coming decades. Much of this is needed in the Asia-Pacific region, where Australia is well positioned to play a leadership role and reap the benefits from exporting skills, expertise and technology.

The post-2012 climate change agreement can provide a vehicle for increasing investment in clean technology in developing countries. Without a significant up-scaling of financial support developing countries are unlikely to take on stronger emission reduction commitments, which is clearly in Australia's national interest.

The post-2012 climate change agreement must include provisions for a Clean Technology Funding Mechanism to remove barriers to the up-take of clean technology in developing countries. Agreement to establish the Clean Technology Funding Mechanism should include a target for annual revenue flows into this fund to ensure sufficient resources are available.

Australia can show a leadership role here by signalling that it is prepared to use 10% of domestic emission trading auction revenue to support technology transfer, financing and

adaption in developing countries. This approach is already being considered by a number of other countries and has the potential to provide a significant global revenue stream for broadscale technology development and deployment.

Australia's emissions trajectory

The setting of Australia's interim target will have important international ramifications and that it should be calibrated towards leveraging international action consistent with Australia's national interest.

Australia's ratification of the Kyoto Protocol has helped build Australia's standing internationally. However, Australia signalling a weak domestic target will undermine the nation's potential leadership position and strengthen the hand of developed countries that are resisting the strong 2020 obligations that are in Australia's national interest.

Australia should commit unilaterally peaking national emissions by 2012 and adopt a unilateral domestic target to reduce emissions to around 25 per cent below 1990 levels by 2020. If a strong international agreement can be agreed, Australia should be prepared to accept an emission reduction obligation of stronger than around 25 per cent by 2020.

Introduction

The Climate Institute welcomes the Joint Standing Committee on Treaties' Review into the Kyoto Protocol and appreciates the opportunity to submit its views. This submission focuses on one aspects of the JSCOT inquiry, as outlined in the inquiry's terms of reference:

> *"the position Australia should be taking to future international negotiations concerning the 'second commitment period' (beyond 2012), both for itself and other nations."*

Established in late 2005, The Climate Institute has a goal of raising public awareness and debate about the dangers to Australia of global warming and to motivate the country to take positive action.

The Climate Institute is a non-partisan, independent research organisation that works with community, business and government to drive innovative and effective climate change solutions. Our vision is for an Australia leading the world in clean energy use and innovation, with clean and low energy solutions a part of everyday life throughout the community, government and business.

The Climate Institute is funded by a donation from the Poola Foundation (Tom Kantor Fund). Further information about The Climate Institute's work, including our publications, is available at our website: www.climateinstitute.org.au.

The Climate Institute would welcome the opportunity to appear before the committee to discuss its submission in more detail.

Dangerous climate change

Central to defining a long-term goal for global action on climate change is what countries view as acceptable climate change impacts.

The UN Framework Convention on Climate Change, signed in 1992, commits governments to avoiding "*dangerous*" levels of climate change and to stabilising the climate in a time frame that allows natural systems to adapt, food production not to be threatened and for economic development to proceed in a sustainable manner.[†] It also commits countries to "*... take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures ...*"[‡].

Australia has ratified the climate convention and is legally bound to help achieve these objectives.

The scientific community has been clear for well over a decade that human emissions of greenhouse gases pose a threat to the global climate. Progressive assessments of the Intergovernmental Panel on Climate Change (IPCC) have strengthened these conclusions but since 1990 it has been well established that that greenhouse gas would cause climate warming (Houghton, Jenkins, Ephraums (eds), 1990; Houghton, Meira Filho, Callender, et al. (eds), 1995; Houghton, Ding, Griggs, et al. (eds), 2001); Solomon, Qin, Manning, et al., 2007). These reports have been endorsed by progressive Australian Governments. This point is important as some have argued that the seriousness of climate change has just dawned on the scientific community and policy makers.

There is an emerging consensus among prominent scientists that a 2°C increase in global temperatures above pre-industrial levels would constitute a threshold above which dangerous, irreversible and potentially catastrophic global impacts may occur (Preston, Jones, 2006; Bali Climate Declaration by Scientists, 2007). For example the 2007 Bali Climate Declaration by Scientists, which was endorsed by many of Australia's leading climate change researchers, concludes:

> *The prime goal of this new [post-2012] regime must be to limit global warming to no more than 2 ºC above the pre-industrial temperature... In the long run, greenhouse gas concentrations need to be stabilised at a level well below 450 ppm (parts per million; measured in CO2-equivalent concentration).*

[†] UN Framework Convention on Climate Change, Article 2, (1992).

[‡] UN Framework Convention on Climate Change, Article 3.3, (1992).

Similarly, the Australian Prime Minister has stated (Rudd, 2007):

> *"... the IPCC found that the level of greenhouse gases in the atmosphere will need to be kept between 445 – 490 parts per million, in order to avoid the most dangerous impacts of climate change."*

More recent assessments indicate global warming well below 2°C may constitute dangerous climate change and that climate tipping points may be approaching much more rapidly than previously anticipated (Pittock, 2006; Hansen, 2007). Indeed, current levels of atmospheric concentrations may already threaten (Hansen, Sato, Kharecha,et al., 2008):

- rainfall declines and increased aridity in southern Australia, southern United States, the Mediterranean region and parts of Africa;
- fresh water supplies from glaciers in the Himalayas, Andes and Rocky Mountains that now supply water to hundreds of millions of people;
- accelerating mass losses from Greenland and West Antarctica and the complete loss of Arctic summer sea ice; and
- severe impacts on the world's coral reefs and knock on impacts to the 500 million people worldwide who rely on them for their food and livelihood.

Figures 1a and 1b outline global temperature increases to 2100 based on greenhouse gas stabilisation scenarios for 350 ppm-e, 400 ppm-e, 450 ppm-e and 550 ppm-e by 2100.[§] This modelling is used to identify potential climate change impacts in Australia and globally for various degrees of global warming. The modelling output also illustrates the risk of exceeding adaptive capacity of key Australian sectors, as identified by the IPCC (Hennessy, Fitzharris, Bates, et al. 2007). This illustrates a number of points relevant to Australia determining its global negotiating position:

- Defining an objective of stabilising atmospheric concentrations at 400 ppm-e or below reduces the risk of irreversible and potentially catastrophic global impacts. Significantly, however, stabilisation at this level still poses risks, particularly to natural systems such as coral reefs.
- Defining an objective of stabilising atmospheric concentrations at 450 ppm-e suggests that Australia is prepared to accept the known adaptive capacity of Australian natural ecosystems being exceeded. Stabilisation at this level also risks

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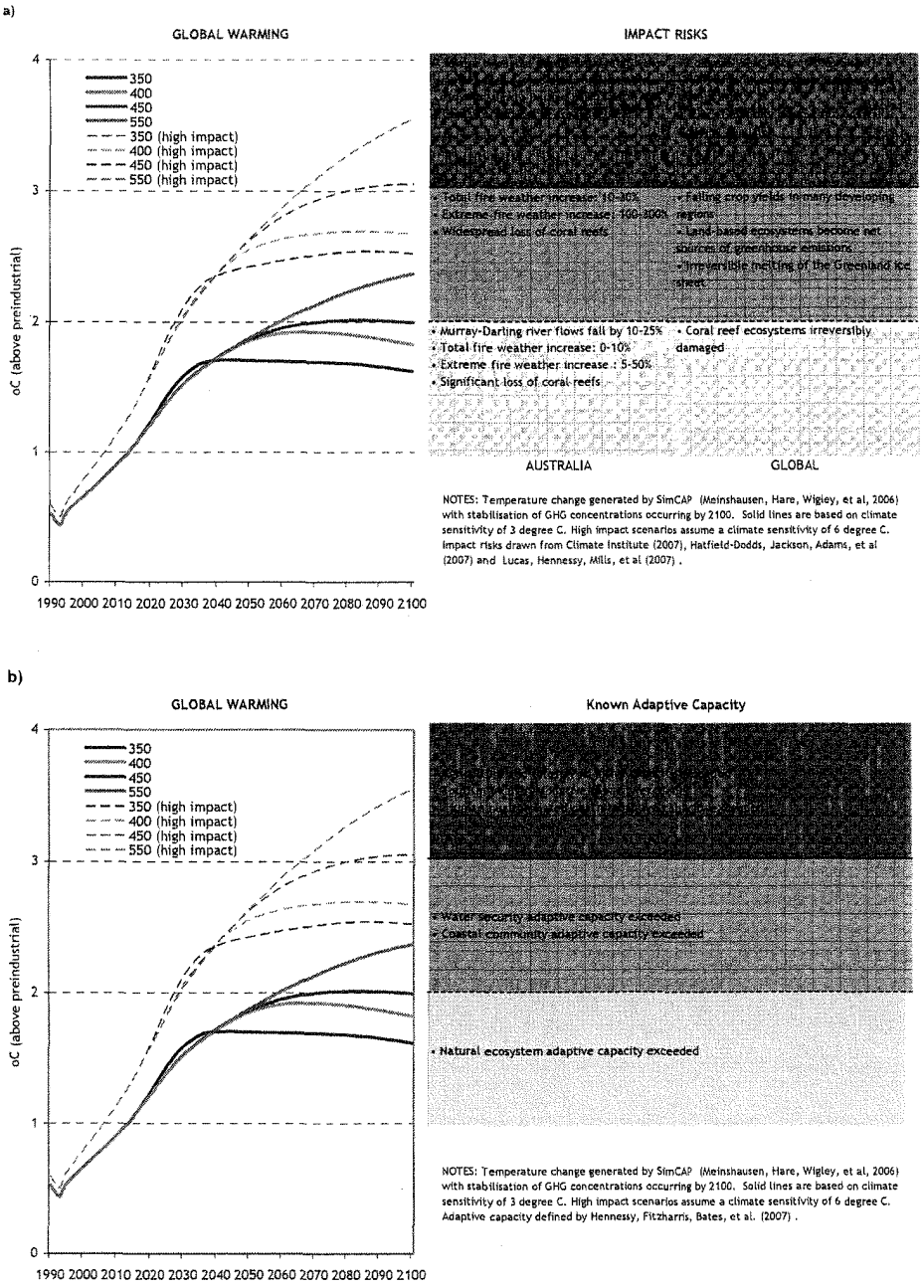
[§] The multi-gas emission pathway model SiMCaP (Meinshausen et al. 2006) is used to generate climate impact and emission pathways in this submission. The strengths and weakness of this approach are outlined by Meinshausen et al. (2006). The SiMCaP model attempts to get as close to the defined target as possible. In both the 400 ppm and 450 ppm scenarios concentrations peak at around 500 ppm before falling towards the desired levels after 2100. In the 350 scenario, concentrations peak at around 475 ppm then fall and stabilise at around 375 ppm in around 2200. Model runs that seek stabilisation at 350 after 2200 are not used in this submission. In addition to scenarios that use *"best guess"* climate sensitivity, scenarios that use a climate sensitivity of 6°C are also used. In addition to scenarios that use *"best guess"* climate sensitivity, scenarios that use a climate sensitivity of 6°C are also used. While such an outcome has a lower probability of occurring than the best guess scenarios, climate sensitivity of this magnitude cannot be ruled out and these scenarios are used to illustrate the potential for low probability/high impact outcomes.

the known adaptive capacity of water security and coastal communities. If the climate system proves more sensitive than currently estimated climate change will lead to severe drought, constraining water supplies and farming over large areas of Australia, hundreds of millions of lives being put at risk globally and catastrophic outcomes such as the collapse of the West Antarctic Ice Sheet.

- Defining an objective of stabilising atmospheric concentrations at 550 ppm-e suggests that Australia is prepared to accept the risk that climate change will lead to severe drought constraining water supplies and farming over large areas of the nation, hundreds of millions of lives being put at risk globally, catastrophic outcomes such as the collapse of the Greenland and West Antarctic icesheets and land-based sinks of greenhouse gases turning into net sources of greenhouse emissions (e.g. if the Amazon collapses). Known adaptive capacity of Australian natural ecosystems, water security and coastal communities would also be exceeded. Stabilisation at this level also risks the known adaptive capacity of agriculture, forestry, tourism and health systems.

Figure 1: GHG stabilisation, global warming and impact risks



Australia's vulnerability to the impacts of climate change has also been highlighted by the Garnaut Climate Change Review, which highlighted some of the potential impacts that may occur unless urgent action is taken to lower global emissions (Garnaut, 2008a).

Table 1: Some of the potential impacts of climate change in 2100 under unmitigated and mitigated scenarios (adapted from Garnaut, 2008a)

Sector	No Mitigation Scenario	Mitigation Scenarios	
		550 ppm CO_2-e	450 ppm CO_2-e
Irrigated agriculture in the Murray-Darling Basin	92% decline in irrigated agricultural production in the Basin, affecting dairy, fruit, vegetables, grains.	20% decline in irrigated agricultural production in the Basin.	6% decline in irrigated agricultural production in the Basin.
Natural resource-based tourism (Great Barrier Reef and Alpine areas)	Catastrophic destruction of the Great Barrier Reef. Reef no longer dominated by corals.	Disappearance of reef as we know it, with high impact to reef-based tourism.	Mass bleaching of the coral reef twice as common as today.
	Snow-based tourism in Australia is likely to have disappeared.	Moderate increase in artificial snowmaking.	
Water supply infrastructure	Up to 35% increase in the cost of supplying urban water, due largely to extensive supplementation of urban water systems with alternative water sources.	Up to 5% increase in the cost of supplying urban water. Low-level supplementation with alternative water sources.	Up to 4% increase in the cost of supplying urban water. Low-level supplementation with alternative water sources.
Temperature-related death	Over 4,000 additional heat-related deaths in Queensland each year.	Fewer than 80 additional heat-related deaths in Queensland each year.	Fewer deaths in Queensland than at present because of slight warming leading to decline in cold related deaths.
Dengue virus	5.5 million Australians exposed to Dengue virus.	220,000 Australians exposed to Dengue virus.	
Geopolitical stability in the Asia–Pacific region	Sea-level rise beginning to cause major dislocation in coastal megacities of south Asia, south-east Asia and China and displacement of people in islands adjacent to Australia.	Substantially lower sea level rise anticipated and in turn greatly reduced risk to low-lying populations.	

Avoiding dangerous climate change

Long-term cooperative action

A central challenge for the international community's response to climate change is to define a goal for long-term cooperative action. Indeed, as concluded by the IPCC (Gupta, Tirpak, Burger, et al., 2007):

> *The choice of the long-term ambition level significantly influences the necessary short-term action and, therefore, the design of the international regime.*

During the 2007 UN Climate Change Conference in Bali, governments agreed to negotiate (UNFCCC, 2007a):

> *A shared vision for long-term cooperative action, including a long-term global goal for emission reductions, to achieve the ultimate objective of the Convention, in accordance with the provisions and principles of the Convention, in particular the principle of common but differentiated responsibilities and respective capabilities, and taking into account social and economic conditions and other relevant factors;*

The EU and others such as South Africa have articulated that global temperatures should not exceed a 2°C above preindustrial levels. Some least developed countries and the Alliance of Small Island States suggest global temperatures should be stabilised well below this level. The clear advantage of climate impact goals over other global targets is that they more clearly indicate to constituents what governments define as acceptable and unacceptable potential climate change impacts.

However, there are a number of difficulties in assigning a particular atmospheric concentration of GHGs to avoiding a particular temperature target. In particular these relate to uncertainties about emissions from other greenhouse gases besides CO_2, the sensitivity of the climate system to increases in greenhouse gases, how current natural sources and sinks will respond to climate change and the potential for large-scale catastrophic impacts. The principle scientific uncertainty is that of climate sensitivity – i.e. how sensitivity the climate is to a given level of greenhouse gas concentration. Also defining global goals based on temperature or other climate change impacts gives business little certainty in investment decisions.

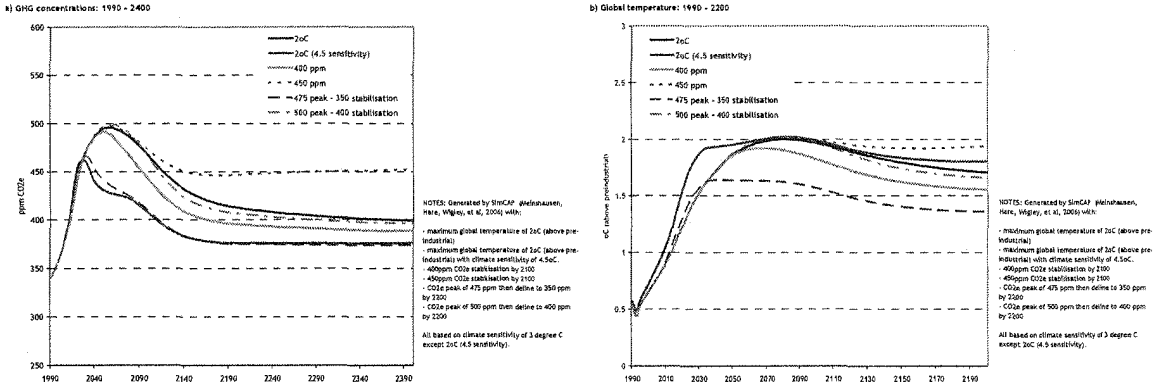
To overcome problems associated with defining emission pathways to avoid a climate change impact the scientific community is using probability assessments to define the risk of overshooting particular global temperature targets with a given concentration of greenhouse gas in the atmosphere (Forest, Stone, Sokolov, et al., 2002; Hare, Meinshausen, 2004; den Elzen, Meinshausen, 2005; Meinshausen, 2006)). For 350-450 ppm-e scenarios the risk of overshooting a 2°C global temperature target by 2100 to be between 10-50 per cent. For stabilising greenhouse gas concentrations at 550 ppm-e the risk of overshooting is very high – a 68-99 per cent chance. This is broadly consistent with work by other researchers who have estimated that the chance of overshooting 2°C enters the "unlikely"

range at around 475 ppm-e. They suggest overshooting 2°C would be "very unlikely" below 410 ppm-e.

Figure 2 a and b illustrates the global temperature impacts of a number scenarios that attempt to keep global temperatures at around or below a 2°C increase in temperature.** Consistent with previous studies, these scenarios illustrate that:

- Global GHG concentrations need to peak at well below 500 ppm-e to give a reasonable change of staying below a 2°C in global temperature.
- Post 2100 global concentrations need to continue to decrease to 400 ppm-e or below to ensure temperature continues to decrease towards preindustrial levels over the current millennium.

Figure 2: GHG concentrations and global temperature



Figures 3, 4a and b, and 5 illustrate global and regional greenhouse emissions (including removals of CO_2) of these scenarios. Key points can be drawn from these scenarios:

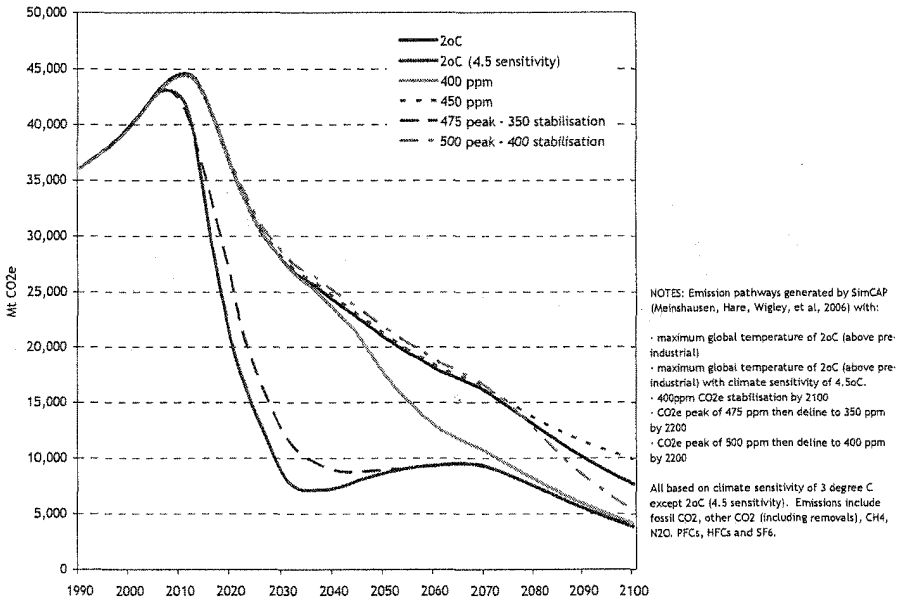
- Global emission pathways associated with 400 ppm-e and 450 ppm-e are similar until 2030 when they diverge. However, decisive global action would be required to avoid a 2°C increase in global temperature above preindustrial levels (global emissions must peak no later than 2015). Also given the long-life of energy related

** The following six scenarios are modelled: **(i) 2°C**: Temperature target is set to peak global emissions at 2°C above preindustrial levels using the IPCC best guess climate sensitivity (3°C); **(ii) 2°C (4.5 sensitivity)**: Temperature target is set to peak global emissions at 2°C above preindustrial levels using a climate sensitivity of 4.5°C; **(iii) 400 ppm**: Global GHG concentrations are set to stabilise at 400 ppm CO_2e by 2100 (IPCC best guess climate sensitivity 3°C); **(iv) 450 ppm**: Global GHG concentrations are set to stabilise at 450 ppm CO_2e by 2100 (IPCC best guess climate sensitivity 3°C); **(v) 475 peak – 350 stabilisation**: Global GHG concentrations are set to peak at 475 ppm CO_2e then stabilise at 350 ppm by 2200 (IPCC best guess climate sensitivity 3°C) (a similar approach as used by den Elzen, van Vuuren, 2007); and **(vi) 500 peak – 400 stabilisation**: Global GHG concentrations are set to peak at 500 ppm CO_2e then stabilise at 400 ppm by 2200 (IPCC best guess climate sensitivity 3°C) (a similar approach as used by den Elzen, van Vuuren, 2007).

infrastructure (e.g. power stations, urban infrastructure) policy decisions today should not compromise the ability of emissions to diverge post 2020.

- Industrialised country emissions (Annex 1 - OECD and REF) emissions need to fall to around 30 per cent below 1990 levels by 2020[††] and developing country (ASIA and ALM) emissions need to peak and begin to rapidly decline over the same period. By 2050, industrialised country emissions need to be around 85-100 per cent below 1990 levels and developing country emissions need to be (well) below 1990 levels by 2050.
- Early, sustained and effective action is need to halt deforestation, promote afforestation and reforestation and build the reliance of natural sinks of CO_2 is needed if global temperatures are to be kept below 2°C. However, a few key words of caution should be considered when comparing reductions in CO_2 emissions from fossil fuels and land-use related CO_2 net removals. Today's carbon sinks are possibly tomorrow's sources and carbon sinks may not bind the carbon for a very long time. In the long-term, enhancing of carbon sinks is not the equivalent to restricting fossil fuel emissions (see Lashof, Hare, 1999; Kirschbaum, 2003; Harvey, 2004).

Figure 3: Net global emissions associated with avoiding 2°C: 1990-2100



[††] With a range 0f 25-40 per cent below 1990 levels by 2020 (see UNFCCC, 2007b)

Figure 4: Net regional emissions associated with avoiding 2°C: 1990-2050.

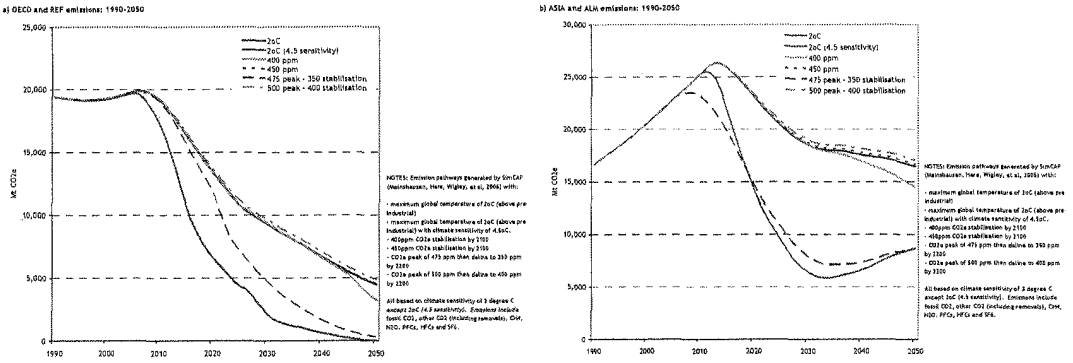
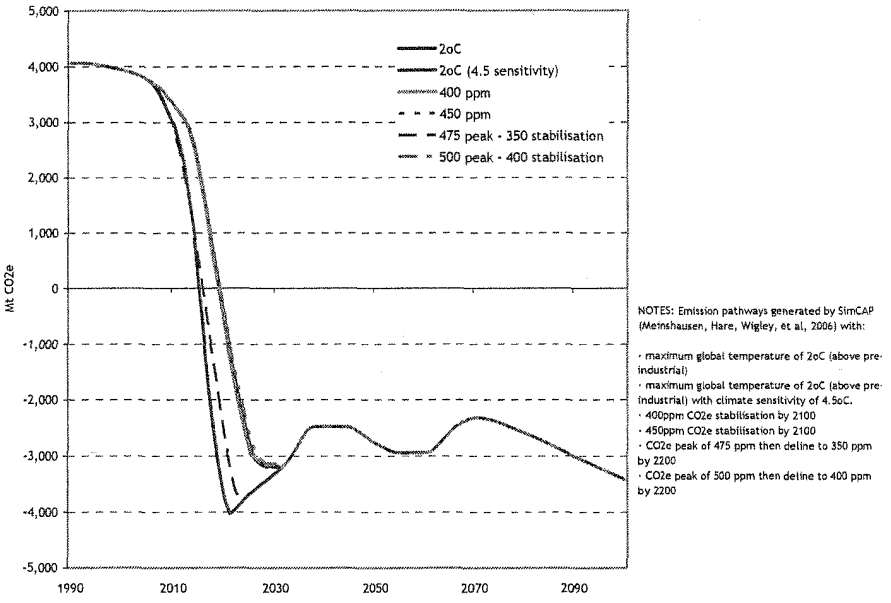


Figure 5: Global non-fossil fuel emissions associated with avoiding 2°C: 1990 - 2100



What does Australia view as dangerous climate change?

While scientists can provide assessments of impacts under a range of scenarios, it falls to policy makers to determine whether such impacts are "*acceptable*". For example, a small increase in global temperature and the consequent increase in sea level and extreme weather events are of major concern to the people and politicians of the low-lying Pacific islands. However, other policy makers and people are less concerned by this particular impact. This is exemplified by the comments in 1998 by the former head of Australian Bureau of Resource Economics who suggested that it would be a more cost effective option to allow climate change to continue and pay to move these people to other countries.

To date the Australian Government has not defined the climate change end game it hopes to achieve through the negotiations towards Copenhagen in 2009. The Australian position notes that a number of countries are seeking agreement to a 50 per cent reduction in global emissions by 2050 (Government of Australia, 2008) and highlights that:

> *... a two degree increase in the global average temperature above 1980-1999 levels*[‡‡]
> *... could already see widespread global impacts that would alter in severity from region to region. Australia, which has the driest and most variable climate of the inhabited continents, is projected to be among the first regions to suffer from the severe impacts of climate change.*
>
> *In considering what constitutes dangerous anthropogenic interference with the climate system, Parties should agree on cooperative approaches that minimise the impacts of climate change at the* ***lowest achievable stabilisation goal.*** *[emphasis added]*

Feasibility of targets and intergeneration equity

There is no doubt that peaking global emissions in the short-term will be challenging. It will require a fundamental reorientation of global energy systems towards low emission technologies and energy efficiency, the rapid deployment of low emission technologies, the premature closure of some of the world's energy infrastructure, and a global program to reduce emissions from land use change and forestry. However, modelling assessments indicate that stabilising concentrations at 450 ppm-e is feasible and affordable if the appropriate policy setting and political will exist (IPCC, 2007; OECD, 2008).

The IPCC note that an increasing number of scenarios are assessing the attainability of very low targets of below 450 ppm-e (Fisher, Nakicenovic, Alfsen, et al., 2007). Achieving such low targets will depend on using a wide range of abatement option and the technology 'readiness' of advanced technologies that remove CO_2 from the atmosphere may be critical (e.g. biomass and carbon capture and storage, soil carbon sequestration, see Azar, Lindgren, Larson, et al., 2006; Van Vuuren, den Elzen, Lucas, et al., 2007; Hansen, Sato, Kharecha,et al., 2008).

It is also critical that intergeneration implications of short-term decision making are fully considered. As the IPCC note (Toth, Mwandosya, Carraro, et al., 2001):

> *"... most of the people who will be directly affected by the problem [of climate change] have not been born yet, which limits their ability to negotiate."*

One danger in the approach suggested by the Government by making pre-emptive judgments on what is "*achievable*" or not is that this is largely a political judgment about what costs we are prepared to accept to avoid impacts in 50 years time, and how much we value the lives and wellbeing of future generations (our children and their children).

[‡‡] Note a 2°C increase above 1980-1999 levels implies around a 2.5°C increase above preindustrial levels.

Further delay of mitigation efforts risks the potential foreclosure of reaching certain climate targets and locking in globally catastrophic climate impacts later in the century.

In particular, concern that climate change may *"feed on itself, accelerate, and bring big global surprises"*[§§] has been discussed since the early 1990s (e.g. Leggett, 1990; IPCC, 2001; US National Research Council, 2002; Schrag, Alley, 2004; IPCC, 2007). More recently they have been described as "tipping points" where the climate can reach a point where rapid changes proceed out of our control (Lenton, Held, Kriegler et al., 2008; Hansen, Sato, Kharecha,et al., 2008). Common examples of the kinds of changes include the collapse of the Gulf Stream, the disintegration of the Earth's great Ice Sheets in Greenland and Antarctica, rapid changes in the El Niño system and the release of large amounts of greenhouse gases from dying forests or other stores of GHGs. In 2003, the eminent German Advisory Council on Global Change concluded these tipping points or non-linear global events as *"a devastating risk to humankind"* (Graβl, Kokott, Kulessa, et al., 2003).

Ultimately, the more we reduce emissions today the less of a burden we create for future generations - and the greater flexibility we give them in responding to the climate change problem. Delay means that future generations and political decision makers will face more stringent emission reductions while confronting the increasing costs of climate change impacts. There is also significant concern that future policy makers would not feel bound by our decision to pass the burden to them and be reluctant to close energy-related capital stock and instead opt for a higher stabilisation target, further delay and even higher future impacts (Schneider, Avar, 2001).

Implications for Australia's desired end game

A number of broad implications can be drawn from the above discussion regarding the position of the Australia Government:

- It is in Australia's national interest to ensure global temperatures peak at the lowest possible level. Even a 2°C increase in global temperature above preindustrial levels would see severe impacts in Australia and our region. Accepting warming at or above this level is accepting the risk of global and large scale irreversible (and potentially catastrophic) outcomes.
- It is in Australia's national interest that the global mitigation effort ensures GHG concentrations peak well below 500 ppm-e then decline to levels below 400ppm-e over the coming centuries. This implies industrialised countries' overall emissions should be around 30 per cent below 1990 levels by 2020, developing country emission should peak over the same time period and global emissions should be less than 50 per cent below 1990 levels by 2050. Global action to rapidly reduce emissions from land use change and deforestation are also required.

[§§] Eminent oceanographer, Dr George Woodwell, Director of the Woods Hole Research Center in a *Boston Globe Magazine* interview, 22 April 2001.

Australia's posture in the lead up to the Copenhagen conference in 2009 should be one that seeks to ensure that the agreement reached does not foreclose achieving these outcomes.

Global architecture

The Kyoto Protocol – An important first step

Australia's ratification of the Kyoto Protocol in late 2007 marked an important shift in national climate change policy. After more than a decade of delay, this move signalled the clear intent of the Federal Government to ensure Australia is actively engaged as a progressive leader in international action on climate change.

The Kyoto Protocol provides a legal framework for international action on climate change. In its first commitment period (2008-2012) the Protocol sets a relatively modest target to reduce total emissions from industrialised countries to 5 per cent below 1990 levels. Recognising common but differentiated responsibilities and capabilities, each developed country is assigned its own, legally binding, target. These targets range from –8 per cent for the European Community to +10 per cent for Iceland. While most countries agreed to cut emissions, Australia's target is for national emissions to increase by no more than +8 per cent above 1990 levels.

This international agreement is an important first step towards stabilisation of atmospheric greenhouse gas concentrations at safe levels. Indeed, the Kyoto Protocol was always intended to kick-start the staged reduction of global emissions to safe levels.

Recognising the need for deeper cuts to global emissions, Article 3 of the Kyoto Protocol includes a provision for industrialised countries to adopt stronger abatement targets for period beyond 2012. The urgent need for bold leadership in this regard has been made clear in recent years as the impacts of climate change have begun to be felt.

The Post-2012 regime

It is likely that future international agreements and action to reduce emissions will build on existing frameworks, and include the following key elements (Stavins, 2004; Boston (eds), 2007):

- Common but differentiated commitments by developed and developing countries, recognising that effective mitigation will require broad-based global participation.
- Leadership from developed nations which account for around 75 per cent of historical greenhouse emissions and current concentrations, and have the greatest capacity to resource required actions and investments. Developing nations account for a large and growing share of greenhouse gas emissions, and an even larger share of the available low-cost abatement opportunities.
- Clear emissions reductions obligations for developed and developing nations, with some differentiation in obligations between these nations (reflecting different national circumstances and capacity to achieve reductions).
- Market based policy approaches and 'flexibility mechanisms' that allow nations to meet their obligations through various forms of emissions trading. Arrangements

that allow developed nations to meet their obligations through supporting emissions reductions in developing nations will be central to achieving a cost-effective, politically acceptable, and worthwhile global framework.

- Long term goals or milestones that build the momentum and confidence required for national policy action, and provide the necessary security for public and private investment in low emissions technologies and other activities.

Many proposals have been developed as the shape of global regime post 2012 (see Gupta, Tirpak, Burger, et al., 2007) but the central question is how to differentiate national obligations in a fair, effective and acceptable way.

Differentiation of national obligations

Article 3.1 of the UNFCCC states that such a differentiation should be in accordance with Parties "*common but differentiated responsibilities and respective capabilities*". Broadly this suggest differentiation based on the criteria of responsibility, capability and potential to mitigate (for example see Ott, Winkler, Brouns, et al., 2004).*** Table 1 outlines possible indicators for each of these areas.

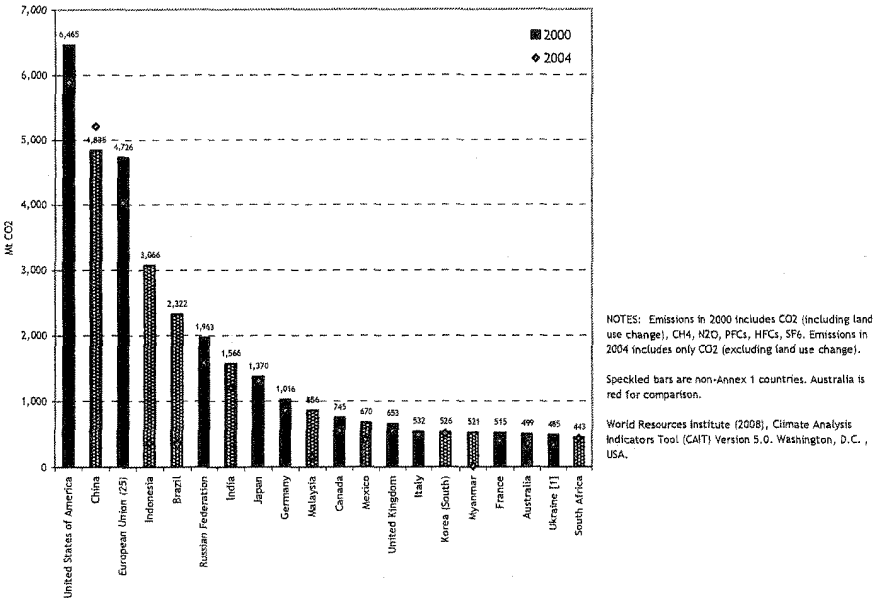
*** Note that these criteria have been developed in the context of industrialized countries continuing to take the lead in global efforts to reduce emissions and have a particular focus on how to differentiate developing country commitments.

Table 1: Criteria for differentiation of commitments

Criteria	Indicator	Notes
Responsibility – a countries responsibility for the problem	Cumulative per capita emissions (1990 to 2000)	The 1990-2000 period avoids 'punishing' countries for historical emissions, since the consequences were less widely known in the past. Since the IPCC's First Assessment Report in 1990, the implications can, at least, be said to be well-known internationally.
Capability – a countries ability to pay for and implement mitigation efforts	The Human Development Index (HDI) Gross Domestic Product (GDP) per capita	A country's capability to reduce emissions might be quite different from its level of responsibility, e.g. a country may have great responsibility for contributing GHG emissions, but be too poor to devote resources toward mitigation.
Potential (to mitigate) – a country's opportunities for reducing GHG emissions	CO_2/GDP emissions per capita	High CO_2/GDP suggests a high potential to mitigate. The more efficient an economy, the less potential there is for lower cost mitigation. High per capita emissions suggest unsustainable consumption patterns, which should provide potential to mitigate without significant reductions in welfare. National GHG emissions are the sum of emissions from different sectors, therefore, potential is also determined by the ability to increase energy efficiency or reduce carbon intensity in particular sectors (in particular the energy sector).

A global solution to climate change will require mitigation and adaptation action – in a fair and equitable way – from all countries. Figure 6 shows the world's top 20 emitters in terms of total emission in 2000 (all Kyoto gases and land use change) and 2004 (fossil CO_2 only). It illustrates that around half of the top 20 emitters are developing countries. Also if Indonesia's and Brazil's emissions from land use change are excluded, both of these countries have emissions comparable to Australia. Exclusion of land use change emissions would exclude Malaysia and Myanmar from the top 20 list.

Figure 6: Top 20 global emitters



NOTES: Emissions in 2000 includes CO2 (including land use change), CH4, N2O, PFCs, HFCs, SF6. Emissions in 2004 includes only CO2 (excluding land use change).

Speckled bars are non-Annex 1 countries. Australia is red for comparison.

World Resources Institute (2008), Climate Analysis Indicators Tool (CAIT) Version 5.0. Washington, D.C. , USA.

Figure 7a, b, c and d brake down the 20 top emitters based on criteria of Responsibility, Capacity and Potential. This illustrates that based on these indicators that among the top 20 emitters:

- **Responsibility**: On a per capita basis, developed countries have higher levels of responsibility and reinforcing the need to take leadership in reducing emissions. This is particularly the case for the USA, Canada and Australia.

  Among the developing countries South Korea and South Africa have the highest level of responsibility if land use emissions are excluded. This implies the early introduction of mitigation responsibilities for these countries. If land use emissions are included Brazil, Indonesia, Malaysia and Myanmar might also be included.

- **Capacity**: With the exception of the Russian Federation and Ukraine, developed countries also have the highest level of economic and technical capacity to reduce emissions. As recently highlighted by the Australian Government's submission to the UNFCCC, Annex 1 former Soviet states have GDP per capita indicators similar to the main developing countries (Australian Government, 2008).

  South Korea has the highest capacity rating among developing countries (nearly double the GDP of other large developing country emitters). Brazil, Malaysia, Mexico and South Africa have similar capacity while China, Indonesia, India and Myanmar have lower capacity.

- **Potential**: If land use emissions are excluded, developed countries have higher per capita emissions than developing countries. Among developed countries the Russian Federation and Ukraine have the most emission intensive economies. Australia, Canada and the USA also have emission intensive economies compared to Japan and EU countries. The USA, Canada and Australia also have high per capita emissions.

  Overall, this suggests that the USA, Australia and Canada have the highest potential to mitigate at lower cost that the EU and Japan. The relative high emission intensity of the Russian Federation and Ukraine also suggests lower cost mitigation potential but needs to be balanced by their average per capita emissions which suggest fewer "luxury" emissions than the USA, Australia or Canada.

  Broadly, developing countries have more emission intensive economies than developed countries, in particular China and South Africa. This suggests lower cost abatement options are available in these countries and this is consistent with more detailed global mitigation assessments (see Barker, Bashmakov, Alharthi,et al., 2007). Among developing countries South Africa and South Korea have high per capita emissions. Indonesia, Brazil, India and Myanmar have low per capita emissions. However, if land use emissions are included Indonesia, Malaysia, and Myanmar have per capita emissions comparable to or much higher than even developed countries.

While these examples do not include an analysis of all UNFCCC countries (see den Elzen, 2005) it does illustrate a number of points including:

- Developed country leadership must the backbone of the global regime. They are most responsible and have the highest capacity to mitigate.
- While developing countries count for around half of the top 20 emitters, there historic responsibility, capacity and mitigation potential varies greatly. Developing countries are not a homogeneous group. This implies the post-2012 climate regime will have to differentiate between developing country obligations. Based on these indicators, there appears a clear rational for developing countries such as South Korea to take on binding emission reduction obligations to cap than reduce their emissions sooner rather than later. Recent press reports suggest that the new South Korean government is examining capping the countries emissions at 2005 levels by 2012 are very encouraging in this regard.[†††]
- While countries like China and India have very large total emissions and are undertake domestic action (Table 2.), their capacity to mitigate is comparatively limited. This implies engaging these countries more effectively in the global regime will require significantly levels of capacity building and technology transfer from developed countries.

[†††] S Korean president wants to help N Korea restore its forests, *International Herald Tribune*, March 21, 2008, http://www.iht.com/articles/ap/2008/03/21/asia/AS-GEN-SKorea-Global-Warming.php

- Broadly developing countries also have low cost higher mitigation potential than developed countries highlighting the importance of global carbon markets in delivering cost effective abatement.
- Emissions from land use change in Brazil, Indonesia, Malaysia and Myanmar account for a large proportion of these countries total and historic emissions. However, these countries have limited governance capacity to ensure long term reduction of emissions. Australia's regional neighbours of Papua New Guinea and the Solomon Islands are in a similar situation.

Figure 7: Differentiation among top 20 global emitters – Responsibility, Capacity, and mitigation Potential indicators

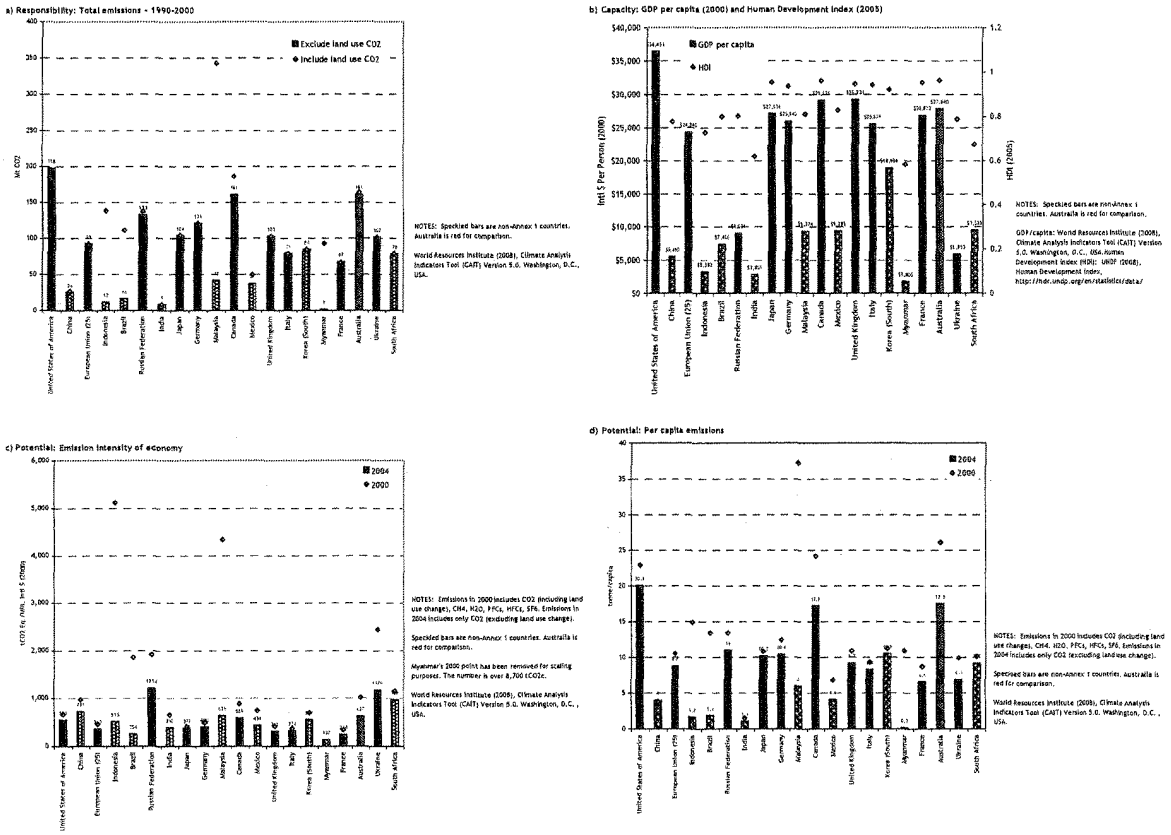


Table 2: Examples of developing country national goals and policies

	Goals	Specific implemented or planned policy examples
China	National energy efficiency target: 20% energy reduction per unit of GDP (energy intensity) by 2010. Renewable energy target: 16% of total energy use by 2020 (up from 7.5% today).	Fuel economy standards for vehicles. Largest industrial and energy facilities required to improve energy efficiency by 20% by 2010. Requirements for energy savings of 50% for new buildings nationwide.
India	National energy efficiency target: 10,000 MW equivalent saved by 2012 National forest cover target of 33% of land area, up from 23% today	Energy efficiency: certificate trading scheme targeted at industrial users, commercial building codes, fuel efficiency standards and accelerated depreciation for energy efficient equipment Mandatory renewable energy target (5% of electricity purchases, increasing a 1%/annum for 10 years) and feed-in tariffs
South Africa	Emissions peak by 2020-25	Setting ambitious and mandatory targets for energy efficiency (including fuel efficiency standards) Increasing the price on carbon through an escalating CO2 tax, or an alternative market mechanism Target for renewable electricity (including incentivising renewable energy through feed-in tariffs) Not approving new coal fired power stations without carbon capture readiness

Clean Technology

Avoiding runaway climate change will require a multi trillion dollar investment in clean technology in developing countries over the coming decades. International negotiations on a post-2012 climate agreement must pave the way for this large-scale investment to arrest the rapidly growing emissions in developing countries. The size of the annual investment required is uncertain, but is expected to be at least US$20-50 billion (United Nations Development Programme 2007, World Bank 2006). Much of this is needed in the Asia-Pacific region, where Australia is well positioned to play a leadership role and reap the commercial advantages.

Under the UNFCCC developed countries, including Australia, have made commitments to provide funding and support for the transfer and uptake of clean technology to developing

countries. While this international framework has produced a number of important outcomes, up-take of clean technology in developing countries remains limited.

Investing in clean technology in developing countries is crucial to achieving deep and lasting cuts to global greenhouse gas emissions. According to the IPCC up to three quarters of the growth in global carbon dioxide emissions between now and 2030 will be in developing countries (Rogner, Zhou, Bradley, et al., 2007). Thus, while leadership from industrialised countries is urgently needed, this alone will not be enough to avoid dangerous climate change. International efforts must unlock clean technology investments in developing countries to ensure their emissions peak no later than 2020.

The post-2012 climate change agreement can provide a vehicle for increasing investment in clean technology in developing countries. Without a significant up-scaling of financial support developing countries are unlikely to take on stronger emission reduction commitments, which is clearly in Australia's national interest.

Key outcomes that Australia should be pursuing include:

- **Clean Technology Funding Mechanism:** The post-2012 climate change agreement must include provisions for a Clean Technology Funding Mechanism to remove barriers to the up-take of clean technology in developing countries. The fund should support the following: concessional loans for clean technology in developing countries; grants to cover the incremental costs of clean technology in least developed countries; full-cost financing of demonstration projects to support the commercialisation of new technologies; full-cost financing for training, capacity building and policy reform to strengthen the enabling environment for technology transfer in developing countries; and ongoing support for completion, review and update of technology needs assessments for developing countries.

  Agreement to establish the Clean Technology Funding Mechanism should include a target for annual revenue flows into this fund to ensure sufficient resources are available. This mechanism should be financed through a share of proceeds from any new flexibility mechanisms to be established under the post-2012 climate change agreement. To ensure funding is sufficient, reliable and predictable, the Clean Technology Funding Mechanism should also include funding guarantee from developed countries.

  Australia can show a leadership role here by signalling that it is prepared to use 10% of domestic emission trading auction revenue to support technology transfer, financing and adaption in developing countries. This approach is already being considered by a number of other countries and has the potential to provide a significant global revenue stream for broad-scale technology development and deployment.

- **Market Pull in Developing Countries:** The post-2012 climate change agreement needs to create the right market conditions in developing countries to attract private

sector investment in clean technology. This will obviously be achieved if developing countries take on fair and equitable emission reduction commitments. However, it will also rely on the right legal and policy framework being in place.

Emissions from Land Use, Land Use Change and Forestry

The Federal Government has publicly recognised the limitations of methodologies for LULUCF accounting. Australia's partnership with Japan and others for developing more sophisticated satellite data imaging to differentiate between anthropogenic and naturally created greenhouse gas emissions is to be commended.

The Federal Government should be undertaking an impact assessment of the benefits and risks of adopting full farm accounting for the Agricultural sector. As the current methodologies stand, farmers have little opportunity to be part of the solution, being liable for methane emissions from ruminants (11% of Australia's total) and nitrous oxides from soil conditioners.

A number of key methodologically robust, continent-wide field-tests would need to be carried out to adequately inform such a risk assessment. Should it be found that the opportunities for sequestering carbon in soils and vegetation is reasonable, Australia's international position on "removals by sinks in agricultural soils and the LULUCF categories (Article 3.4)" will need to reflect this change in domestic accounting and policy.

Even if the evidence regarding soils is inconclusive, Parties to the Kyoto Protocol will be looking to Australia to move beyond its special clause for "land use change", notably Article 3.7 and include a broader range of anthropogenic LULUCF sources and sinks.

Adaptation

A key finding from the IPCC's Fourth Assessment Report is that a certain level of climate change is unavoidable. Indeed, for those countries that are particularly vulnerable, the impacts are already being felt. This means that adaptation is an urgent and immediate priority.

The position Australia adopts in the post-2012 negotiations must reflect an acceptance of responsibility to support adaptation measures in developing countries. The most important outcome will be to ensure the post-2012 agreement delivers sufficient and predictable funding for adaptation measures in developing countries. While there is still some uncertainty about the exact costs of adaptation, initial estimates indicate that it will require tens of billions of dollars annually (World Bank 2006, Oxfam International 2007, UNDP 2007). In Pacific island countries alone it is estimated that in the short-term approximately US$290-530 million will be required to implement urgent and immediate adaptation actions (McGoldrick, forthcoming).

Australia should support consistent and guaranteed levels of funding to meet the adaptation needs of developing countries. Full consideration needs to be given to current proposals that would require that a share of proceeds from all flexibility mechanisms be paid into the Adaptation Fund and the establishment of a levy on air and sea travel, with a proportion of revenue to be direct towards adaptation measures.

Opportunities for Australian Diplomacy

The ultimate final diplomatic end game in climate talks in Copenhagen will revolve around an agreement between the USA and large developing country emitters such as China and India. For the first time in Bali, developing countries signalled their willingness to take on measurable and verifiable emission obligations. As the South African delegate stated, *"Developing countries are saying voluntarily that we are willing to commit ourselves to measurable, reportable and verifiable mitigation actions. It has never happened before. A year ago, it was totally unthinkable."*

However, building on this spirit will require strategies to build trust and capacity to fulfil these obligations among developing countries.

Building trust

Unless the USA and other large emitting developed countries commit to substantial domestic action, large developing countries will continue to resist strong measures. Australia can play an important role through signalling a strong domestic emission reduction target and engaging with the USA Administration. The posture of the new USA administration under existing Republican or Democrat presidential candidates is likely to be more favourable to global cooperation on reducing emissions. As a well regarded (and non-European) developed country Australia should be engaging early with all prospective Presidential Candidates to ensure that when they enter office they have the capacity to engage early in talks toward Copenhagen and don't engage in belligerent posturing towards China and India as has marked current Administrations approach. Equally important will be engagement with domestic political leaders in the Senate and Congress to build confidence in international collaborative efforts (e.g. around linkages between Australia's emission trading scheme and emerging US markets, and the role the two countries can play in deploying low emission technology).

Building capacity

Capacity building in developing countries has two main elements. Firstly, building political capacity will be important as developing country leaders will have an eye to the domestic political impacts of agreeing to emission reduction obligations. This is closely ties to building trust but also engagement with stakeholders in key developing countries as suggested above for US domestic decision makers.

Technology transfer and finance will be another important area of capacity building. Carbon markets and domestic clean energy policies are already driving substantial amounts of low emission technology investment in developing countries. Strong developed country emission reduction obligations which allow international trading would accelerate this. However, it is difficult to imagine developing countries agreeing to emission obligations without firm commitments to overcoming barriers to technology transfer and substantial technology financing. Financing reductions in deforestation will also be central for some countries.

Australia's emission trajectory

The Garnaut Climate Change Review notes that (Garnaut, 2008b, p.21):

No domestic decision made by Australia in the area of climate change mitigation will have greater international ramifications than the choice of Australia's emissions budget.

As a party to the Kyoto Protocol Australia *"strongly supported"* the inclusion of a science based range of reductions as guidance for the relevant Working Group on future industrialised countries (Annex 1) post 2012 commitments (UNFCCC, 2007b):

> *.. the [IPCC] AR4 indicates that achieving the lowest levels assessed by the IPCC to date and its corresponding potential damage limitation would require Annex I Parties as a group to reduce emissions in a range of 25–40 per cent below 1990 levels by 2020 ... . The AWG also recognized that achievement of these reduction objectives by Annex I Parties would make an important contribution to overall global efforts required to meet the ultimate objective of the Convention as set out in its Article 2 [of avoiding dangerous climate change].*

There remains some confusion around what this emission reduction range means for Australia. This is not a domestic emission reduction target. In the Kyoto first commitment period, industrialised countries overall (or in aggregate) had an emission reduction target of a 5 per cent reduction below 1990 levels by 2008-2012. Australia negotiated an 8 per cent increase. The range of 2020 targets discussed in Bali sought to define what this overall target for industrialised countries will be in 2020. It is not a range of possible domestic emission reduction targets for industrialised countries. Also, any final national target agreed would be an international obligation not a commitment to reduce domestic emissions by this total amount. Countries would have the opportunity to use international emission trading to help meet any international commitment.

Australia's 2020 target

As outlined above, based on criteria that judge a nation's contribution to avoiding dangerous climate change Australia should be taking a leadership role in global efforts to reduce emissions. On a per capita basis, Australia carries a high level of responsibility for the problem, relative to other countries (both developed and developing) has the ability to pay for and implement mitigation efforts, and has many potential opportunities to reduce GHG emissions at low cost than other countries. This conclusion is consistent when compared to other developed countries. While Australia does have high population, economic and emissions growth compared to some developed countries (e.g. the EU and Japan), compared to other major emitting developed countries (the USA and Canada) Australia faces similar challenges.

Also while national indicators such as population are important, the structure of the economy and the mitigation potential of particular sectors are likely to be more important in determining Australia mitigation potential. Analysis to date suggests that Australia has yet to unlock its energy efficiency potential and given the high greenhouse intensity of our electricity sector (which accounts for around a third of national emissions) this implies lower cost fuel and technology switching capability than other countries which have already seen the widespread deployment of lower emission power sources.

The leadership premium

Hatfield-Dodds, Jackson, Adams, et al. (2007) conclude:

> *Committing now to very substantial reductions in emissions would carbon proof the Australian economy, insulating it from future climate policy shocks, and help to achieve decisive global emissions reductions ... Australia can afford to take a leadership position in committing to substantial reductions in our net greenhouse emissions, in order to help manage the economic risks to Australia, and to contribute to the global momentum and concrete actions required to avoid dangerous global climate change.*

This conclusion was based on macro-economic modelling of various emission reduction targets in Australia and a qualitative assessment of the benefits of taking a leadership position in global efforts to reduce emissions including:

1. **Prudent Risk Management**: Making more rapid early reductions helps to manage the economic risks to Australia from uncertainty about climate impacts and the pace of global action in response to it. This is because it is much more difficult and costly to accelerate emissions reductions than to decelerate them in response to improved climate science or changing international circumstances. In particular, incremental tightening of long term emission targets risks the premature retirement of long lived emissions intensive capital assets, such as traditional coal fired power stations.

2. **Leadership and leadership benefits**: A clear Australian commitment to decisive emission reductions would help build the confidence and willingness of others to take comparable actions, and provide greater credibility and leverage in mobilising international action to reduce emissions. An associated benefit is that Australia may find it easier to pursue other climate policy objectives, such as in relation to the treatment of emissions intensive traded goods, if it is clear that Australia is not seeking to delay effective global action to reduce emissions. Beginning the journey to very deep cuts in emissions would also have a number of domestic advantages which are difficult to capture in economic models, such as building a flexible domestic policy regime, the development of new industries and technologies, and expanding the benefits of participating new markets in low emission technologies and emissions offsets (see for example MMA, 2006).

Australia negotiated a very favourable target in Kyoto. Australia's ratification of the Kyoto Protocol has help build Australia's standing internationally. However, other progressive countries and those most vulnerable to the impacts of climate change (such as our neighbours in the Pacific) will be looking to Australia to build on this momentum and support strong interim targets for developed countries. Australia signalling a weak domestic target will undermine the nation's potential leadership position and strengthen the hand of developed countries that are resisting strong 2020 obligations (e.g. Japan, Canada and the USA).

It is The Climate Institute's view that Australia's unilateral domestic target should be set at around 25 per cent below 1990 levels by 2020. This is based on:

- Economic modelling that suggests that with appropriate policy responses that an interim target of this scale is affordable and manageable (Hatfield-Dodds, Jackson, Phillips, et al. (2007).
- On a per capita basis, Australia carries a high level of responsibility for the problem, relative to other countries (both developed and developing), has the ability to pay for and implement mitigation efforts, and has many potential opportunities to reduce GHG emissions at lower cost than other countries. This implies Australia can and should be taking a leadership position in setting its interim target.
- This interim target would be an international obligation not a domestic reduction requirement. Through international emissions trading, Australia could supplement domestic efforts with opportunities to reduce emissions at low cost in other countries.
- Decisive early action would make it easier for Australia to pursue other climate policy objectives, such as achieving a global agreement that avoids dangerous climate change impacts and in relation to the treatment of emissions-intensive traded goods. It would also build a more flexible domestic policy regime, encourage the development of new industries and technologies, and expand the benefits of participating new markets in low emission technologies and emissions offsets.

If a strong international agreement can be agreed, Australia should be prepared to accept an emission reduction obligation of stronger than around 25 per cent by 2020.

Conclusions: Strategic outcomes for Australia

International climate change negotiations are notoriously complex, with many difficult, inter-related issues open for discussion and layers of competing national interests. For this reason, it strategically important that the Australian Government adopts a set of priority outcomes that it will seek to achieve from the negotiations.

The Climate Institute believes that the Australian Government and its negotiating team *should be focussed on achieving the following outcomes from the international* negotiations:

1. Legally binding targets for all industrialised countries, which will bring their overall emissions to around 30 per cent below 1990 levels by 2020.
2. Expansion of the number of countries adopting binding targets.
3. Measurable, reportable and verifiable commitments for developing countries, recognising that their overall emissions should peak and begin to decline rapidly by no later than 2020.
4. A shared vision for global emissions to be at least 50 per cent below 1990 levels by 2050.
5. Firm rules and mechanisms for global action to rapidly reduce emissions from land use change and deforestation.

6. Comprehensive support programme (including financial support) for developing countries to enable them to reduce greenhouse gas emissions and adapt to the unavoidable impacts of climate change.

7. An investment framework for clean technology, aimed at unlocking the funds needed to achieve deep cuts emissions in both developed and developing countries.

Australia's posture in the lead up to the Copenhagen conference in 2009 should be one that seeks to ensure that the agreement reached does not foreclose achieving these outcomes.

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