



Garnaut
CLIMATE CHANGE
REVIEW UPDATE 2011

2

Progress towards effective global action on climate change

Update Paper 2



Garnaut

**CLIMATE CHANGE
REVIEW UPDATE 2011**

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Garnaut Climate Change Review – Update 2011

Update Paper two:

Progress towards effective global action on climate change

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PROGRESS TOWARDS EFFECTIVE GLOBAL ACTION ON CLIMATE CHANGE

Key points

- The 2008 Garnaut Climate Change Review said that strong mitigation, consistent with Australia's national interest, requires effective global action, with Australia playing its proportionate part. Effective global action requires comprehensive agreement among countries.
- The Copenhagen meeting in December 2009 and the Cancun meeting in December 2010 moved the world towards several elements of such agreement, but away from one important element.
 - The reality of considerable positive movement is obscured by the diplomatic fiasco at Copenhagen, which was rescued from comprehensive failure by the President of the United States reaching an understanding with leaders of China, India, Brazil and South Africa during the meeting itself.
- The Copenhagen and Cancun meetings have led us into a messy world in relation to the setting of each country's ambitions on emissions reductions. But they have embodied strong progress on several crucial and difficult issues, and may have laid a basis eventually for the comprehensive and binding international agreement that is still necessary to avoid high risks of dangerous climate change.
- Most developed countries—members of the European Union, Japan, New Zealand and now Korea—are reasonably well placed to make full contributions to achieving strong global mitigation goals.
- Major developing countries seemed to be sources of weakness at the time of the Review, but are now making large emissions reductions below business as usual. Chinese climate change policy is at the centre of the international effort to reach global agreement, because it is the world's largest source of greenhouse gas emissions, because it is by far the largest prospective source of emissions growth, and because economic and strategic competition between China and the United States is important in the policy dynamics of both countries.
- The three countries which have been the largest drags on the global mitigation effort are the three highest per capita emitters amongst the developed countries—Australia, Canada and the United States.
- The United States faces large domestic constraints on early action, but is still committed to a significant reduction in emissions. It is also benefiting from favourable developments, such as the 'gas revolution', in its efforts to reduce emissions.
 - The United States commitment is supported by substantial government support for low-emissions technologies; by extension of regulatory oversight of energy efficiency and emissions standards by Federal agencies; and by many state-based initiatives to establish ETSs and emissions-reducing regulations.
- If Australia were to introduce a carbon price, one that was seen as commensurate with carbon prices in other countries, it would cease to be a drag on international mitigation. Australian success in introducing a carbon price is likely to assist the United States and Canada to maintain momentum in policies to reduce emissions.
 - Australia could also exercise global leadership in the mitigation effort without making unrealistic demands on community support for action, by implementing efficient means of reducing emissions—through policy innovation to get the largest possible reduction of emissions from a given cost of mitigation.

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1. Introduction

The threat of climate change to prosperity in one country cannot be removed by the actions of that country alone.

Effective action to moderate the risks of human-induced climate change requires large contributions to reductions in emissions from all major countries, and substantial contributions from the rest of the world as well.

As a result, the search for effective climate change policy is partly a search for effective cooperation amongst countries of a kind and dimension that has never previously been known.

This paper discusses that search for an international basis for effective climate change policy. It cannot avoid analysing wider changes in the international system, as these are the context of any success or failure in this new province of international cooperation.

Australia's place in the search for a basis for effective cooperation is a curious one, as distinctive as our native fauna, or the peculiar social and economic institutions that emerged as we made our way—with our neighbour New Zealand—as the world's first democracy in which ordinary people claimed for themselves a share of the bounties of modern civilisation.

Developed countries can be expected to recognise more strongly than developing countries that they have an interest in effective global mitigation, for the reasons explained analytically in Update Paper one (*Weighing the costs and benefits of climate change action*). The 2008 Garnaut Climate Change Review (the Review) demonstrated that Australia has a larger interest in effective global mitigation than any other developed country, because it is already a country of climate extremes, because of its geographic location in relation to shifts in global climate, and because it is located in a region of vulnerable developing countries.

At the same time, Australia is one of the four developed countries whose economic structures have evolved most elaborately around the abundance of low-cost fossil fuels. Among these countries, Norway—the only other developed country with comparable abundance to Australia of natural resources relative to population—is a special case, having recognised a responsibility for contributing leadership to an effective global mitigation effort. Norway's per capita emissions of greenhouse gases are modest. That leaves Australia, with Canada and the United States, as one of the three countries in which effective mitigation is constrained most powerfully by the role of established fossil fuel industries in the economic structure and the political process. Of the three high-emitting developed countries, Australia stands out for having the highest emissions per capita, and the greatest importance of coal in both domestic energy supply and exports.

So Australia is at once the country with the greatest interest in effective mitigation and the greatest domestic political challenge of mitigation.

I say greatest political and not economic challenge of mitigation because Australia's exceptional advantages in the old world, in which the use of fossil fuels is not constrained by concerns for climate change, is matched by exceptional advantages in supplying virtually all of the potentially major low-emissions energy sources: uranium oxide for nuclear power; intense insolation for solar power; proximity and accessibility to some of the world's richest hydro-electric power resources across the narrows and shallows of Torres Strait in Papua New Guinea; unusually productive opportunities for development of algae as a low-cost source of bio-fuels; amongst the world's highest quality wind resources; exceptional ocean waves and tides; the world's richest deep rock geo-thermal resources (themselves associated with the prevalence of the radio-active elements that also make it a rich source for the raw materials of nuclear power); superior sites for carbon capture and storage near established places of coal-based power generation; and natural and coal-bed gas as a lower-emissions fuel during the transition from exceptional dependence on coal. We seem to be an exceptionally prospective location for the rare earths that have become increasingly scarce as the world focuses on the materials necessary for large-scale electrification of transport for the low-carbon economy of the future.

Australia's advantages as a low-cost supplier of energy and its raw materials are likely to be even greater after a successful global transformation to a low-carbon economy than they are in a world in which fossil fuels dominate energy supply. Australia's advantages in a low-carbon global economy are extended by the developed world's largest per capita opportunities for biosequestration in various forms.

We return to the various energy technologies that may be important to Australia in Update Papers seven (*Low emissions technology and the innovation challenge*) and eight (*Transforming the electricity sector*). For this paper on the international context of policy, it is enough to know that Australia occupies an unusual place in the community of nations that together must address the mitigation issue: the country with the greatest national interest in effective mitigation; the country facing the greatest resistances to changing the established pattern of energy use; and the developed country that is placed best to do well in a low-carbon global economy. The first and third special features of Australia's situation represent benefits of effective global action that will be experienced by Australians in the future (beginning at a time not far from now), while the second special feature involves costs in the present.

Even more than in other countries, the struggle to find Australia's appropriate place in a global mitigation effort is a struggle between the interests of the past and the present, against the interests of the present and the future.

1.1. A world transformed

This Update Paper examines international developments since the Review was presented to the Prime Minister and the State Premiers and Territory Chief Ministers in 2008. I handed the Review to former Prime Minister Kevin Rudd famously on the day when global financial markets collapsed after the United States Congress rejected President George W. Bush's initial proposals for managing the consequences of the bankruptcy and dissolution of one of the world's largest global financial institutions.

Over these past 28 months, the international context of economic development and therefore of climate change policy has been transformed. Through late 2008 and early 2009, the world as a whole experienced a sharper nine-month contraction of economic output and international trade than any since the emergence of capitalism (Garnaut with Llewellyn-Smith 2009). The Great Crash of 2008 precipitated a decline in employment that was deeper than any experienced in the developed world as a whole and in most countries including China since the Great Depression of the 1930s. For a while that contraction threatened a downward spiral into even worse conditions.

The sharpest ever financial shock to the world economy was followed by a remarkable and remarkably successful policy response. The response was centred in the policies of individual countries but profoundly influenced by international communication of ideas (especially amongst leaders of the major developed and developing countries in the G20) and some important collective efforts. The world as a whole and most developed and many developing countries embarked on the largest economically motivated expansion of economic activity through fiscal and monetary policy that the world has ever seen.¹ The expansionary policy was strongest in Australia's own Western Pacific region, where China, Australia and South Korea led the world in speed and depth of expansionary response.

The legacy of the Great Crash of 2008 shapes the contemporary world. Its central geo-political effect has been to accelerate the reality and the comprehension of a powerful tendency of the early twenty first century: the shift in economic and therefore political and strategic weight away from the established industrial economies and towards the largest developing countries.

The Great Crash of 2008 has pushed the developed countries of the northern hemisphere onto a lower long-term growth trajectory. It has left most of Western Europe and the United States with an awful legacy of unemployment, public sector debt and financial vulnerability that has sapped the confidence of communities and weakened the influence and power of even the most able leaders.

¹ I say economically motivated to exclude the wartime expansion that finally lifted the United States out of the persistent high unemployment of the 1930s.

On the other hand, the Great Crash only briefly slowed the immense growth momentum of the large developing countries led by China and India, but extending to and beyond Indonesia and Brazil. It only briefly disturbed the early twenty first century improvement in living standards in the regions that had been home to the most desperate and deeply entrenched development problems, including in most of Africa. ‘The Platinum Age’ of accelerated economic growth in the developing world to which I referred in the early chapters of the Review continues, with its wonderful augmentation of opportunity for better lives for most of the world’s people.

Now, as before the Great Crash, this harvest time for modern economic growth is accompanied by a fateful challenge to the equable climatic and other environmental conditions that have provided a congenial home for the emergence of human civilization over these past ten thousand years.

The geo-political context of climate change policy changed with the Great Crash. The major developing countries’ full participation in leadership became essential for any effective international cooperation. The immense challenge of climate change—the diabolical policy problem—remained much as it was. If there was a change in the climate change challenge, it was the confirmation of the robust nature of the acceleration of economic growth in the developing world in the early twenty first century—confirmation of the robust nature of the Platinum Age.

The Great Crash and its geo-political, as well as economic, implications was the largest transformative event of these past three years. But there were some other large changes with implications for the international context of climate change policy. We became much more aware of an immense expansion of economically valuable gas reserves in many countries, an important part of it through new technologies reducing the costs of gas from non-traditional sources—from shale, from coal bed methane and from natural gas in deeper and more complex geological structures. This has greatly reduced the costs and therefore improved the prospects of early movement from high-emissions to low-emissions fossil fuels. Moreover, the allocation of substantial funding for research, development and commercialisation of low-emissions technologies in the anti-recessionary stimulus packages of the United States, China, South Korea and other countries contributed to large reductions in costs across the range of low-emissions technologies. Here there is one exception: carbon capture and storage, which is essential for the future of coal, has lost ground in the global competition for public resources in support of innovation.

Some of the developments in technologies over the past several years have underlined the importance of old verities of economics. The rapid growth in hybrid and electric vehicles has drawn attention to the importance of free and open international trade and investment in the rare earth metals that are essential inputs into high-performance batteries and electric motors. The increased competitiveness of nuclear power as a result of reductions in costs relative to coal, especially in China, has underlined the importance of open trade and investment regimes for uranium oxide. Australia provides the world’s largest known potential for expanding exports of uranium, and has significant potential as a source for rare earths. These matters are discussed in Appendix 3.

One other large change in the international context of climate change policy has been the uncomfortable juxtaposition of increasing confidence in the scientific evidence of global warming and the human contribution to it, and the strengthening of scientific evidence of high risks of dangerous and possible catastrophic change, with increasingly strident denial of the validity of mainstream science in some political communities in the high-emitting developed countries. The scientific evidence and the reaction to the mainstream science are considered in Update Paper five (*The science of climate change*).

1.2. The importance of international agreement

People and governments in many countries understand the importance of breaking the nexus between economic growth and greenhouse-gas emissions. Why can’t we solve the problem by each of us getting on with the job, and reducing emissions to the best of our capabilities? Why do we need international agreement?

Some reductions in emissions below business as usual could be achieved by each country taking unilateral decisions—doing as much as its government judged to be fair, with each country being cognisant of the actions of others. The Review described this as “the messy approach” to mitigation.

The international agreement embodied in the Copenhagen Accord and now Cancun Agreements is a strong version of this approach, with important elements of international agreement supporting an approach to emissions reductions in each country. Success of this “strong messy approach” depends on transparency in commitments and their verification, on peer pressure across countries, and on a degree of trust across the international community.

The Review argued that the messy approach was unlikely to achieve the emissions reductions that would be necessary to meet strong emissions objectives, such as the goal of limiting temperature rise to 2°C which is now embedded in the Copenhagen Accord and Cancun Agreements. A central reason is that separate and non-binding decisions are unlikely to provide a firm basis for efficient trade, which would increase the costs of global mitigation and therefore reduce ambition in mitigation, especially in developing countries. This would provide others with rationalisations for doing less than others in the short term—the free-rider problem.

However, on this issue there is a saving grace: there is exceptional community interest in and support for action on climate change mitigation in many countries. Communities in each country take a close interest in the national mitigation effort and in monitoring the comparability of the home country’s effort with others’. The saving grace has been effective so far in the messy world after Copenhagen, and seems set to assist international peer pressure in securing substantial progress across many of the major emitters.

I should acknowledge in this Update one surprising development for which allowance was not made in the Review: some countries, notably China and the United States, have been willing to make larger commitments to constrain emissions when action has not been internationally legally binding. We will learn the magnitude of this surprise over the next few years.

In the light of these developments, it is worth re-considering the four important purposes that an international agreement serves.

First, through setting a global emissions-reduction objective and developing an allocation of the global mitigation effort amongst countries, it can resolve a prisoner’s dilemma. Without agreement, each country is tempted in its own narrow interests to contribute little, with the result that the total global effort is inadequate.

Second, if it takes the form of agreement on the quantity of each country’s emissions entitlement, agreement can provide a firm basis for international trade in entitlements, which would reduce the costs of global mitigation by a large amount and therefore improve the prospects of strong global mitigation. Australia’s economic structure means that environmentally and economically efficient trade in entitlements would reduce the costs of Australian mitigation proportionately more than for most of the world. International trade in entitlements would have the additional benefit of bringing carbon prices closer together in all participating countries.

Third, it can provide a differentiated set of incentives that encourage widespread participation by developing countries, which otherwise may weigh the present costs of mitigation more highly than the future gains of avoiding dangerous climate change. The participation in global mitigation of countries that currently have low incomes requires a set of incentives, including differentiated bases for calculating obligations to reduce emissions, opportunities to sell entitlements to emit greenhouse gases when they exceed emissions-reduction obligations, and financial payments to assist in the reduction of emissions and adaptation to the inevitable effects of climate change.

International agreement to achieve these purposes can be tightly or loosely defined. It can be legally binding or voluntary. It can involve specific reciprocity (with contributions being matched point by point) or diffuse reciprocity (with broad balancing of contributions over the agreement as a whole).

The Review’s suggestions for movement towards an international agreement emphasised the tight, the binding and the specific. It is worth going over the elements of the Review’s approach, as a way into assessment of the somewhat different agreement that has emerged from Copenhagen and Cancun. The Review’s approach had four elements and implied a fifth.

First, established arrangements should be reformed and not scrapped, as it would take a considerable time to build support for a radically different approach to international cooperation. However, some elements of established arrangements that were solidified at Kyoto and confirmed at Bali—most importantly, the binary division of the world between developed and developing countries with only the former accepting commitments to reduce emissions—were inconsistent with the required extent and timeliness of action and would have to be changed.

Second, there would need to be international agreement on a mitigation objective. It was in Australia's national interest that the international community agree on holding emissions concentrations in the atmosphere at 450 parts per million (ppm) carbon dioxide equivalent (CO₂-e) or lower, roughly corresponding to reasonable prospects of holding average temperature increases to 2°C above pre-industrial levels.

Third, a set of principles would need to be developed for allocating entitlements to an emissions budget that was consistent with environmental objectives. The Review judged that there would be no basis for international agreement on the allocation of entitlements which was not in the end based on equal per capita entitlements. The Review suggested modified contraction and convergence as a suitable framework of principle, with the modifications providing transitional headroom for rapidly growing developing countries.

Fourth, developed countries would need to commit additional public funding to assist the technological transition in developing economies and to provide incentives for developing countries to participate more fully in reductions in emissions, including in forestry. In addition, developed countries would each commit to minimum levels of expenditure on research, development and commercialisation of low-emissions technologies.

The fifth requirement is international agreement on accounting for and verifying emissions and their reduction.

These were all desirable and perhaps essential elements of effective international agreement. However, the foundations upon which the United Nations Framework Convention was seeking to build international agreement after Kyoto in 1997 contained deep flaws.

The artificial segregation of countries into two groups based arbitrarily on levels of economic development in 1992 was perpetuated by the acceptance in Kyoto that there would be no firm emission reduction commitments from developing countries. This froze in a damaging form the so called 'common but differentiated responsibilities and respective capacities' that fixed (and restrained) the ambition of individual countries and the global mitigation effort. It did this for a world in which a rigid, binary distinction between developed and developing countries no longer made sense.

Thus despite the so-called 'breakthrough' at Bali, there was still no agreement by the rapidly-industrialising developing economies, especially China, India, Brazil and Indonesia, that their participation would be in the form of legally-binding commitments. And there was no mechanism to elicit the necessary contributions of the high-income developing countries, including the OPEC oil producing countries, Singapore, Mexico and South Korea. Without substantial institutional change, the world seemed destined to ineffective partial climate change action.

The agreement that emerged from Copenhagen and Cancun tended towards the loose, the voluntary and the diffuse. It did deal with the central flaw in the post-Kyoto regime. This paper examines how far Copenhagen and Cancun can take us towards the purposes that must be served by international agreement.

2. Recent international climate change negotiations

With the long-term geo-political consequences of the Great Crash not yet understood and with the formalities of international relations still defined by a long-gone past, the United Nations Framework Convention on Climate Change meeting in Copenhagen in December 2009 became a critical test of multilateral cooperation within the new international power structure.

The Copenhagen conference was a diplomatic fiasco, but, as is now clear, made it possible to strengthen constraints on global emissions and to keep open the possibility of effective mitigation towards strong objectives. The Cancun Agreements have taken a step further away from the world of partial mitigation by anchoring all countries' pledges under the UN Framework Convention. At the same time, it placed a question mark over the efficacy of a second Kyoto commitment period.

The developments at Copenhagen and Cancun have changed the international regime through major modification of the Kyoto framework. They have introduced a strong global mitigation objective (no more than two degrees warming) that is in Australia's interest; brought developing countries into the mitigation fold with pledges from the major countries to domestic actions; secured support for the need for measurement, reporting and verification of domestic commitments and actions; and introduced mechanisms for assisting mitigation of, and adaptation to, climate change in developing countries. The domestic mitigation pledges of China and other major developing countries taken together for the period immediately ahead are consistent with what would have been required for the achievement of a strong global mitigation outcome within the modified contraction and convergence framework.

Copenhagen and Cancun can also be seen as having taken backward steps, away from the binding targets that would have been a more secure foundation for emissions reductions and would have provided an environmentally and economically sound basis for large-scale international trade in emissions entitlements. Developed country commitments so far fall well short of what would be required for achievement of a strong mitigation outcome.

2.1 The Copenhagen Accord

Although officials failed to deliver their main objective—a clearly defined and comprehensive set of binding commitments to mitigation—the Copenhagen Accord was a significant and positive step in international climate change efforts.

Substantive elements of the Copenhagen Accord included the following:

- International acceptance for the first time of a global mitigation target: recognition that global warming should be limited to no more than 2°C.²
- Pledges to take mitigation actions by developed and developing countries.
- Significant fast-start financing (up to US\$30 billion between 2010 and 2012) to support emissions reductions and urgent adaptation in developing countries.
- US\$100 billion per year long-term financing goal in the context of transparent mitigation.

The Copenhagen conference marked the serious multilateral re-engagement of the United States on international climate change efforts after a gap of nine years. And on the other side, the BASIC (Brazil, South Africa, India and China) group of major developing countries emerged as a disciplined and influential negotiating 'bloc'.³ Interaction between China and the United States was explicitly at the centre of the definition of possibilities for the first time on a major multilateral issue. In the end, the formal adoption of the Copenhagen Accord was blocked by six countries, preventing it from becoming the core decision of the Copenhagen conference. However, it was noted by the conference, and Parties were invited to bring forward pledges to reduce emissions.

2.2 Progress on the provision of financing for developing countries

The Review recognised that the limited extent of global public funding for mitigation, technology support and adaptation in developing countries was a weakness in the world's response to climate change. The Review proposed that high-income countries should make quantified contributions to an International Adaptation Assistance Commitment to provide new resources to developing countries. It further

² Research indicates that stabilisation of greenhouse gas concentrations at 450 ppm would yield a 50 per cent chance of limiting temperature rise to 2°C (Hare et al. 2006).

³ However we note the BASIC group is not a formal negotiating bloc such as the Group of 77 and China, or the European Union.

proposed high-income countries should support an International Low-Emissions Technology Commitment, which would provide support for innovation in low-emissions technologies at home or in developing countries.

The Copenhagen Accord contained an unconditional undertaking by developed countries to provide resources to support developing country action on mitigation, adaptation, technology development and transfer, and capacity building. Under fast-start financing, it was agreed to provide financing approaching US\$30 billion for the period 2010-2012 (Table 3 summarises pledges), with a goal to ramp up financing to US\$100 billion per year by 2020.

In June 2010, Australia announced it would commit A\$599 million to support fast-start efforts in developing countries, through the aid budget. While countries' pledges are based on various measures, Australia's fast-start contribution constitutes around 1.8 per cent of the global commitment. This amount is roughly consistent with Australia's contribution to the International Development Assistance arm of the World Bank and the Global Environment Facility.

Assuming Australia were to provide 2.8 per cent of global climate financing for developing countries, in line with the formula in the Review for developed country obligations under the Low-Emissions Technology Commitment but above current contribution shares, this would amount to A\$2.8 billion per year by 2020, or around A\$1.4 billion per year at 2015 assuming a steady increase to the maximum level.

As laid out in the November 2011 report by the UN High-level Advisory Group on Climate Change Financing (United Nations 2010), countries' contributions are likely to come from a range of private and public sources rather than from a single instrument. Carbon pricing and carbon markets are seen to play a major role in providing finance. Private sources are expected to provide an increasing share of the total over time. Part of the publicly financed component could come from new dedicated revenue sources, for example levies on international transport emissions. Part of the financing is likely to come from government budgets.

Many countries will fulfil part of their financing commitments from aid budgets. This makes sense in the light of the synergies between climate change adaptation and broader development objectives. In many cases, this would continue the practice from the fast-start period to 2012. For example the newly elected UK Government has retained its commitment to increasing its spending on overseas aid from 0.5 to 0.7 per cent of national income from 2013, while noting that its commitment to climate finance will be met out of the increased aid spending. The expenditure on climate finance would represent 7.5 per cent of the UK aid budget by 2014-15 (Fast Start Finance 2010).

As the Review noted, developed countries will need to ensure that climate change funding does not displace development funding for other purposes. In Australia's case, there is large scope to provide climate change funding through aid channels, as overseas development assistance is planned to be doubled over the next five years. In this context, it would be reasonable for Australia to allocate a portion of its increasing Overseas Development Aid (ODA) commitment for international climate change contributions. This could be done without serious concerns about diversion away from other purposes.

To illustrate possible magnitudes, if three quarters of a A\$1.4 billion financing commitment at 2015 were to be met through public sources, and three quarters of such public funding were to come from increased aid, the draw on development assistance would amount to around A\$787 million. The Australian Government committed, in the 2007-08 Budget, to increasing its overseas development aid program to 0.5 per cent of GNI by 2015-16. In order to meet this commitment, the Australian Government will need to almost double its aid budget over five years from around A\$4.3 billion in 2010-11 to around A\$8.6 billion per annum in 2015-16. Under the above assumptions climate change financing would account for 18 per cent of the proposed increase in overseas development aid, or 9 per cent of overall Australian aid.

This does suppose that other financing sources, both public and private, are harnessed to support climate change action in developing countries. If this were not the case and all or most of Australia's contribution were to come out of the aid budget—as is the case under fast start financing—then this could take up around one third of the planned increase in aid by 2015.

A share of Australia's public climate finance could be provided to the UN Green Climate Fund, or to satisfactory alternative mechanisms perhaps administered by the World Bank.

Table 1: Australian Government overseas development aid

Australian Government's overseas development aid in 2010-11	Additional amount needed to meet Australian Government's commitment to increase overseas aid to 0.5 per cent of GNI by 2015-16	Illustrative magnitude of Australia's total climate change financing commitment	Illustrative magnitude of climate change financing from increased aid	Share of increase in overseas aid allocated to climate change
(A\$billions)	(A\$billions)	(A\$billions)	(A\$millions)	(%)
4.3	4.3	1.4	787	18%

2.3 The Cancun Agreements

Many doubted whether the multilateral system of universal consensus would survive the diplomatic fiasco of Copenhagen. In contrast to the exceedingly high expectations for Copenhagen, expectations were low for Cancun. As it turned out, the 2010 Cancun Agreements consolidate and extend the Copenhagen Accord, and are widely seen as a new beginning for international climate change efforts. Cancun provides further building blocks toward comprehensive international agreement that includes emissions reductions by all major emitters.

The main outcomes of Cancun are:

- to anchor under the UN Framework Convention the pledges made by developed and developing countries in the Copenhagen Accord, providing an agreed pathway to achieve major emissions cuts;
- the establishment of a new Green Climate Fund to support developing countries' climate change responses;
- a REDD+ mechanism to deliver economic opportunities for developing countries to reduce emissions that result from deforestation;
- new measurement, verification and reporting and international consultation and analysis rules to ensure that all countries will be able to see what others are doing to tackle climate change;
- agreement to provide strong and practical support for vulnerable developing countries to manage unavoidable climate impacts; and
- the establishment of a technology mechanism to help diffuse clean energy technologies around the world.

When we come to look back at the legacy of Cancun, one of the most important developments may well be Japan's unequivocal statement that it would not enter a target in a second Kyoto commitment period. The effectiveness of Kyoto has been under increasing scrutiny and other countries, including Canada and Russia, are likely to follow Japan. Cancun may therefore mark the beginning of the end of the Kyoto regime and, accordingly, the end of the binary structure of climate change effort. A reality where all countries made commitments to reduce emissions and to report on their progress under one universal instrument—the UN Framework Convention—is likely to lead to a more effective global outcome.

Box 1: Climate change negotiations before Copenhagen – a short history

Adopted in 1992, the United Nations Framework Convention on Climate Change highlights two objectives: stabilising greenhouse-gas concentrations at levels that would prevent dangerous climate change; and at the same time, maintaining sustainable economic development for all countries.

The UN Framework Convention divided Parties to the convention into two groups—developed and developing. Although the structure of the UN Framework Convention in theory obliged all countries to take mitigation actions, the Kyoto Protocol entrenched a binary structure—by specifying emissions reductions for only one group of countries. This binary structure was only partially eroded by the agreements that followed in Bali and Copenhagen. This transition away from the world of partial mitigation was completed under the Cancun Agreements.

The Kyoto Protocol set an aspirational goal for developed countries together to reduce emissions by 5 per cent below 1990 levels between 2008 and 2012. It allocated emissions limits to most developed countries and established three ‘flexibility mechanisms’ to promote international collaboration and assist developed countries to meet mitigation targets affordably. Australia agreed to a target to limit growth in emissions to 8 per cent above 1990 levels between 2008 and 2012. Australia is on track to meet this target (DCCEE 2010a, p8).

The Review concluded that the Kyoto model, which left emissions reductions to politics, arm twisting and negotiations, would prove problematic in the early twenty first century, ‘the Platinum Age’, when an increasing number of countries sought to draw deeply from an increasingly constrained global emissions budget. A further flaw—one that was potentially fatal—was the refusal of the United States, the world’s largest emitter until 2006, to join the Kyoto regime and to accept enforceable targets.

The meeting in Bali in December 2007 was defined by three emerging realities that would shape climate change efforts. The first was growing recognition that climate change was ‘unequivocal’, with human action almost certainly making a major contribution (IPCC 2007), and that impacts would most likely be more severe than previously understood. Second, there was a growing domestic interest in the United States from outside the Administration and international pressure on the United States to contribute proportionately to global mitigation efforts. Third, there was growing recognition that emissions from developing countries would account for almost all of the growth in and a rapidly growing proportion of future global emissions. This meant that even the most ambitious commitments by historically developed countries, including the United States, would not avoid dangerous levels of global emissions.

In response to these three challenges, Parties to the UN Framework Convention reached an agreement on the Bali Action Plan, which set out a two-year road map for negotiations on two tracks to settle the scale and scope of post-2012 commitments. The Kyoto track aimed to agree a second commitment period and mitigation targets under the Kyoto Protocol due to commence in 2013. Under the universal Convention track, the main objective was for all countries to agree a ‘shared vision’ in Copenhagen to underpin a post-2012 agreement consistent with a safe stabilisation pathway. The aim would be to agree a framework where all countries, including those without mitigation commitment under the Kyoto Protocol, would agree to mitigation commitments and actions consistent with a safe stabilisation pathway.

In practice, the United States agreed to take on mitigation commitments or actions comparable to the commitments of the other developed countries in the Kyoto Protocol. China and the developing world also agreed, for the first time, to consider mitigation actions. However, there was no agreement as to whether the Bali Action Plan would lead to legally binding commitments by either developed or developing countries under the Convention. Potential emissions-reduction activities were significantly expanded to cover new sectors—notably the forest carbon sector—with international support for emissions-reducing technology, finance for reducing emissions especially in forestry, and adaptation.

Many developing countries continue to value the Kyoto structure, with its clear delineation of the binding commitments from developed countries and no quantified commitments by others. There will need to be deft diplomatic footwork around the next UN Framework Convention meeting in Durban in December 2011, to allow some formal retention of Kyoto language alongside substantive departure from its binary content.

3. Implications for global emissions of Copenhagen and Cancun

The Copenhagen Accord for the first time brought together mitigation commitments and actions by developed and developing countries alike. The main distinction was that while developing countries pledged mitigation actions, developed countries were required to commit to quantified economy-wide emissions targets.⁴ Least-developed countries and small-island developing states were not obliged to pledge actions in order to be a Party to the Accord.

3.1 Assessment of the Copenhagen Accord pledges

To date, 85 developed and developing countries, representing over 80 per cent of global emissions and about 90 per cent of the global economy, have pledged targets and actions under the Accord. The quantitative pledges on 2020 emissions by a selection of major countries are listed in Table 2. In addition, many countries have made pledges on specific goals such as renewable energy generation or forestry. Under the Copenhagen Accord, developed countries also committed to provide major financing for climate change action in developing countries, as discussed elsewhere in the paper.

Mitigation action in major countries

In defining their pledges, countries have chosen different types of commitments and different base years. Developed countries have framed their targets as reductions in absolute emissions relative to different base years, China and India have pledged to reduce the emissions intensity of their economies, and a number of developing and newly industrialised countries have pledged reductions in emissions relative to a business as usual trajectory, with that baseline in most cases yet to be defined.

The targeted changes in emissions can be compared to the emissions allocation entitlements under the Review's modified contraction and convergence approach, for a global system of commitments that add up to a global trajectory toward stabilisation of atmospheric greenhouse gas concentrations at 450 and 550 ppm, respectively (Table 3).

For developed countries, this comparison requires adjusting countries' targets to a common base year. Australia's pledged target range is in line with the Review's recommendations, encompassing the range between a 450 ppm and 550 ppm entitlement. The pledges by the United States, EU and Japan lie between the Review's 450 ppm and 550 ppm entitlements. The targets by Canada and Russia by contrast are less ambitious than under the Review's 550 ppm scenario. On average, developed countries' pledged 2020 targets are somewhat less ambitious than called for under the Review's 550 ppm scenario.

For developing countries, the Review suggested that emissions entitlements should be limited to a growth rate of half the rate of GDP growth under both mitigation scenarios, starting in 2013. This is an alternative formulation of an emissions intensity target. The Review's suggested approach, on the basis of the data available and projections made then, implied a targeted reduction in China's emissions intensity of 35 per cent from 2005 to 2020. Thus China's pledge to reduce emissions intensity by 40 to 45 per cent from 2005 to 2020 significantly exceeds what the Review saw as an adequate commitment for China even under an ambitious global agreement. India's required reduction would have been a 43 per cent reduction.

⁴ While Bali, Copenhagen and Cancun all made progress towards a broader mitigation action by all covered developed and developing countries, none have been able to resolve the issue of the legal form of that action. The vast majority of countries in the negotiations support a legally-binding outcome for all major emitters, but China, India and the United States continue to have concerns about taking on legally-binding mitigation commitments. In light of this continuing disagreement, the decisions coming out of Bali, Copenhagen and Cancun were all deliberately ambiguous as to whether the post-2012 negotiations would lead to a new treaty or not.

An assessment in the light of even higher rates of economic growth in the developing world than the high levels anticipated in the Review will be provided in Update Paper three (*Global emissions trends*).

For countries that have pledged reductions relative to a business-as-usual scenario (including Indonesia, Brazil, Mexico, South Africa and South Korea), assessments can be made by constructing business-as-usual scenarios. Such analyses (for example, see Jotzo [2010]) have shown that if realistic baselines are applied, the Copenhagen pledges imply reductions in absolute emissions in these countries between 2005 and 2020. They would thus be significantly more ambitious than called for in the Review.

Table 2: Mitigation Pledges to 2020 by selected major countries under the Copenhagen Accord

Party	Country or region	
Annex I Parties	Australia	5% reduction relative to 2000 unconditional; up to 15% reduction if there is a global agreement which falls short of securing atmospheric stabilisation at 450 ppm CO ₂ -eq and under which major developing economies commit to substantially restrain emissions and advanced economies take on commitments comparable to Australia's; and 25% reduction if the world agrees to an ambitious global deal capable of stabilising levels of greenhouse gases in the atmosphere at 450 ppm CO ₂ -eq or lower.
	Canada	17% reduction relative to 2005. To be aligned with the final economy-wide emissions target of the United States in enacted legislation.
	European Union	20% reduction relative to 1990; 30% reduction as part of a global and comprehensive agreement, and provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities.
	Japan	25% reduction relative to 1990. Premised on the establishment of a fair and effective international framework in which all major economies participate and on agreement by those economies on ambitious targets.
	Russia	15% to 25% reduction relative to 1990, conditional on appropriate accounting of the potential of Russia's forestry, and legally binding obligations by all major emitters.
	United States	Reduction in the range of 17% relative to 2005. In conformity with anticipated U.S. energy and climate legislation, recognising that the final target will be reported to the UN Framework Convention Secretariat in light of enacted legislation.
	New Zealand	10% to 20% reduction relative to 1990, conditional on a comprehensive global agreement to limit temperature increase to less than 2 degrees Celsius, with effective rules for land-use, land-use change and forestry regulation, recourse to a broad and efficient international carbon market and with advanced and major emitting developing countries taking comparable action commensurate with their respective capabilities.

Update Paper three (*Global emissions trends*) will compare in detail the extent of these commitments alongside with requirements for 450 ppm and 550 ppm objectives within the framework presented in the 2008 Review.

Table 3: Comparing the Copenhagen Accord pledges with the Review's framework

Country or region	Target type	Copenhagen pledges: change in absolute emissions at 2020 relative to 2000 ^a	Garnaut Review (2008): emissions entitlement allocations at 2020, relative to 2000-01	
			550 scenario	450 scenario
Australia	Reductions in absolute emissions	-5% to -25%	-10%	-25%
United States		-16%	-12%	-28%
European Union		-12% to -23%	-14%	-30%
Japan		-33%	-27%	-41%
Canada		-13%	-33%	-45%
Russia		+15% to +31%	n.a.	n.a.
New Zealand		-27% to -35%	n.a.	n.a.
<i>Weighted average of developed countries</i>			<i>-10% to -16%</i>	<i>-15%</i>
		Copenhagen pledges: reduction in emissions intensity, 2005 to 2020	Garnaut Review (2008): reduction in emissions intensity 2005 to 2020, applying the Review's suggested approach ^b	
China ^c	Reductions in emissions intensity (ratio of emissions to GDP)	-40% to -45%	-35%	
India		-20% to -25%	-43%	

^a Computations for developed countries (absolute targets): Countries' targets are converted from their chosen base years (see Table 3) to the 2000 base year used by the Review using estimates of total greenhouse gas emissions, excluding emissions from bunkers and land-use, land-use change and forestry (World Resources Institute 2011). The base year adjustment accounts for divergences from countries' submitted pledges as listed in Table 3, including the large divergence for Russia due to significant reductions in emissions between 1990 and 2000.

^b Computations for China and India (emissions intensity targets): Applying the Review's rule of emissions entitlements growing at half the rate of GDP growth for the period 2013-20 to the GDP growth assumed in the 2008 Review, in line with China's and India's pledges. The difference in required emissions intensity reductions between China and India is because of different rates of change in emissions intensity during the 2005-12 period which are carried forward in an assessment under the Review's proposal. If the Review's rule of half the rate of GDP growth had applied from 2005, the 2005-2020 reductions in emissions intensity would have been 44 and 43 per cent respectively.

^c China's Emissions Intensity Target only applies to carbon dioxide emissions.

Measuring the comparability of effort

The Review established that it is in Australia's national interest to play its full proportionate part in a strong global mitigation effort. It suggested the following targets: a reduction of 25 per cent from 2000 levels by 2020 in the context of an effective international agreement to stabilise greenhouse gases at 450 ppm concentrations; a reduction of 10 per cent in the context of agreement on 550 ppm; and an unconditional agreement on 5 per cent reduction in the absence of an agreement at all. These targets were broadly accepted by the Australian Government in 2009 and have been incorporated, with some additional qualifications, in the Copenhagen Accord. In this form they represent serious international political commitments but failure to comply would not have international legal consequences.

What does this mean in the continuing absence of a binding global agreement, but with substantial agreement on other important matters, all major countries specifying emissions targets under the UN Framework Convention and significant mitigation policy action in many countries?

The Review's framework of determining national emissions entitlements under a global agreement, based on a modified contraction and convergence model provides one basis for comparison of efforts of different countries in the messy world of domestic commitments.

The Copenhagen and Cancun agreements retain the focus on each country's percentage reduction of emissions below a base year (developed and transitional countries) or reductions in emissions intensity or against business as usual (others). The differentiation between developed and developing countries in this way is sound; the Kyoto differentiation between some major countries that were required and others that were not required to constrain emissions was not.

Emissions intensity is greatly to be preferred over business as usual as a base for developing country emissions reductions, as it is objectively and precisely measurable. For this reason, emissions-intensity targets could provide a sound basis for international trade in entitlements, whereas targets calibrated against the imprecise business as usual could not.

There is, however, one matter of measurement of emissions intensity that must be tied down precisely. Emissions in the base year and in the year of testing must both be compared with real GDP in the prices of the base year. This is important because a low-income developing country experiencing sustained rapid economic growth—for example China—will eventually come to a point at which labour becomes scarce, real wages rise sharply and the real exchange rate appreciates by a large amount. These are the circumstances of contemporary China, as they were the circumstances of Japan in the decade to the mid-1970s and Taiwan, South Korea, Hong Kong and Singapore at various times in the 1980s. In these circumstances, comparisons of emissions with GDP as measured in the current national accounts, converted into international currency, and adjusted for an international price deflator would lead to artificially rapid reductions in measured emissions intensity of output. I have discussed this issue with China's National Development and Reform Commission, which has carriage of climate policy within the Chinese administrative system, and have been assured that China has in mind the valid and not the erroneous approach to measurement.

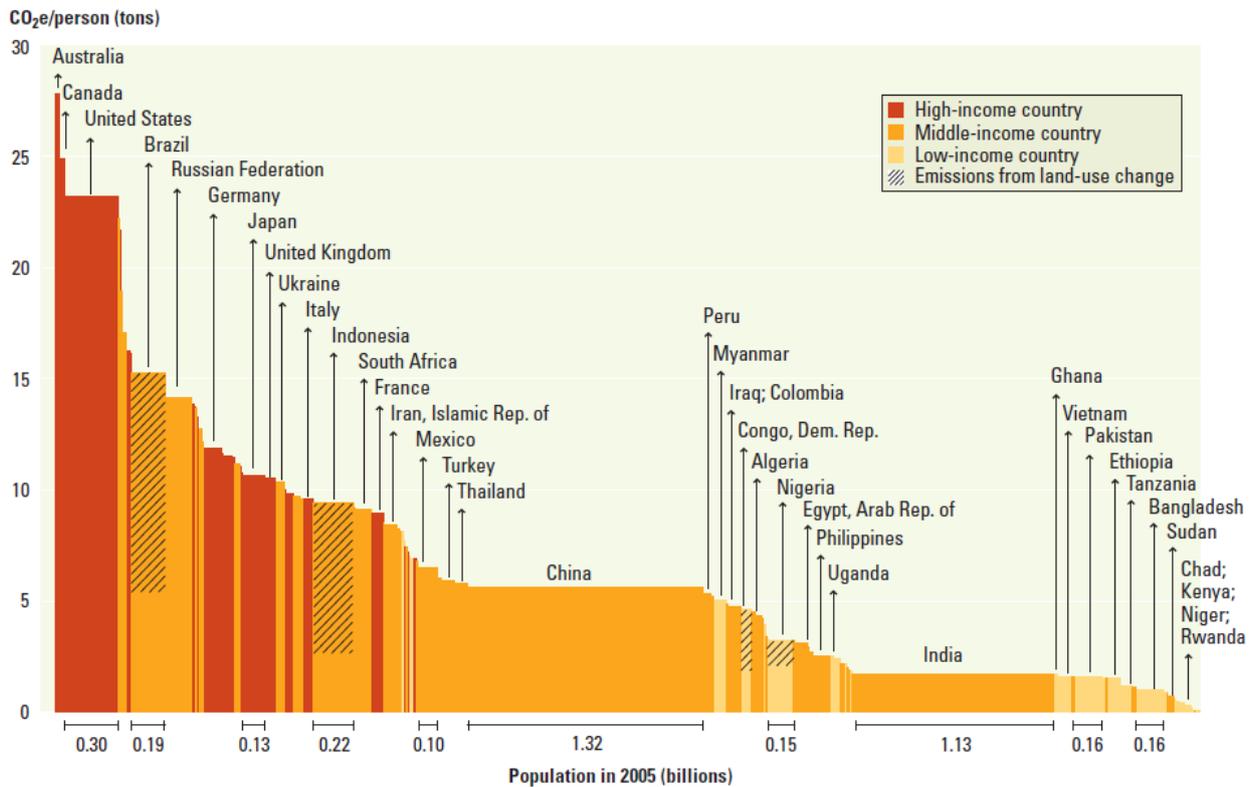
The continued focus in the Copenhagen and Cancun Agreements on percentage reductions in emissions from a base year for comparisons of mitigation performance amongst developed countries now seems unlikely to change, until there is an agreed basis for allocating a defined emissions budget across countries.

A focus on percentage reductions from a base year is apparently favourable to Australia in one way, but apparently unfavourable in another. It is apparently favourable for allowing continued per capita emissions well above those of any other developed countries. If a country starts with much higher per capita emissions than others, and all countries reduce emissions by a similar proportion, it continues to have higher per capita emissions than other countries. It is apparently unfavourable to Australia because it fails to adjust for population growth. Australia with—and currently more than—Canada and the United States, is one of the three developed countries in which population continues to grow strongly.

I said apparently favourable and apparently unfavourable because Australia’s national interest is in effective global mitigation of climate change, and therefore in the development of principles for allocating emissions entitlements around which an effective global agreement can be built. There is no way that most developing countries would accept the indefinite continuation of much higher per capita emissions that is implied by continued use of percentage reductions in emissions below a specified starting point. Nothing at Copenhagen or Cancun or elsewhere in the international discussion weakens, and some of the international conversation strengthens the Review’s judgement that an effective global agreement on emissions allocations will need to be built around convergence over time towards equal per capita entitlements.

Convergence towards equal per capita entitlements will put more pressure on Australia by ending the privilege associated with having been the world’s highest developed country per capita emitter of greenhouse gases, but will ease pressure through taking population into account. These two influences will tend to cancel each other out. Australia has no narrowly defined national interest in opposing principles based on convergence to equal per capita entitlements to set against its overriding national interest in effective global mitigation.

Figure 1: Individuals’ emissions in high-income countries overwhelm those in developing countries



Sources: Emissions of greenhouse gases in 2005 from WRI 2008, augmented with land-use change emissions from Houghton 2009; population from World Bank 2009c.
 Note: The width of each column depicts population and the height depicts per capita emissions, so the area represents total emissions. Per capita emissions of Qatar (55.5 tons of carbon dioxide equivalent per capita), UAE (38.8), and Bahrain (25.4)—greater than the height of the y-axis—are not shown. Among the larger countries, Brazil, Indonesia, the Democratic Republic of Congo, and Nigeria have low energy-related emissions but significant emissions from land-use change; therefore, the share from land-use change is indicated by the hatching.

Sourced from the World Bank’s 2010 World Development Report, page 39 (The World Bank 2010).

While the Cancun agreement may open a way toward negotiating a future international binding agreement, this is not assured and in any event is likely to take more than a few years. Australia should retain and reiterate its promise to adopt a national target commensurate with other countries’ commitments under a global agreement, and be prepared to have that compared with others on a range of measures, including the extent of proportionate reduction against a baseline, and an explicit formula based on modified contraction and convergence.

In the meantime however, other measures of commensurate effort are likely to be discussed.

One measure sometimes advocated is 'comparable pain', as measured by the economic cost of mitigation measures relative to the size of the economy. It could, for example, be argued that countries should calibrate their policy effort to experience a similar percentage GNP cost, or that percentage GNP costs should be calibrated to correlate with countries' average per capita income or emissions intensity. Modelling typically shows that Australia would carry relatively high GNP costs for a given amount of abatement when embedded in international action, principally because other countries' abatement policies reduce demand for Australian exports of fossil fuels and energy-intensive goods (see, for example, McKibbin et al. [2010]).

However, there is no prospect that special Australian treatment along these lines would be acceptable to the international community. The modelling of comparative GNP impacts is fraught with uncertainty and any particular version would be strongly contested. An argument that the Australian economy's exceptional dependence on coal and in particular its high exports of coal warrants special treatment is likely to be counterproductive. Indeed, there are larger prospects that in the messy world without binding emissions targets, other countries will find implicit discrimination against coal imports the easiest politically amongst available routes to reductions in emissions.

Comparable carbon pricing is another possible guide to calibrating Australian policy effort in the transitional period before there is a secure basis for large-scale international trade in entitlements. Here the appropriate benchmark could be the developed countries and, given its pervasive influence on emerging patterns of international trade, China. Limiting divergences in the effective marginal cost of abatement between countries is essential to achieve a global mitigation outcome at minimum cost. To the extent that it could be achieved, a similar carbon price across countries would reduce the risks of corrosion of the international trading regime being especially damaging for Australia, and remove any valid basis for incurring indefinitely the public finance costs of providing assistance to trade-exposed emissions-intensive industries.

The estimation of effective carbon prices prevailing in different countries is a highly complex exercise. The Australian Productivity Commission is currently undertaking an assessment of comparative carbon pricing. One source of complexity is the use in many countries of regulatory approaches to enforcing reductions in emissions, rather than a market-based approach with a carbon price. Examples include regulations for building, equipment and fuel consumption standards. Another is the ambitious goal announced by President Obama in his 2011 State of the Union Address, to increase the proportion of 'clean' energy used in the electricity sector to 80 per cent by 2035, which will be supported by a wide range of public policy interventions. Such measures have an implicit carbon price, although measurement is complicated—especially when there are large regional variations in regulatory constraints.

When the results of the Productivity Commission's work become available, they will measure the costs of interventions, and not their effects on reducing emissions. They will have valuable roles as indicators of comparative effort and in assessing the merits of claims for assistance by trade-exposed and emissions intensive industries on the grounds that they are facing higher carbon related costs than their competitors.

The Update will provide further discussion of these issues in Update Paper six (*Carbon pricing and reducing Australia's emissions*).

4. Policies in selected countries of importance to Australia

As with the Kyoto Protocol, countries which pledged targets or actions under the Copenhagen Accord were free to determine what policy measures they put in place to achieve their pledged targets or actions⁵.

Most developed countries have made significant progress in establishing ambitious emissions targets and putting in place the instruments through which the desired outcomes will be achieved. More than 30 developed countries have introduced, or are seriously considering introducing, market based measures to help meet their emissions-reduction targets affordably and efficiently. Several countries' carbon pricing mechanisms include design features that allow the rate of emissions reductions to be accelerated in the event that other countries take on more ambitious targets. Countries and regions that have implemented carbon pricing mechanisms (New Zealand and the European Union [EU], for example) are considering various options to link up their trading schemes. The EU implemented its emissions trading scheme (ETS) in 2005. The scheme operated under an explicit trial phase between 2005 and 2007 and is currently in its first full phase, which runs from 2008 to 2012. The scheme covers over 11,500 installations which represent around half of Europe's carbon dioxide emissions and about 40 per cent of its greenhouse-gas emissions. The 27 EU Member States plus Iceland, Liechtenstein and Norway are covered by the scheme (European Commission 2010).

The New Zealand ETS commenced in 2008, initially covering forestry. Transport fuels, electricity production and industrial processes were added on 1 July 2010. Transitional measures in place between July 2010 and December 2012 allow participants to buy emissions units from the New Zealand Government for a fixed price of NZ\$25. At the same time, participants in the energy, industrial and liquid fossil fuel sectors are required to surrender only one emissions unit for every two tonnes of emissions they produce. The combined effect of these measures is to cap the price of emissions units at NZ\$12.50 until the end of 2012 (NZ MfE 2010).

In 2010, the Japanese Government announced its intention to pass legislation that supported an ETS, carbon tax and feed-in tariff measures. However, in late 2010, the Government announced that it would delay, but not scrap, plans to implement an emission trading scheme. A number of voluntary ETSs exist in Japan. These include the Japanese Voluntary ETS which was launched in 2005 and the Experimental ETS, launched in 2008. The Tokyo Metropolitan Government also launched an ETS in April 2010. The Japanese private sector has taken strong steps to put itself in a leading position technologically in the development of products and processes that are suitable to a low-carbon economy.

In December 2009, South Korea's National Assembly passed the Framework Act on Low-carbon Green Growth which paves the way for a mandatory ETS. While the scheme is still being developed, the South Korean Presidential Committee on Green Growth has indicated that the first phase of the scheme may run from 2013 to 2015 (Point Carbon 2010a).

A number of European countries, including Denmark, the Netherlands, Sweden and Switzerland, have implemented carbon taxes, with some operating since the early 1990s.

The South African Government is also considering how to introduce a carbon price; its National Treasury released in December 2010 a discussion paper exploring the economic rationale for and possible approaches to introducing a tax on carbon.

⁵ The information on carbon pricing measures in other countries other than the US and China is drawn from *An overview of international climate change policies*, produced by the Department of Climate Change and Energy Efficiency for the Multi-Party Climate Change Committee, available at <http://www.climatechange.gov.au/government/initiatives/multi-party-committee.aspx>.

4.1 Three developed countries with exceptionally high per capita emissions

Australia, Canada and the United States have the highest per capita emissions of the developed world.⁶ The economic structure and pattern of political interests associated with exceptionally high emissions have made it difficult for these countries to break away from old patterns of energy use with the result that they have held back the global mitigation effort. There has been a tendency for each to look to the others for comfort in relation to under performance on emissions reductions. The United States is obviously more influential in the smaller countries than the other way round, although Australians probably underestimate the extent to which their own discussion and decisions play into the American debate. Over recent months, American officials close to the President of the United States have emphasised to me the significance of Australian progress in pricing carbon to the prospects for the use of economically efficient approaches to mitigation in their own country.

Australia's position is not identical to that of the United States and Canada. While all three would suffer heavily from unmitigated climate change, Australia's interest in strong and effective mitigation is the greatest and most urgent. Australia therefore has an interest in leading the other high-emitters into making positive contributions to the global effort.

Australia, as a close friend and ally of the United States, more than most developed countries, has good reasons to look beyond narrow and specific reciprocity on climate change policy with the United States. There are many areas of common interest in which the United States carries disproportionate costs. This is true of much of the two countries' shared security interests. If it happened that in one area of shared interests, climate policy, the United States Government found it difficult fully to reciprocate an Australian contribution, there would be good reason for Australians to accept this as part of the web and waft of a larger relationship from which it derives large benefits.

However, despite the considerable current domestic political difficulties on climate change mitigation policies, the United States is far from standing still.

Although a shift to a global carbon market suffered a blow when the United States Administration announced it would not pursue the passage of federal cap-and-trade legislation in 2010, there have been considerable developments with 10 North-Eastern and Mid-Atlantic states currently participating in a regional ETS—the Regional Greenhouse Gas Initiative (RGGI).

On 16 December 2010, the California Air Resources Board approved a cap-and-trade plan for California to be implemented in January 2012. Only ten national economies are larger than California. The ETS will be the world's second largest (after the EU ETS) and aims to cut California's emissions to 1990 levels by 2020 (Point Carbon 2010b).⁷

At the Federal level, the United States Environmental Protection Agency is pursuing aggressive regulatory measures, such as tightening regulatory restrictions on emissions from vehicles, and mandating the closure of the most heavily polluting coal-fired power stations. Strong support for low-emissions sources of energy has been a feature of budget programs since the early stimulus packages in response to the 2008 financial crisis (DCCEE 2010b).

The United States discussion is important globally and in Australian consideration of climate change policies, and is worth considering in detail. In a big polity like the United States—or China, as discussed below—crosscurrents and eddies inevitably complicate interpretations of developments in a complex and new area of policy.

We would be wise to recognise that the United States Government, following the reputed scientific community of the United States, is working on the basis that climate change is a reality, that human

⁶ Luxemborg also has high per capita emissions but has not been considered a major developed country for these comparisons.

⁷ Note that California is also a member of the Western Climate Initiative collaboration of independent jurisdictions who commit to work together to identify, evaluate and implement policies to tackle climate change at a regional level.

activity is contributing influentially to it, and that in the absence of strong mitigation, the human community faces large risks of disruption to its economic and political life. The United States Government is committed to playing an effective role in building international action to avoid risks of dangerous climate change. There are reasons beyond avoiding high risks of dangerous climate change for people who value the strategic role that a strong United States can play in world affairs to wish the United States Government well in its climate policy.

This area of policy is every bit as difficult in the United States as in our own country. There are participants in the political process (rather more influentially than in the general community—and with only minor reinforcement from a few people with current claims on relevant scientific expertise) who deny the conclusions of the mainstream science, or whether action is worth the costs. There are different views about the best instruments for mitigation, but that is a different matter. Those who wish failure in climate policy for the President of the United States generally wish failure for the President more generally. Their weakening of the President at this challenging time would have large consequences for the success of the United States and the strategic role that it is able to play in world affairs.

Here I will focus narrowly on climate change policy in the United States, except where interaction with wider political and strategic matters is germane to climate policy.

The United States has experienced great swings in Government climate policies over the past two decades.

The United States was part of the agreement at Kyoto in 1997, and accepted a target to reduce average annual emissions by 7 per cent from 1990 levels between 2008 and 2012. The Clinton Administration was committed to the international processes of which it had been a part, but failed comprehensively to secure the ratification of the Kyoto Protocol in the United States Senate. Here ratification ran into old and entrenched resistance to using international treaties to bind domestic policies. It was a reality check for the international polity: it is much more difficult to bring the United States legally to an international agreement than to secure the Government's agreement and commitment to active implementation. This might have been read as a warning sign about seeking a binding international agreement as a centrepiece of a global mitigation regime.

The Bush Administration elected in November 2000 downplayed support for reduction in emissions, confining policy to some encouragement of low-emissions technologies. Increasing domestic interest in the climate change issue and support for more active policy to reduce emissions forced some change of rhetoric late in the Bush Presidency. Both Presidential candidates fought the 2008 election campaign on platforms that included commitments to reduce substantially United States emissions, and to achieve that outcome through the introduction of an ETS.

Several bills to reduce emissions through an ETS were developed in the House of Representatives and the Senate through the first two years of the Obama Presidency. The Waxman-Markey Bill targeted reductions in emissions from 2005 levels of 20 per cent by 2020 and of 83 per cent by 2050. The United States Government returned to active support for the international negotiations under United Nations auspices on climate policy, most influentially at the Copenhagen meeting in December 2009.

The 2005 base was established because that was the latest year for which data were available in the early stages of development of the Bill; there was little change in emissions between 2000 and 2005.⁸

In the lead-up to the 2010 mid-term Congressional elections, the Senate Majority Leader Harry Reid announced in July that the Senate would not consider a comprehensive climate bill in 2010. The circumstances following the 2010 mid-term elections, with Democrat strength reduced in the Senate and a Republican majority in the House of Representatives ruled out passage of Waxman-Markey or any alternative market-based approach to reductions in emissions at least until the conclusion of the current Presidential term. The Republican majority in the House of Representatives contains elements

⁸ US carbon dioxide emissions increased by 2.2 per cent from 2000 to 2005; carbon dioxide equivalent by 1.3 per cent; and carbon dioxide emissions net of biological sinks fell by 3.1 per cent.

that are strongly opposed to many aspects of the Administration's policies, climate change policy amongst them. The United States polity is fractured by the Great Crash and its recessionary aftermath; it has been left with suspicions of the financial markets that would play central roles in an ETS; and is giving clear priority to employment.

The Administration has remained committed to strong outcomes from international climate change negotiations. The United States played a central role in the development of the Copenhagen Accord, and in its consolidation and extension in the Cancun agreements. It has left its 'minus 17 per cent' emissions reduction on the table as a commitment under the Copenhagen Accord, necessarily qualified by references to United States domestic processes. It has indicated that it will meet commitments to the funding mechanisms established at Copenhagen and Cancun.

United States officials at the highest levels state that the emissions reduction target will be met, despite the absence of a market-based instrument for securing that result. They are supported in their statements about the targets by the slower economic growth that has followed the Great Crash; by the 'gas revolution', through which the competitive position of lower-emissions gas has been greatly strengthened against coal by an historically exceptional and rapid expansion in gas reserves; by productive responses to the heavy support for low-emissions technologies that was part of the anti-recessionary stimulus packages; by extension of regulatory oversight of energy efficiency and emissions standards by Federal agencies including the Environmental Protection Agency; by many state-based initiatives to establish emissions trading schemes and emissions-reducing regulations; and by pervasive uncertainty about and expectations of future constraints on emissions, that has inhibited investment in coal-based power generation in particular.

On the effects of recession, carbon dioxide equivalent emissions net of sinks were 1.2 per cent lower in 2008 than they were in 2000. They fell by 2.9 per cent from 2007 to 2008. In the absence of mitigation policies and efforts, a resumption of growth could be anticipated with recovery of production and incomes by 2011.

The expansion of gas reserves has taken the United States by surprise—Australia and other countries have also been surprised by recent increases in their gas reserves. In the United States, the increase in gas reserves is associated most strongly with technological developments that have reduced the cost of large-scale gas recovery from shale deposits. A recent major study of the United States gas position by the Massachusetts Institute of Technology (2010) estimates that gas reserves after depletion increased by 77 per cent from 1990 to 2010. This expansion of reserves has already reduced both average prices and their volatility, making gas a much more competitive fuel for power generation.

The opportunity for rapid expansion of the use of gas for power generation is enhanced by the rapid expansion of gas generation capacity over recent decades. Since the removal in 1987 of various regulatory restrictions designed to preserve gas for what were thought to be socially more valuable uses, the United States added 361 GW of power generation capacity, of which 70 per cent was gas-fired (MIT 2010). Much of the new gas capacity was underutilised through a period in which gas prices were tending higher towards high oil-equivalents, and were subject to considerable volatility. It is now relatively easy and cheap to switch from coal to gas-fired units. With greater regulatory pressure to close 'dirty coal' units, including some which are the source of unacceptably high concentrations of mercury and particulates, there is considerable value in switching to gas-based generation. Incidentally, the expansion and reduction in costs of domestic gas supplies has for the time being rendered redundant a great deal of physical capital that had been committed to the import of liquefied natural gas.

The shift from coal to gas will help the United States to meet emissions reduction targets over the next decade.

The high priority of emissions reduction and more generally the shift to 'clean energy' and independence from the insecurity of Middle East oil supplies were powerful motivating factors in the allocation of stimulus spending in the immediate aftermath of the Great Crash. Programs for 'clean energy' research, renewable energy deployment, public transportation, vehicle electrification and smart grid technology were allocated a total of US\$67 billion, of which about US\$8 billion was spent by the end of 2009 (The Pew Charitable Trusts 2010). These themes have been continued in subsequent administration policy. The centre piece of new policy in President Obama's State of the Union Address

in January 2011 was a commitment to raise the proportion of ‘clean energy’ in United States electricity generation from 40 per cent to 80 per cent by 2035.

One spur to American encouragement of transition to ‘clean energy’ is the realisation that the world is in the process of transition to greatly reduced reliance on fossil fuels, and that countries that are at the forefront of the transition will have competitive advantages in many markets that are expected to be important to the United States. There is some anxiety in the United States that they may be falling behind in this transition, and that this may carry economic costs in future. The State of the Union Address focussed on competition with China in particular. This is likely to be a continuing source of pressure for public investment in innovation in relation to low-emissions technologies.

In recognition that there will be no market-based system of emissions reduction for the time being, the Administration has increased the profile of regulation. The path for a wider role for regulation through the Environmental Protection Agency was cleared by a Supreme Court decision in 2007 that greenhouse gases fit within the United States Clean Air Act definition of ‘air pollutants’. Coupled with the Environmental Protection Agency’s finding in 2009 that greenhouse gases threaten public health and the welfare of Americans, this paved the way for the Environmental Protection Agency’s promulgation of greenhouse-gas emission standards for new cars and light duty (passenger) vehicles. The new standards will apply from model year 2012, and are estimated to reduce emissions from the United States light duty fleet by 21 per cent by 2030, relative to what they would have been in the absence of the regulations. On 21 May 2010, President Obama issued a memorandum to expand the scope of the regulations to cover medium- and heavy-duty vehicles, starting with 2014 model year vehicles.

Over recent years, considerable effort has been devoted to the calculation of a social price of carbon emissions through an inter-agency process (EPA 2010). The resulting number—or numbers, as there is a range thought to be appropriate across various circumstances—are now being systematically applied in decisions on the regulation of emissions from vehicles, appliances, and power generation and industrial facilities. The ‘central’ price, most commonly applied, is US\$21. This price will be reviewed regularly to take account of increasing knowledge of the science and economics of climate change.

The Environmental Protection Agency has also played a role in reducing greenhouse gas emissions incidentally to its older mission in relation to other pollutants. Many environmentally inefficient coal based generators have been closed to reduce mercury and particulate emissions, with incidental benefits for greenhouse gases.

The extension of the Environmental Protection Agency regulation to greenhouse gases has been resisted by elements in the Congress. Opponents of greenhouse-gas regulation will seek to change the law to constrain the power of the Environmental Protection Agency in this area. The proponents of such legislation would lack the required Senate majority, and would face a Presidential veto. Alternatively, opponents of the Environmental Protection Agency’s new powers might adopt the confrontational strategy of placing conditional restrictions on funding of the Environmental Protection Agency within general supply bills. While it is unlikely that this issue alone would be the subject of such a contest of wills between the legislative and executive arms of Government, it could become part of a wider political confrontation.

Meanwhile, the regulatory powers of the Federal Government are having substantial effects in reducing greenhouse-gas emissions, and are likely to contribute much more in future. Beyond the Federal Government, many of the states have been active with regulatory powers and now with the establishment of regional emissions trading arrangements. Californian action has been prominent and effective. It was the subject of direct attack during the recent Congressional elections, when oil interests sought unsuccessfully to overturn by referendum the 2006 Global Warming Solutions Act.⁹

⁹ At the state level, there are a number of emissions trading schemes either in place or in the pipeline. Ten North-eastern and Mid-Atlantic states currently participate in the Regional Greenhouse Gas Initiative (RGGI). Permit revenues from the scheme are directed towards energy efficient development. Two other North American regional schemes—the Midwestern Greenhouse Gas Reduction Accord and the Western Climate Initiative—are currently under development. Collectively, the three schemes cover 23 US states and four Canadian Provinces, and account for approximately half of the US population and one-third of US GHG emissions (MGGRA 2008).

The Obama Administration included in its support for clean energy the provision of loans for new nuclear power plants. Construction has not yet commenced on a nuclear power plant in the United States since 1977 (US EIA 2009). Despite fiscal and political encouragement, progress remains slow. There is strong opposition from communities that have not hitherto lived with neighbouring nuclear plants, but there is often more support for the expansion of established plants. The economics of nuclear power generation have been set back by the new abundance and low costs of gas.

In an environment of regulatory focus on non-greenhouse gas pollutants from coal, regulatory concern about high-emissions energy, local political activism against coal-based power generation, uncertainty about future pricing of emissions, and low gas prices, there is recognition in industry and in the environmental community that investment in new coal-based power generation is unlikely. Independent organisations have assessed that established regulatory measures and other policies could in favourable circumstances reduce United States emissions by up to 14 per cent below 2005 levels by 2020 (World Resources Institute 2010). These studies do not take account of the gas revolution. The wide range of developments described above make it possible that the United States will achieve its 2020 emissions reductions targets, despite the absence of economy-wide pricing of emissions. Of course, much will depend on the evolution of the national political balance in the years ahead.

Canada has now hitched its mitigation ambitions to the American wagon. Its Copenhagen commitment is to reduce 2005 emissions by 17 per cent by 2020, unless the United States objective is varied. While the United States and Canadian mitigation goals fall well below those of many other countries, and while they fall well short of the requirements of current international climate objectives, they would represent a marked departure from historical trends. In both countries, such a change in trend would create an opportunity for acceleration of progress in emissions reductions.

Australia has so far been a drag on the global mitigation effort in contradiction to its own strong national interest in effective global mitigation. If we are able to correct this anomaly, and play a proportionate part in the international community's efforts to achieve strong global mitigation, the influence of our efforts would be expanded through the positive effect this would have on North American discussion of climate change policy. Without placing disproportionate burdens of adjustment on Australians, we could come to exercise a significant leadership role. That leadership role would be expanded further if we were to apply economically efficient means to constraining emissions, built around an economy-wide carbon price. This would be likely to have significant influence in the American policy discussion.

4.2 China and the major developing countries

Chinese climate change policy is at the centre of the international effort to reach global agreement, because it is the world's largest source of greenhouse-gas emissions, because it is by far the largest prospective source of emissions growth over the next two decades, and because economic and strategic competition between China and the United States is important in the policy dynamics of both countries.

Until about 2007 or 2008, China sat comfortably as one of the developing countries that faced no strong requirements to reduce emissions below business as usual. It supported the 'differentiated' responsibilities of developing countries that had been agreed at Kyoto and came under only mild challenge at Bali.

The Review put the view that there would be no effective global mitigation unless China moved the trajectory of emissions growth strongly below business as usual. The obligations on China for the time being could be established differently from those for developed countries, but they would need to be as firm as those for developed countries. The Review's proposed "modified contraction and convergence" would for the time being allow growth in total emissions, while reducing them a long way below business as usual. This was not because it was fair—developed countries had faced no such constraints when they were at similar stages of economic development. It was because there would be no effective agreement to reduce the risks of dangerous climate change to acceptable levels without it.

China took proposals for major reductions in emissions below business as usual to the Copenhagen meeting: to reduce the emissions intensity of output by 40 to 45 per cent from 2005 levels by 2020. These goals had been opposed by official advisers with responsibility for economic policy, on the grounds that they may be unattainable, or attainable only at unacceptable cost to economic growth.

Once they had been accepted by the leadership, it became the responsibility of the economic officials to make sure that they were achieved.

China's most important emissions reduction measures have been regulatory, with the authorities seeking to implement multiple environmental, energy security and other objectives by closing some and constraining other emissions-intensive plants and industries. There has also been substantial fiscal support to accelerate the deployment of a wide range of low-emissions technologies in energy and transport. This was a focus of the stimulus packages adopted in late 2008 and early 2009, in response to the Great Crash. For example, there was massive support for deployment of virtually all of the low-emissions technologies: solar; wind; nuclear; biomass; hydro-electric. There was major investment in the electricity transmission grid to reduce energy losses and to facilitate integration of new sources of electricity. There was huge commitment to expansion of public transport within urban areas, and extraordinarily rapid progress in developing 13,000 kilometres of fast train infrastructure by 2012 to join most of the large cities of China. There has been rapid reduction in the emissions intensity of coal-fired electricity generation. Environmentally damaging, unsafe and economically inefficient small coal-fired generators have been closed at the rate of one every one or two weeks, and replaced by larger, and economically and environmentally much more efficient plants.

Not all of this went smoothly. There were examples of wind power capacity growing well in excess of the grid's capacity to use the product. There was criticism by economists of wasteful levels of subsidy for deployment of rooftop solar and electric cars. But the overall effect was transformative.

In August 2010, China's National Development and Reform Commission (NDRC) launched a national low-carbon province and low-carbon city experimental project. The eight cities and five provinces covered by the project will develop emissions reduction plans and explore options to use market mechanisms to achieve abatement goals (People's Daily Online 2010). The emissions intensity targets have been devolved down to provincial levels, and from there to local governments. National officials have stepped in to override local government decisions that were thought to be inconsistent with the national objectives. China also plans to impose a new tax on coal, oil and gas extraction in its western provinces. The tax, introduced in June 2010 in Xinjiang, China's largest gas-producing province, will be broadened to include all western areas (Bloomberg 2010).

The Chinese economic policy authorities have been surprised by the rate at which the costs of the low-emissions technologies have fallen. These developments will be discussed in detail in Update Paper seven (*Low-emissions technology and the innovation challenge*).

Costs of nuclear power have fallen so much that in coastal China—where the coal alternative involves the import of expensive coal from Australia and elsewhere or the expensive transportation of coal from the inland of China over hopelessly over-extended rail and road systems—nuclear is close to being economically competitive with coal, with the relative costs continuing to move in favour of nuclear. The main constraint on expansion of nuclear at the expense of coal will soon not be cost directly, but anxiety about whether adequate supplies of high-grade uranium oxide would be available to meet China's demands. Costs of wind power have fallen by one fifth in two years despite the general inflationary environment in China. Solar photovoltaic units have been falling rapidly in cost and, being a younger technology, will continue to do so for some time.

What once seemed unattainable targets to Chinese economic authorities are now viewed with confidence. Officials have been pleasantly surprised at the rate of decrease in costs and are beginning to talk of reaching the high point of the emissions intensity reduction and then possibly going further.

China would not have committed itself to the targets offered under the Copenhagen Accord if they had been internationally legally binding, but senior officials are now suggesting privately that China may strengthen the nature of its commitments in the context of stronger international agreement.

There has continued to be some scepticism outside China about whether China's efforts go beyond what they would have done under business as usual. This is based on fundamental misunderstanding of the Chinese reality. Some is based on extrapolation of the energy efficiency gains of the 1990s when central planning was replaced by price mechanisms for allocating energy and other raw materials. Those gains were once-for-all in nature and had been fully realised by the end of the twentieth century.

The magnitude of the change in China is beginning to seep into the external consciousness, and to affect the international discussion of emissions reduction. It played an important role in President Obama's State of the Union Address. Christiana Figueres, the head of the UN Framework Convention on Climate Change, said at the recent World Economic Forum in Davos, "China is going to leave all of us in the dust... They're committed to winning the green economy race" (Associated Press 2011). According to the World Economic Forum (2010), China last year boosted spending on low-carbon energy by 30 per cent to US\$51.1 billion, "by far the largest figure for any single country." Global accounting firm Ernst & Young (2010) said in September that China for the first time overtook the United States in its quarterly index of the most attractive countries for renewable energy projects.

The Review's calculations indicate that China's targets are consistent with what is required under its notional allocation of emissions entitlements within a global agreement to achieve 450 ppm. The Review introduced much greater realism into international perceptions of future economic growth in China, and emissions growth under business as usual. Current assessments of the Chinese outlook will be provided in Update Paper three (*Global emissions trends*).

India has pledged to 'endeavour' to reduce the emissions intensity of its GDP by 20 to 25 per cent by 2020 in comparison to the 2005 level. In July 2010, India imposed a Clean Energy Tax of 50 rupees per tonne (approximately A\$1.13 per tonne) on both imported and domestically produced coal. Revenue from the tax will fund research and projects in clean energy technologies (DCCEE 2010b).

Indonesia has committed to reining in deforestation and improving land management, in a bid to help fulfil its pledge to cut emissions by 26 to 41 per cent relative to business as usual by 2020. A moratorium on issuing new licences for land conversion was agreed as part of a US\$1 billion agreement with Norway, and initiatives to improve institutions, incentives and monitoring in the forestry sector are underway, including with Australian support through the Indonesia-Australia Forest Carbon partnership. Indonesia is also preparing major expansion of geothermal power production as a zero-emissions alternative to new coal-fired electricity generation. The Indonesian Government provides financial incentives for investment in low-carbon power supply, and the possibility of a carbon tax was mooted in a 2009 Ministry of Finance climate policy strategy paper.

In 2008, Brazil committed through its National Climate Change Policy, to reducing greenhouse-gas emissions by between 36.1 and 38.9 per cent by 2020, relative to business as usual. The Policy pledges that fiscal and tax measures are to be introduced to bring about these emissions reductions. The Brazilian Government aims to reduce electricity consumption by 10 per cent by 2030 via a range of direct-action measures. Much of Brazil's emissions reductions are likely to come through changes to land use. The Brazilian Government aims to reduce deforestation to 80 per cent of the annual average between 1996 and 2005 and to double the area of forest plantation by 2020.

5. Where next for international action?

5.1 What can the UN Framework Convention deliver after Copenhagen and Cancun?

It will take some time for the full implications of the change in the international regime to emerge. There will be international interest in and pressure on each major country's domestic commitments and progress towards their achievement. This interest and pressure will now join domestic political and economic pressures and create political dynamics that could raise the level of effort over time.

As countries begin to implement and to learn the lessons that emerge from the systems of measurement, verification and reporting and international consultation and analysis that have now been agreed, the climate policy response of all countries will become increasingly apparent. If increasing transparency confirms evidence of global progress, it will increase confidence in more ambitious action. It could also expand opportunities to explore alternative arrangements for trade in international permits. Ultimately, progress will depend on perceptions in each country of progress in others over the period ahead.

For the last 18 years the UN Framework Convention has provided a platform for climate change negotiations. Outcomes have been substantial but have fallen well short of stated goals.

The international climate change regime had to change.

The developments secured at Copenhagen in December 2009 and Cancun in December 2010 changed the regime. The new regime, recognising the institutional realities of the United States and the influence and preferences of large developing countries, is workable in the new international power structure.

The question is whether it can deliver the purposes that international agreement must serve, as discussed earlier in this paper. The new geo-political and international economic realities that shaped the Copenhagen conference forced developed and large developing countries to place constraints on growth in emissions. The Cancun Agreements have taken a step further away from the world of partial mitigation by anchoring all countries' pledges under the UN Framework Convention. At the same time, there is a serious question mark over the efficacy of a second Kyoto commitment period.

The first of the three purposes of the international agreement, set out in the opening paragraphs of this paper, are being served rather better than they had been for the first commitment period of the Kyoto Protocol. The individual commitments of countries participating in mitigation within the Copenhagen Accord fall well short of what is required to meet an objective of holding temperature increases to around 2°C. However, with the reasonably strong commitments of China and other large developing countries, the sum of the commitments from Copenhagen is much more satisfactory than the commitments (by developed countries alone) to the end of 2012. Moreover, the United States has accepted a commitment under the new arrangements, when it had refused to do so within the Kyoto Protocol. The arrangements for measuring, reporting and verifying emissions agreed at Cancun are a large step forward. A framework has been established within which one can imagine international peer and domestic political pressure pushing many countries towards much stronger domestic commitments. It is possible that the prisoner's dilemma could be substantially resolved under these arrangements.

The second purpose of an international agreement is not being served by these new arrangements. There is no mechanism by which varied domestic commitments, in countries with widely different costs of abatement, could move towards similar carbon prices. Individual countries may see advantages in setting a domestic carbon price by reference to some international average, to answer demands that domestic trade-exposed industries are being placed at a competitive disadvantage while avoiding excessive claims on the public finances. If a number of the countries adopted this approach, one can imagine the gradual movement towards comparable carbon pricing through much of the international economy. One cannot imagine this happening rapidly, so that mitigation is likely to be associated with further corrosion of the non-discriminatory global trading regime and unnecessarily high costs.

It is not clear how the Copenhagen and Cancun agreements will evolve towards the kinds of binding commitments on mitigation that could provide the basis for deep international trade in emissions entitlements. Groups of states, most likely neighbours in a region, could replicate many of the advantages of deep, multilateral trade within regional trading systems. This would require members to enter binding commitments comparable to the successors over time of their Copenhagen undertakings. Regional trade would reduce costs of mitigation and encourage greater ambition in the countries involved. Perhaps such regional trading systems could gradually move towards linkages with each other and with other countries.

Here we should take care not to make the best the enemy of the good: most of the advantages of international trade for one country, and many of the advantages for the world as a whole, could be realised without all major countries participating. Indeed, if such large countries as China and the United States chose to secure their mitigation targets purely through domestic action, this may not increase costs for the rest of the world or for themselves, to the extent that they would have tended to self-sufficiency even within a global trading system.

It is worth reflecting on the extent to which the Copenhagen Accord and the Cancun Agreements deliver the five elements of effective international agreement that were identified by the Review, and set out earlier in this paper.

Yes, they build on existing arrangements, so that major regime change is secured without destroying some positive contributions of the UN Framework Convention and the policies and institutions which it had sponsored and nurtured.

Yes, the agreement on measuring, reporting and verifying emissions is an important step forward.

Yes, the agreement on an objective of holding temperature increase to 2°C or less meets an essential global requirement as well as being consistent with Australia's national interest.

No, there has not been any progress towards identifying and agreeing on principles for allocating limited emissions entitlements across countries. This is a major weakness, which will reduce the prospects for achievement of the global objective, and raise the costs of whatever mitigation is achieved, for as long as it persists.

And yes, the developed and some other high-income countries went a long way towards meeting requirements of support for mitigation and adaptation in developing and especially low-income developing countries.

The current international agreement seems to have provided the basis for a substantial and favourable change in emissions trends. It has provided the arrangements within which the international community has agreed on a strong global objective. It seems to be capable of taking the international community further over the next few years.

The real world of climate change is never simple. One ironic advantage of non-binding commitments was referred to above. They may lead to higher ambition. Binding commitments lead to greater caution, to avoid the embarrassment and costs of non-compliance. China would have offered a lower commitment if it had been formally binding; the United States may not have offered any commitment at all. To continue to pursue as an urgent a binding outcome now, may actually lead to a perverse outcome where countries lower their ambition. In contrast, with the current non-binding targets, there is a possibility that as confidence builds that mitigation is consistent with continued prosperity and strong economic growth, and new technologies and policy measures become available, more ambitious domestic mitigation goals will be offered.

Nevertheless, the judgement of the Review in 2008 still seems to be sound: it is unlikely that the world will achieve the two degrees or 450 ppm objective unless there is comprehensive and binding international agreement on entitlements to emissions that adds up to the emissions constraints implied by that objective; and unless that agreement has the legal force to support economically and environmentally efficient trade in entitlements.

There will need to be another change of gear in the global mitigation effort once confidence has grown that the current arrangements are delivering substantial results.

The UN Framework Convention has some advantages that are worth preserving for this change of gear. Near universal membership has been the main benefit of the Convention. Universality provides the foundation for legitimacy. But with the broad range of circumstances and interests that compete for supremacy, universality is also the UN Framework Convention's major drawback.

The Copenhagen climate change conference demonstrated that complex international decisions cannot be made through open fora that require unanimous support from all of the world's sovereign nations. In the UN Framework Convention's system, which requires consensus, a small group of countries may stymie effective global mitigation. However, it seems—as was evident in Cancun—that one country will not be permitted to hold up progress where the will of all others, and in particular the major economies, is to move forward.¹⁰

The way that the UN process operates will need to continue to evolve if it is to remain relevant to the international mitigation effort.

¹⁰ In Cancun, Bolivia was the only country not to join the consensus. However, Mexican Foreign Minister Espinoza said Bolivia's views would be noted, but that Bolivia would not be permitted to hold up agreement by 193 other countries.

5.2 International trade in entitlements

Trade has the potential to reduce substantially the cost of mitigation for the world as a whole. All countries would be worse off if there were no system in which to sell and purchase international permits. But some countries would be affected more adversely than others. Australia is among the worst affected countries.

The largest economies, such as the United States or the EU (seen as an integrated entity for climate change policy), are likely to have a range of low-cost domestic abatement opportunities to set against high-emissions activities. Smaller economies are likely to have more skewed production and demand patterns so that proportionately the costs of meeting any internationally-agreed target through domestic action alone are exceptionally high or exceptionally low. Smaller economies that have a comparative advantage in emissions-intensive industries and others that are naturally specialised in relatively low-emissions activities, or have ample opportunities for low-cost abatement, both have much to gain from opportunities to exchange entitlements.

Trade in entitlements can play one other crucial role in the international system: it imposes pressure towards a similar carbon price in many countries which in turn reduces pressure for distortion of competitive arrangements for trade in emissions-intensive goods. This reduces risks of corrosion of trade and budget policies in many countries.

All of the most influential large studies of the costs of mitigation have noted the importance of flexibility in the geographical distribution of emissions reduction so that abatement occurs in the locations in which it can be secured at lowest cost (Stern 2007; Nordhaus 2007; Garnaut 2008; Commonwealth of Australia 2008).

In a world of increasing marginal abatement costs, many developed countries will look for access to credible lower-cost international emissions units to achieve their 2020 targets.

Without secure access to international trade in entitlements, Australia will need to achieve its abatement primarily through domestic measures. This will significantly increase the cost for Australia to meet any emissions reduction target, above levels emerging from the Garnaut-Treasury modelling of 2008 and the subsequent Treasury modelling.

The current trading framework under the Kyoto Protocol establishes common market rules that are determined at the international level. It is likely that the Clean Development Mechanism will continue in some form following the end of the Kyoto first commitment period in 2012. However this is not certain and there is no agreement on the shape, scope or operation of alternative arrangements. In any case, mechanisms like the old Clean Development Mechanism which do not involve hard national targets are problematic, as discussed in the Review. Continued uncertainty around international market mechanisms, including existing mechanisms such as the Clean Development Mechanism, is already affecting this market's operation. In 2010, Japan, the United States and the EU began to consider decentralised governance arrangements for international trade in permits. This meant countries could meet international commitments by recognising trading arrangements that are not necessarily established through multilateral processes.

The freedom to negotiate new market mechanisms outside of the UN Framework Convention to achieve international commitments would represent a significant change in the way the international carbon markets operate. But in the continuing absence of global agreement, there could be advantages in a period of eclectic development of rules to provide environmentally sound bases for international trade, as well as overcome risks to effective mitigation.

5.3 The challenge of transitional assistance to trade-exposed industries

In the period prior to the emergence of comprehensive and binding agreement on allocating entitlements to a limited global emissions budget, the pressure for “assistance” to trade-exposed industries has the potential greatly to distort international trade in emissions-intensive goods, as well as to deplete the public revenues of countries.

Is it possible to overcome the distortions introduced by the absence of a comprehensive and binding international agreement through a possibly long transition period?

Variations in mitigation effort and policies across countries mean that trade exposed and emissions-intensive industries face differences in mitigation-related costs from country to country. Some firms will be substantial beneficiaries of Governments of countries in which they have production facilities imposing lower costs of mitigation than important competitors.

The major attempts to analyse the effects of such trade distortions have concluded that the economic costs of differential implicit or explicit carbon pricing are mostly relatively small. Of much greater importance to economic prosperity in individual countries and the world as a whole is the opportunity that differential effort or policies provide for producers to seek political preferment through subsidies or protection against imports or “free” allocation of permits. The Waxman-Markey proposed legislation in the United States, and the proposed post-2012 arrangements for the European Union Emissions Trading Scheme, for example, both made provision for restrictions on imports from countries that were judged to be making inadequate efforts in mitigation.

It is sometimes argued that the threat of discriminatory trade treatment against countries that are thought to be making inadequate contributions to global mitigation can be a spur to increased effort. The history of trade policy is not promising in this respect: it is likely that protectionist interests would capture the policy processes, and that the resulting trade distortion would increase unnecessarily the costs of mitigation.

The long-term solution is comprehensive agreement on allocation of entitlements to emit greenhouse gases, accompanied by international trade in entitlements. This would move the world towards similar carbon pricing in all countries, and remove any case for assistance to trade-exposed industries.

As we may be living for a considerable while in a messy world of non-binding targets and weak opportunities for international trade in entitlements, it is important to develop clear principles for allocation of assistance to enterprises that are genuinely and materially affected by differential implicit or explicit carbon pricing. This can be done country by country, or through international agreement. Update Paper six (*Carbon pricing and reducing Australia's emissions*) will discuss principles for assistance to trade-exposed industries.

5.4 The potential role of regional trading arrangements

If binding global agreement remains out of reach for some time and the rules for emissions trading remain uncertain under the UN Framework Convention, is it possible that bilateral and regional arrangements could fill a substantial part of the gap left by the absence of a basis for global trade in entitlements?

The short answer is yes—much more clearly and emphatically than regional preferential trade agreements can fill the gap left by the absence of multilateral free trade. If carefully structured, they can become building blocks for a genuinely open global trading system.

Careful structure requires application of internationally acceptable rules for measuring, verifying and reporting emissions. It requires internationally the acceptance of targets for emissions within the member countries of the bilateral or regional arrangements that are built on principles that could be the basis of a comprehensive global agreement. It requires openness to economically and environmentally sound trade by member countries with external countries.

In the possibly long transitional period before there is comprehensive binding international agreement, the most attractive and practical option for realising large gains from trade may be to establish arrangements between countries that already have established economic and political relationships, and that comprise both prospective buyers and sellers of entitlements.

Regional partnerships are likely to be particularly suitable, as they could build on established economic linkages, better understanding of each others' circumstances and often shared objectives in the international arena. Regional arrangements could involve a large entity at the core that engages a number of smaller partners or groupings of mid-sized countries. Of course, the shape of future trading

arrangements will be affected by how mitigation commitments are ‘framed’, by accounting rules, and by the overall measurement, reporting and verification framework. The way this evolves will in turn have implications for the governance of regional arrangements, and vice-versa. It will often be necessary for developed countries or a regional international body to take responsibility for establishing measurement, reporting and verification mechanisms.

International trade in emissions require firm and internationally credible targets and reliable emissions accounting in selling countries. In a regional scheme without global agreement, judgments on these matters will need to be made principally by the regional partners, although the views of third parties will determine international credibility.

Ideally, countries’ targets within a regional scheme would be in line with a clear guiding principle, such as the Review’s modified contraction and convergence approach. One way to apply this in the absence of a global agreement would be for countries within the scheme to set targets that are in line with the global model, with the global ambition being calibrated by the average observed in countries outside the scheme. Targets for all countries within a regional scheme could be revised in response to changes in targets by countries outside.

In practice, the Copenhagen targets, as modified over time, could provide a starting point for calibration of targets in regional trading schemes. Countries could take their pledged targets—or where applicable a chosen point within their target range—to their proposed partner countries. Regional agreement would be required on targets.

Box 2: Potential regional REDD+ trading mechanisms

In establishing a regional trading mechanism, Indonesia would be a potential trading partner for Australia. Indonesia has demonstrated high level political commitment to addressing climate change, including through its pledge to reduce emissions by 26 to 41 per cent relative to business-as-usual, and also has significant mitigation potential, particularly from REDD+ (reducing emissions from deforestation and degradation in developing countries). Indonesia’s emissions are estimated at approximately 2Gt of carbon dioxide equivalent per year, around three and a half times Australia’s total emissions. Deforestation accounts for approximately 71 per cent of Indonesia’s emissions (World Resources Institute 2011).

Indonesia is already taking steps with support from partners including Australia and Norway to establish institutional, legal and technical frameworks that will be required for REDD+. Nonetheless, to establish a fully functional and credible trading mechanism considerable capacity building would still be required in Indonesia.

Indonesia, with support from Australia, is developing the Indonesia National Carbon Accounting System for measuring and accounting for emissions from forests. Once complete, Indonesia will be able to report and verify emissions from the forest sector. To participate in a regional mechanism, standards for measurement, reporting and verification would need to be negotiated by all participating countries and the Indonesian National Carbon Accounting System would need to be compliant with these standards.

Indonesia would also require a registry system to enable participation in a trading mechanism. The registry would need to be capable of tracking emissions reductions from the forest sector in Indonesia and tracking trade in carbon units. To be part of a regional mechanism, the registry would need to be compatible with registries in partner countries, like Australia’s Kyoto Protocol registry, so that it could trace carbon trades and ensure there was no double counting.

In negotiating the parameters of a regional trading mechanism, partner countries would also need to determine the stringency of baselines and targets in each country that underpin the trading mechanism. This would require considerable work in Indonesia. Data underpinning the baseline would need to be credible with a high level of accuracy. Once fully operational, the Indonesian National Carbon Accounting System could generate much of the information required to establish a REDD+ baseline.

The credibility of claimed reductions in a linked system is only as strong as that of its weakest component. In regional partnerships between developed and developing countries, it would therefore be necessary to develop measurement, reporting and verification systems of high integrity to avoid double counting.

In a world of decentralised climate policy, regional schemes would also allow additional flexibility in defining the scope of emissions. For example, Australia and Indonesia both have substantial opportunities for biosequestration or reducing land-based emissions. A broad coverage of land-based emissions sources and sequestration could be agreed, applying the particular expertise available in the countries of the region.

Trading arrangements between small groups of countries could be integrated into broader cooperation on climate change mitigation. The opportunities would be large when regional groups included both developed and developing countries. Such arrangements could in the first instance be government-to-government, consisting of negotiated programs for investment and technical assistance over several years. There could be risk-sharing arrangements and mutual involvement in program design, implementation and monitoring.

Australia would naturally look to establish partnerships and trading arrangements with a small number of countries in our region, with developing countries as prospective sellers and some other developed countries as prospective buyers of emissions reductions.

6. Conclusion

We have an international agreement on climate change after Cancun and Copenhagen that is capable of supporting an historic change in trends on global emissions over the next few years.

Whether this agreement is capable of evolving over time into an instrument for achieving the transformation that is required to hold global warming to near two degrees will be revealed through the behaviour of many countries over the next few years. The behaviour of Australia—the developed country with the highest per capita emissions, with the largest interest in early strong mitigation, and the best prospects for success in a future low-carbon global economy, will have considerable influence.

Australia will be influential because the developed countries with high per capita emissions will be expected by the rest of the world fully to contribute to the global effort. If they do not, this will materially weaken the commitments of others, especially in the developing world. We, and other developed countries, can through inaction exercise a veto over effective global mitigation.

Australia will be influential because of the interests and structures and challenges that it shares with the developed countries of North America.

Australia can also be influential diplomatically and by the example of soundly based policy in leading the world towards economically and environmentally more efficient approaches to reducing emissions.

The surprising agreement that emerged from Copenhagen and Cancun is well suited to the geo-political realities in the immediate aftermath of the Great Crash of 2008. It is in Australia's national interest for that agreement to evolve in ways that make it suitable as well for achievement of the deep cuts in emissions that are necessary to avoid high risks of dangerous climate change.

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Appendix 1: Important developments beyond the United Nations Framework Convention on Climate Change

Climate change negotiations have almost exclusively taken place under the United Nations Framework Convention on Climate Change or complementary forums such as the Major Economies Forum on Energy and Climate. The Major Economies Forum covers the world's 17 largest economies and an increasing number of observer countries including representatives of the small island developing states and least developed countries. Climate change discussions have also been important in the G20 and APEC Leaders' Summits.

Progress is being made in avenues which do not have climate change mitigation as their object, but which have connections to climate change, and could be influential to build support for effective global mitigation action.

Energy security

Energy Security is of crucial interest to the world's largest economies, including the United States and China. As trade in international energy resources and technologies increases, countries have become increasingly reliant on the efforts and actions of other countries to maintain and advance their national security interests. Efforts to safeguard national energy security interests have provided strong incentives to implement domestic policy measures that promote energy efficiency, sustainable environmental outcomes and improved economic competitiveness. Governments have also recognised the growing level of global interdependence in the energy sector and that the global energy challenges we face cannot be adequately addressed to any significant degree at either a unilateral or bilateral level. Multilateral international cooperation will be necessary to progress the development of cleaner energy technologies to reduce CO₂ emissions, while also recognising the need to promote sustainable economic development, particularly in developing countries.

While the Great Crash tempered the appetite of some countries to directly address global climate change efforts, it was coupled with a growing interest in securing future economic and commercial advantages associated with the deployment of low-emission technologies of the future. That the American Clean Energy and Security Act of 2009 (Waxman-Markey bill), and the American Power Act (Kerry-Lieberman bill) were so titled, is evidence of the fact that in the United States at least, public interest is focussed on energy security and independence that provides cleaner environmental outcomes from energy use and supply.

A further example was China's US\$586 billion economic stimulus injection that followed the Great Crash. A substantial portion of this was directed at technology research, development and gradual deployment over the next decade. While the support of the new technologies has multiple objectives, there will be important reductions in emissions below where they would otherwise have been, as well as contributions to securing China's future energy needs, and to commercial interests in low-emission technologies.

Elimination of fossil fuel subsidies

At the September 2009 Group of Twenty (G20) meeting in Pittsburgh, Pennsylvania, Member countries committed to "rationalize and phase out over the medium term inefficient fossil fuel subsidies that encourage wasteful consumption." G20 leaders re-affirmed their commitment at the 2010 Leaders' Summit in Seoul. Mexico, India, Russia and China, among others, have made some progress toward the goal of phasing out fossil fuel subsidies in the medium term. President Obama also said that he would work with Congress to phase out over US\$3 billion per annum in preferential tax incentives for the coal, oil, and gas industries, consistent with the FY2010 and FY2011 budget proposals (The White House 2010).

Reducing and removing inefficient fossil fuel subsidies is a considerable mitigation step. OECD analysis of IEA data shows that phasing out subsidies to fossil fuel consumption in emerging and developing countries could reduce global greenhouse gas emissions by 10 per cent in 2050 compared with business as usual levels (OECD 2010).

Appendix 2: The special problem of international transport emissions

International aviation and shipping transport fuels (bunkers) currently account for around 4 per cent of global CO₂ emissions and are growing rapidly. With major reductions likely to occur in other sectors constrained through measures such as market based mechanisms, unconstrained growth in emissions from this unique sector could represent a disproportionate share of the 450 ppm emissions budget by 2050.

Domestic transport emissions are currently included in developed country inventories and targets under the Kyoto Protocol. However, international bunker fuel emissions are not—reflecting the difficulty of assigning responsibility for international emissions to individual countries. Rather than regulating these emissions under the United Nations Framework Convention, the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO) are mandated to pursue options to limit or reduce international transport emissions.¹¹

The Review concluded that the difficulties of attributing these emissions to individual countries (as opposed to operators) meant the most logical solution would be to treat them as emissions-intensive, trade exposed (EITE) sectors. Emissions would be included against national limits or subject to a comparable carbon tax by the fuel supplying country. The fuel supplying country would retain the revenue, and so would have a strong incentive to enforce the rules.

Since 2008, minimal progress has been made to conclude global sectoral agreements for EITEs. However a sectoral approach that treated the two sectors themselves as countries for emissions accounting purposes could result in responsible parties appropriately addressing these emissions at an international level (United Nations 2010).

The division of labour between the United Nations Framework Convention, ICAO and IMO has some awkward consequences as the three organisations have specific objectives and are founded on contrary principles.

While each organisation is country-led, the ICAO and IMO have a special industry focus and do not consider emissions in an economy-wide or global context. Unless directed authoritatively to impose specific caps – and the UNFCCC mandate to work on GHG emissions has given the ICAO and IMO some purpose and momentum in addressing GHG emissions in the context of the global commons – the ICAO and IMO will retain a specific industry focus. Importantly, these bodies operate according to a principle of non-discrimination, meaning measures apply to all countries and operators equally.

In contrast, the United Nations Framework Convention considers emissions in a global and economy wide context, and is in large part guided by the principle of common but differentiated responsibilities and respective capabilities.

Thus while countries have granted a mandate to the IMO and ICAO to develop emissions control strategies, developing countries have strongly objected to any such measures applying universally and without discrimination, irrespective of the principles on which the bodies are founded. The perceived advantage of implementing one or other of the two competing principles has led to an unfortunate incidence of ‘forum shopping’.

As a result, countries under the United Nations Framework Convention have debated how best to balance these principles¹² and which principles should apply. At the same time, proposals to reduce emissions from international transport sectors have been considered by the ICAO and the IMO¹³, but no current proposals for a levy or any other type of market based measures are in play in either organisation. The ICAO has agreed to develop a framework for market based measures before the next

¹¹ See Article 2.2 of the Kyoto Protocol.

¹² See for example FCCC/CP/2010/2

¹³ For international aviation see for example ICAO Doc9885, GIACC/3. GIACC/4-WP/3 GIACC/4-IP/8, CAEP/8-WP/80; MEPC 60/4/22, MEPC 60/4/26, MEPC 60/4/41, For international maritime see for example MEPC 60/4/43, MEPC 60/4/54, MEPC60-Inf.7

Assembly (mid 2013). Similarly, the two main pillars of the IMO's approach are technical improvement and market based measures. And while substantial progress has been made on the former (Energy Efficiency Design Index), very little has been achieved on the latter.

Introducing a market based mechanism in these sectors would provide a price incentive to improve efficiency or reduce emissions.

Proposals for market based measures fall into two broad approaches: a levy (or a tax) on international bunker fuel sales; or an emissions trading scheme. Universal application of either measure would be necessary to avoid economic and environmental distortions. Universal application would also be consistent with the ICAO and IMO principles of non-discrimination and flag neutrality.

The results of exempting some countries and operators would result in environmental leakage, and competitiveness distortions. In a practical sense, this would mean that some airlines could be penalised compared with international airlines based in 'developing' countries. For international shipping, the issue could be even more acute as ship owners could change the vessel's flag of registration relatively easily if an additional cost was applied on vessels registered in some, but not all countries. Vessels currently operating under flag states with emissions reduction obligations would quickly move to exempted states again resulting in carbon leakage and lost revenue.

On the other hand, if measures were universally applied, carriers would all bear increased costs equally. Competitive distortions between countries, carriers and the two sectors themselves would be minimised thus diminishing the likelihood of carbon leakage.

An issue related to the mechanisms applied to reduce emissions in these sectors is the potential for market based measures to raise significant amounts of revenue¹⁴ (United Nations 2010). This could serve two purposes. First, to address the United Nations Framework Convention differentiation principle in the spirit in which it was intended (that is, to consider our common responsibilities and respective capabilities). The mechanism to reduce emissions could be applied as a common responsibility. Differentiation, however, could be achieved by implementing well designed compensation, especially for the most vulnerable developing countries. Second, a proportion of the revenue could be used as a source of climate change financing, with the remainder returned to industry to support the development and deployment of low-emissions technologies.

¹⁴ The UN Secretary General's High Level Advisory Group on Climate Change Financing estimated that market based measures applied to international aviation and shipping could generate annual revenue from US\$3-25 billion.

Appendix 3: The importance of free trade in goods and services

The Indonesian Minister for Trade, Mari Pangestu, took the opportunity of the gathering of economic leaders in Bali in December 2007 to call a meeting of Trade Ministers, to examine trade policy issues that may arise in the context of international climate change discussions. This meeting recognised the value of free and open trade in goods and services that are inputs into mitigation efforts, and also for adaptation to climate change.

There are several ways in which Australia's interests in global free trade intersect with the global climate change agenda.

As is clear from the above discussion of mitigation in major countries, anxieties about supplies of mineral resources are emerging as a an inhibiting factor in the replacement of coal by nuclear power in China, and in the electrification of vehicles in the United States. Australia has more potential for expansion of uranium exports than any other country, and probably more potential for expansion of exports of rare earths than any country except China. There are good reasons for Australia's rules constraining the countries to which it is prepared to sell uranium, related to nuclear weapons proliferation and safety of disposal of waste. Within these rules, the adoption of liberal approaches to expansion of investment to expand mining and processing capacity, and to exports, would ease the growth of low-emissions energy in much of the world. Similarly, and with less reason for inhibition on security and safety grounds, Australia could materially affect international confidence in electrification of transport by facilitating the expansion of investment and exports in rare earths.

The world as a whole has a considerable interest in free trade in biofuels. This reality runs against a recent but deeply ingrained tendency for national bio-fuels markets to be captured by domestic producer interests, who secure privileged access to the markets at the expense of environmentally and economically more efficient imports. In a world of free trade in bio-fuels, it is likely that production and exports would expand in a few developing countries with considerable capacity to expand production of agricultural inputs of biofuels at a much lower costs and with much smaller emissions of greenhouse gases than the grains and oilseeds that are used for these purposes in developed countries. Free trade in biofuels would contribute to higher incomes in several developing countries, first of all Brazil, and remove the strong upward pressure on global grain and oilseed prices associated with mandatory requirements to use local biofuels in transport in the European Union and the United States. Imports of bio-fuels would provide much larger net environmental advantages, at much lower costs. Restrictions on imports of biofuels in Australia also have negative environmental and economic effects.

The "clean energy" industries are relatively young, and so have generally not had time to build elaborate systems of cost-increasing protection against lower cost means of meeting environmental objectives. However, the political economy pressures for protection are never still nor silent. It is important always to keep in mind that a given commitment of economic resources to mitigation will achieve a better environmental result if producers of low-emissions goods and services are free to purchase energy, capital goods and materials in the places where costs are lowest. Alternatively, a given environmental objective can be achieved at lowest economic cost if producers of low-emissions goods and services are free to purchase energy, capital goods and materials in the places where costs are lowest.

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