

INNOVATION AND CLIMATE CHANGE MITIGATION AFTER A DELAYED START

Ross Garnaut

Vice-Chancellor's Fellow and Professorial Fellow in Economics,
The University of Melbourne

Carbon Capture and Storage under the Spotlight

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This presentation seeks to review the recommendations of the Garnaut Climate Change Review on Australian climate change mitigation policy in general and policy on geo-sequestration of fossil fuel combustion wastes in particular in the light of economic and political changes since 2008. I accepted the invitation to deliver the talk a long time ago, before there was any suggestion even of the possibility of an August election. The febrile election environment is unsuitable for sober analysis of serious policy issues. I take as my audience the sober seekers after good policy. My remarks will not be relevant for the contemporary electoral frenzy.

Global Changes Since 2008

The world has changed a great deal since I presented the Garnaut Climate Change Review to former Prime Minister Kevin Rudd and the State Premiers on 29 September 2008. That was the morning after the Australian night during which northern hemisphere financial markets reached the nadir of panic, as the United States Congress rejected the President's proposals to shore up the financial system against the accumulation of failure on Wall Street. The Great Crash of 2008 has left a legacy of high unemployment, financial fragility and weak prospects for economic growth through the developed countries of the Northern Hemisphere. But the early twenty first century momentum of sustained rapid growth through much of the developing world has continued undiminished.

The enduring legacy of the global financial crisis on global development is an acceleration of established trends: a speeding up of the shift in the centre of gravity of world economic activity and strategic weight away from the old industrial countries and towards the developing countries, first of all China, and then India, Indonesia and Brazil.

This has two consequences for effective global efforts to reduce the costs of human-induced climate change.

One consequence is that the strong concentration of the growth of global emissions in the large developing countries, which was the focus of analysis in The Garnaut Climate Change Review, has been reinforced and extended. As a result, effective global mitigation depends crucially on full participation by large developing countries. As discussed in the Review, this requires the international community to break the mould of the United Nations Framework Convention on Climate Change meetings in Rio de Janeiro and Kyoto. Agreements shaped in these earlier meetings were premised on developed countries taking early actions on mitigation, and developing countries following when the developed countries had demonstrated substantial progress.

The second consequence is that global governance now relies heavily on participation of and leadership from the large developing countries. The developed and developing countries alike must make major adjustments for international cooperation to be effective in this new world. Neither group of countries is ready for the necessary new patterns of leadership. Diplomatic incoherence at Copenhagen was one amongst many consequences.

The Copenhagen meeting changed the context of global climate change mitigation in complex ways. As an international diplomatic event it was a fiasco. A large number of the world's heads of government including the heads of major countries appeared late in the proceedings, to draft documentation that had no prospect of being converted into an agreed text. In the aftermath of Copenhagen, there is little hope of an early, comprehensive and binding agreement even for developed countries on targets that add up to a reasonable developed country contribution to an effective and ambitious global mitigation effort.

But the practical achievements of the lead-up to and aftermath of Copenhagen were considerable, exceeding reasonable hopes on developing countries' commitments to reduce emissions below business as usual. The Copenhagen Accord, merely noted by governments at the time, has now been formally accepted by governments representing a large majority of countries and all substantial economies. It embodies the first global commitment to a specific climate objective: the holding of the probable increase in temperature to less than two degrees Celsius. It covers commitments from developed countries to fund large transfers to developing countries for climate change adaptation and to support reduction in forestry-related emissions. It requires each developed country to commit itself to specific emissions reduction targets, and all have done so. It requires each developing country to make voluntary commitments to substantial reductions in emissions below business as usual, and nearly all substantial developing countries have done so.

The commitments from the developed countries are together much weaker than would be required to achieve the agreed constraints on increases in global temperatures. Media commentary at the time made much of China's resistance to a commitment by developed countries to reduce their emissions by 60 percent from 1990 or 2000 levels by 2020. Whether the Chinese motives were good or ill, they helped the international community to dodge a bullet: any effective international agreement to hold the probable increase in temperatures to 2 degrees will require developed country commitments to reduce emissions by something like 90 percent.

Australia's unconditional target, of reducing emissions by 5 percent from 2000 levels by 2020, falls short of all other developed countries except the United States as comparisons are conventionally made, as percentage reductions against emissions levels in some base year. The Australian target is closer to the middle of the pack if measured against baselines drawn from the modified contraction and convergence framework explained by the Garnaut Climate Change Review. The 5 percent reduction was recommended by the Garnaut Climate Change Review as being appropriate in the absence of an effective international agreement. Several of the developed country targets, including Australia's, have conditional components, so that they become more ambitious if others commit to doing more. However, even the triggering of the strongest conditional targets would leave the developed countries well short of a reasonable and internationally acceptable contribution to the agreed temperature control objective. The maximum 25 percent reduction embodied in

Australia's conditional targets was recommended by the Garnaut Climate Change Review as being Australia's proportionate contribution to an ambitious global mitigation agreement, aimed at holding emissions concentrations to 450ppm, or probable temperature increase to 2 degrees. The calculation of a proportionate contribution depends on use of modified contraction and convergence as the basis for the international allocation of emissions entitlements. On the other hand, the developing countries, led by China, together have made commitments which, if implemented, would do all that would be required to achieve the agreed global temperature control objective within the modified contraction and convergence framework. The commitments by China, Indonesia and Brazil—the world's first, fourth and fifth most populous countries—go further than required, and balance the lesser ambition of India's commitment.

The reality is that there is an international agreement, the Copenhagen Accord, although we do not yet know how effective it will be. If Australia were to set its emissions reductions target in line with the average of other countries' commitments within the Copenhagen Accord, compared with what would be required within the modified contraction and convergence framework as defined by the Garnaut Climate Change Review, it would need to reduce emissions by 15-20 percent. Standing back from the diplomatic chaos of 2010, Copenhagen looks like an historic change in approach to mitigation by the newly influential developing countries together with the United States, rather than a retreat from mitigation. The accord that was shaped by the leaders of the world's most populous countries establishes a new paradigm, built upon voluntary commitments to hold emissions well below business as usual, in place of the highly structured and binding commitments to reduce emissions by specified percentages from a baseline that was the basis of the Kyoto agreement. For the world as a whole, it ratchets up domestic national commitments to strong mitigation, but not in a form that provides a basis for international trade in entitlements, and therefore for minimising the global costs of mitigation.

In the meantime, the mainstream science tells us that, Climategates notwithstanding, any change in the outlook for global warming has been for the worse. The recent scientific analysis causes us to take more seriously the bad end of the range of possibilities. At the same time, the continued strong growth in the large developing countries has confirmed the Garnaut Climate Change Review's sobering message about business-as-usual global emissions growth.

While the science and the economics tell us that the need for early and strong mitigation is greater than the weight of international opinion suggested a few years ago, the earliest possible start and the largest possible early effort are respectively later and smaller than they were. As a result, the achievement of agreed global objectives on mitigation will be harder, involve sharper reductions in emissions, and be more expensive in terms of foregone economic growth than had been indicated by the work of the Review a few years ago.

Australian Changes Since 2008

Changes in climate change policy since September 2008 are more profound in Australia than in the rest of the world. Two years ago, Australia was one of the large majority of developed countries committed to full participation in a strong global mitigation effort. Both sides of mainstream Australian politics were committed to the introduction of an Emissions Trading Scheme that would support this Australian commitment.

Since Copenhagen, we have reverted to being a drag on the international mitigation effort, as we were from the time of the decision not to ratify Kyoto in 2001 until Bali in 2007.

There has been and is bipartisan support for the target to increase the share of renewable energy in Australian electricity generation to over 20 percent—a measure that would have been redundant with an effective and strong Emissions Trading System, but which for the time being is the main instrument of mitigation. The Government has promised not to introduce policies that would make major contributions to reducing emissions until 2013—too late to reach even the unconditional Australian targets except at costs that are much higher than had been suggested by analysis for the Garnaut Climate Change Review as being associated with early introduction of sound policy.

The Opposition has made larger commitments to regulatory interventions to reduce emissions than the Government, but claims to have ruled out more or less forever the economy-wide market-based approaches that would allow Australia's full participation in an ambitious global effort at the lowest possible cost.

Perhaps the most positive development in Australian climate change policy over the past two years has been Australian leadership of the global effort on research, development and commercialisation of geo-sequestration technologies. The most important dimension of Australian leadership has been support for projects which are discussed in presentations later this evening.

The reversion to the pre-2007 position of applying a brake on the global effort on climate change is curious in the developed country that is the most vulnerable of all to damage from unmitigated climate change. Curious, and prominent and influential in the global discussion.

The new old Australian position is unlikely to be sustainable. We are not a superpower, and will suffer high costs if we seek to impose our own norms on the international community. If the mainstream science is right on climate change, and it probably is, then the awful probable consequences for Australian interests of a failure of international mitigation will eventually weigh heavily in domestic policy discussion. Sooner or later, the Australian polity is likely to respond strongly to the high costs of standing against international opinion, and to increasing realisation that a failure of mitigation is hugely damaging to Australian interests. By then, any Australian efforts will be much less effective and much more costly than timely action would have been.

The Basics of Good International and Domestic Policy

It is a diabolical feature of climate change policy that there can be no effective mitigation without the participation of all substantial economies. This makes climate change harder than most if not all other important areas of policy with substantial international dimensions—for example, the reduction of trade barriers.

Some reductions in emissions below business as usual could be achieved by each country taking its own decisions—doing as much as its Government judged to be a fair thing, with each country being cognisant of the actions of others. It may be that this approach, that I described in 2008 as “the messy approach” to mitigation (Garnaut 2008a), is the best that the world can manage for some time. It is the approach embodied in the Copenhagen Accord. With communities in each country taking a close interest in the national mitigation effort and monitoring the comparability of each country’s effort with others’, it now looks as if it may lead to substantial progress, first of all in China.

Regrettably, the messy approach is unlikely to allow us to achieve emissions reductions that are deep enough in the world as a whole to meet the Copenhagen Accord’s goal, of holding the probable human-induced increase in temperature to 2 degrees. One reason is that separate unilateral decisions are unlikely to provide a firm basis for efficient trade, and therefore for low-cost global mitigation. A second reason is that each country can identify good reasons why it should do less than others, so that confining the political framework for each country’s emissions reduction targets within that country would underwrite the influence of national arguments for caution. This is obviously important in the developed world’s three largest per capita emitters, Australia, Canada and the United States.

So a global agreement on mitigation, involving all of the world’s larger emitters—something like the G20 members—is going to be necessary for deep reductions in emissions. An international agreement on limiting emissions could, in principle, take one of two general forms. A global budget on emissions that was consistent with climate objectives could be allocated by agreement amongst countries. Alternatively, there could be agreement for all countries to apply a uniform carbon price at a level that would reduce emissions to levels that met the climate objective.

The allocation of emissions entitlements amongst countries has been the focus of international discussions so far. It remains the more likely path to international agreement on strong mitigation.

A global agreement on limiting emissions must be based on principles for allocating emissions entitlements that are judged to be reasonable by governments of all major countries. The Review took the position that the only likely basis of agreement is convergence over time towards equal per capita entitlements to emit greenhouse gases. The absence of an explicit framework of principle for allocating emissions amongst countries has been a fundamental weakness in the formal international discussions.

The achievement of large reductions of global emissions at the lowest possible cost requires high levels of public investment in research, development and commercialisation of new technologies. There has been some increase in the global innovation effort on low-emissions technologies in recent years, including in “stimulus packages” in the aftermath of the financial crisis. However, it is unlikely that an adequate level of investment in innovation will be achieved without international agreement on minimum contributions from each high-income country.

Australian Domestic Mitigation Policy

How can Australia minimise the costs of meeting its proportionate contribution to global mitigation?

The Garnaut Climate Change Review identified two main instruments of policy: a price on emissions; and public financial support for research, development and commercialisation of new technologies. In addition, a case could be made for some additional interventions to correct market failure related to provision of information to consumers of emissions-intensive goods and services, network infrastructure, and distorted incentives within relationship between principles and agents.

The carbon price can be implemented through an Emissions Trading System or a carbon tax. Each has advantages and disadvantages. The Review, on balance, favoured an ETS. However, in the absence of a global agreement supporting comprehensive international trade in entitlements, an ETS with a fixed price—in effect, a form of carbon tax—was seen as being the best option. I would now add that a fixed price is superior to a floating price within an ETS for as long as the policy is the subject to strong disputation and liable to large fluctuations in political expectations that affect the value of permits.

What level of carbon price would be necessary for Australia to meet the target that represents our proportionate contribution to meeting the Copenhagen temperature objective? The Review’s modelling suggested about 40 Australian dollars per tonne of carbon dioxide equivalent in 2005 prices in 2013, rising at about 4 percentage points per annum in real terms. That points to a carbon price of about 60 dollars in 2005 prices in 2020, and about 200 (standard technology) or 150 dollars (enhanced technology) in 2050. The Review estimated the total costs of Australia playing its proportionate part in a strong global agreement up to 2050 at 3-4 percent of GNP in present value terms. The Review calculated that these costs of strong mitigation were smaller than the benefits of reducing the risk of dangerous climate change, when appropriate discount rates were applied to both costs and benefits (Garnaut, 2008b, Chapters 11 and 12).

The Review’s calculations of the carbon price and the costs of mitigation assumed an immediate and strong start, and a comprehensive international agreement within which trade in emissions entitlements would cause mitigation to go furthest where it could be achieved at lowest cost. None of these conditions has been met. Calculations in 2010 would indicate a higher carbon

price and a larger cost of mitigation in the next four decades, as a result of the late and weak start. The Review noted the possibility that improvement in low emissions technologies may proceed more rapidly than assumed in the modelling of the costs of mitigation, once an appropriate incentives structure has been established.

Interim Arrangements

We are a long way from the world of strong mitigation with Australia playing its proportionate part, and even further from the Australian policies that would achieve any specified degree of mitigation at the lowest possible cost. Is it worth doing anything much before we have optimal policies in place? What should and can we do in the interim?

There is a tendency during this drought in official focus on good policy to think that anything that reduces emissions at all must be better than nothing. We should place two limits on expressions of this tendency. First, mitigation measures that involve high costs for little emissions reductions are likely to discredit mitigation policies more generally, and therefore to be counterproductive in the broader debate about policy. Pink batts come to mind. Second, the appearance of action, through high-profile political gestures for little mitigation effect, can dissipate scarce political capital, and make it more difficult to move forward with effective policies to reduce emissions by large amounts.

Four sorts of things are worth doing during this policy drought.

First, it is worth continuing the discussion of the risks of unmitigated and weakly mitigated climate change to our economy, society and civilisation, and of the costs of soundly based mitigation. It is my hope, if not a reasonable expectation, that when this doleful electoral season has passed into history, a new and secure Australian government will take the lead in creating a forum for transparent discussion of the range of issues that is important to policy on climate change and its mitigation. This may not lead to consensus, but it may strengthen the base of public support for rational policy action in the national interest.

Second, it is worth taking action to reduce the costs of market failure related to information and incentives, notably on measures related to energy efficiency. Some of these actions are warranted in the absence of a carbon price, and will be rendered more valuable by carbon pricing.

Third, it is worth providing support for research, development and commercialisation of new, low-emissions technologies. It is important that this be effectively targeted on projects that have good chances of future commercial success when there is an adequate carbon price, in areas in which Australia has a national interest, and in specialisations in which Australia has comparative advantage in research. The targeting at the commercialisation and to some extent at the development stage is achieved most efficiently if public funds match private investment subject to objectively assessed conditions: that

it involves technological innovation in the Australian context; and that the innovation would lead to reduction in emissions.

Fourth, it is worth introducing a small number of regulatory measures to avoid investments that would be rendered redundant by the introduction of a satisfactory carbon price.

Application of Interim Arrangements to CCS

The third and fourth of the interim things worth doing are applicable to CCS.

On the third, CCS meets each of the tests for support of innovation in new technologies.

The carbon prices that are likely to prevail in Australia upon adoption of effective mitigation policies will, on current knowledge, become high enough to encourage commercial applications of CCS in favourable locations. Remember that the late start means that they carbon prices will be higher than suggested for a 2010 start in the Garnaut Review. Modelling for the Review suggested that over 40 percent of Australian electrical energy would come from gas or coal with CCS by mid-century on the assumption of incomplete (90 percent) capture of carbon dioxide, and over two thirds if the technology allows complete capture. Note that these shares relate to electricity demand that is greatly enhanced by the use of electricity in place of petroleum as a fuel for motor vehicles. Note also that outcomes will be more favourable to CCS the more technological change lowers the costs of CCS, and less favourable to CCS the more that technological change lowers costs for other low emissions technologies

This outcome from the Review's modelling comes from a case in which nuclear is excluded from the Australian energy mix. When nuclear is chosen whenever it is the lowest cost source, the modelling suggests that nuclear comes to supply a bit over one quarter of Australian electricity requirements by 2050. This reduces electricity from CCS and renewable energy more or less proportionately.

The costs of CCS include the energy that is used in the capture, transport and storage processes. These costs are large. Energy sources that have low costs net of the emissions price will be favoured by CCS. Latrobe Brown Coal in Victoria is a prime example, especially if brown coal drying techniques substantially reduce the volume of emissions to be captured, transported and stored. There are substantial costs for transport of carbon dioxide from the point of combustion to storage, so that generators adjacent to good geo-sequestration sites will be favoured. Again, Latrobe Valley brown coal has advantages.

Investment in research, development and commercialisation of CCS technologies meets the national interest test in two ways. The test is met because of the large proportion of Australian power generation that comes from coal combustion at present, and which would come from coal combustion in

future with an economically efficient carbon price and successful CCS. It is also met because coal is Australia's largest export industry, and the future of coal exports in an emissions-constrained world depends on other countries adopting carbon capture and storage. Other countries are more likely to continue to expand coal combustion and to capture and store the emissions if commercial applications of CCS technology are mature. In the absence of commercially attractive CCS, other countries' replacement of imported coal by low-emissions domestic energy will be politically if not economically compelling.

The comparative advantage test would seem to be met by the leading position that Australia now takes in CCS research, and by the underdeveloped nature of CCS relative to other low-emissions research in other developed countries.

Given the delayed start on effective mitigation, long-term costs can be constrained to some extent by some forms of interim regulation of industry to reduce emissions. The priority is to prevent expansion of high-emissions electricity generation capacity that would not be economically viable with an adequate carbon price. It is unlikely that there would be any investment in expansion of coal-based electricity generation in the absence of CCS with an economically efficient carbon price. The costs of eventual adjustment to a carbon price could be reduced below what they otherwise would be if State and Territory Governments now banned any expansion of electricity generation capacity with emissions intensity greater than combined cycle gas; and if the Commonwealth Government made it clear that there would be no "compensation" for new investment in coal-based capacity when carbon pricing is introduced.

Such regulation would be more costly than early introduction of general carbon pricing; but less costly than allowing investment that was made redundant early in its life by carbon pricing.

Alternatively, a State or Territory government could seek to define less prescriptive interim measures. One or more States or Territories could consider State-based carbon pricing, with proceeds being allocated exclusively to pro-rata capital subsidies on investments in the energy sector. This approach may lead to substantially smaller increases in electricity prices and to lower economic costs than a simple interim ban on investment in new coal-based capacity that is not connected to CCS.

One way or another, the interim regulation or interim State-based carbon pricing with capital subsidies would introduce an interim "shadow price" on emissions. This would increase incentives for investment in low-emissions including CCS power generation technology prior to the introduction of the necessary national carbon price.

REFERENCES

Garnaut, R., 2008a, "Will Climate Change Bring an End to the Platinum Age?", *Asian-Pacific Economic Literature*, May 2008, Volume 22, Number 1, pp. 1-14.

Garnaut, R., 2008b, *The Garnaut Climate Change Review*, Cambridge University Press, Melbourne. <http://www.garnautreview.org.au>.