A CLIMATE CHANGE POLICY

# to manage uncertainty

Climate change is a serious long-term problem which we don't yet fully understand. To deal with it, world-renowned economic modeller Professor Warwick McKibbin says we need long-term policies that recognise uncertainty and react to changes in our understanding.

**Warwick McKibbin**

Professor of International Economics, ANU Research School of Pacific and Asian Studies

Director ANU Centre for Applied Macroeconomic Analysis

Senior fellow at the Brookings Institution in the US

Adapted from Warwick McKibbin's address to *Greenhouse gas emissions and the Australian economy*, a CEDA Adelaide conference on 21 November 2005

We know relatively little about climate change. We know that the carbon concentrations in the atmosphere have risen more than 30 per cent since the Industrial Revolution. We also know the science of the Greenhouse effect.

But we are uncertain about the links between carbon dioxide emissions, and we are uncertain about the timing and magnitude of climate change. Some forecasters predict very severe and large changes in temperatures very quickly. A small minority believe that this is a complete and utter scientific fraud. I'm making the argument that this is a serious issue that we should take seriously. Nonetheless, we have to acknowledge that there is a great deal of uncertainty about climate change itself.

There's also uncertainty about the costs and benefits of climate change. Most of the losers from climate change, as we currently see it, are countries located around the equator. These are the countries that are least able to cope with the costs of climate change, and these are the countries that are most likely to be harmed by a variety of climate change effects – higher sea levels, increases in mosquito-born diseases, and so on. But there are some winners as well. Parts of Northern Europe and parts of North America probably would like to have some climate change. The costs and benefits are very disparately spread around the world.

There's also a great deal of uncertainty about the costs and benefits of abatement – about the costs and benefits of removing carbon from the atmosphere or preventing it from entering the atmosphere.

We can't do a great deal about these uncertainties. Since Swedish scientist Svante Arrhenius first noted the possibility of climate change 100 years ago, we haven't learnt a great deal that reduces the uncertainty. We have learnt a great deal. But the more we've learnt, the more we realise there's more to learn. So we can't just invest in research and development and be satisfied that the problem will go away – certainly not over the next 50 to 100 years, anyway.

Finally there's a great deal of uncertainty about the policy responses. And this is where I think the fundamental problem lies. No one really knows exactly what the right policies are at the global level, at the national level and at the local level. Or if they do know, they know the policies for the next one or two years. They don't know the policies for the next 20 years or 30 years or 50 years – the sort of time horizons that matter for energy investments. So we have this enormous policy uncertainty accumulating on top of the more fundamental uncertainties about climate change.

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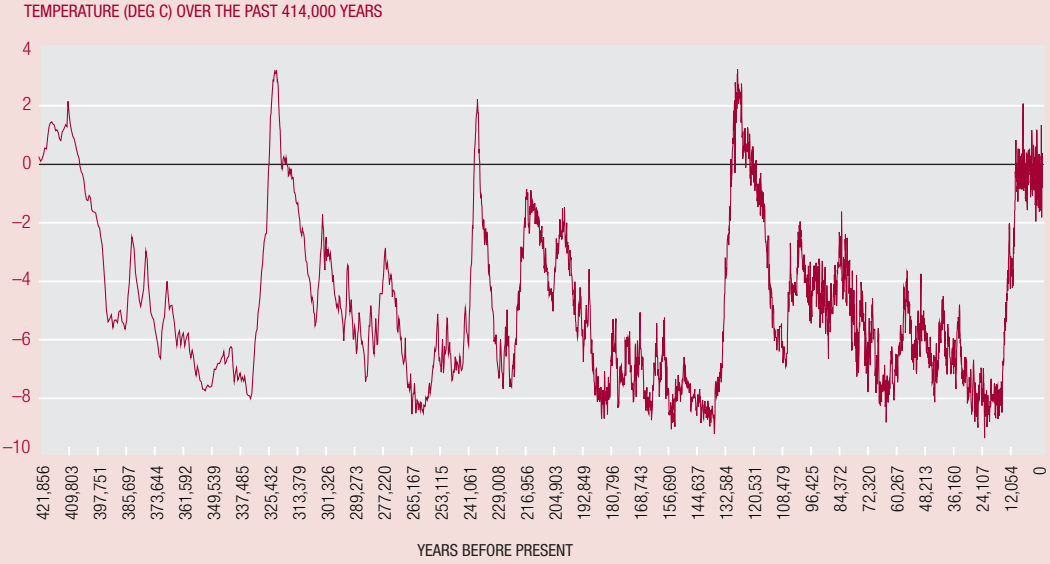
**Figure 1**

414,000 years of climate change

Source: "Historical isotopic temperature record from the Vostok ice core data", in Trends Online: A Compendium of Data on Global Change, 2000




So the first lesson that I want you to take away is this:

**Climate policy is fundamentally about managing uncertainty.**

It's not about picking a target and hitting that target to solve the problem. It's about designing a set of institutions to deal with a very complex set of problems (see Figure 1).

## 425,000 years of changes

We can graph the average temperature over the past 425,000 years relative to the temperatures since the Industrial Revolution. Figure 1 tells you several things.

Firstly, there's a lot of natural climate change already in the system. It's caused by events which scientists understand only when they look backwards. There's a lot of uncertainty in our understanding of this change. If you had stood here 425,000 years ago and asked what the future climate would look like, you would have been badly wrong using most of our current techniques.

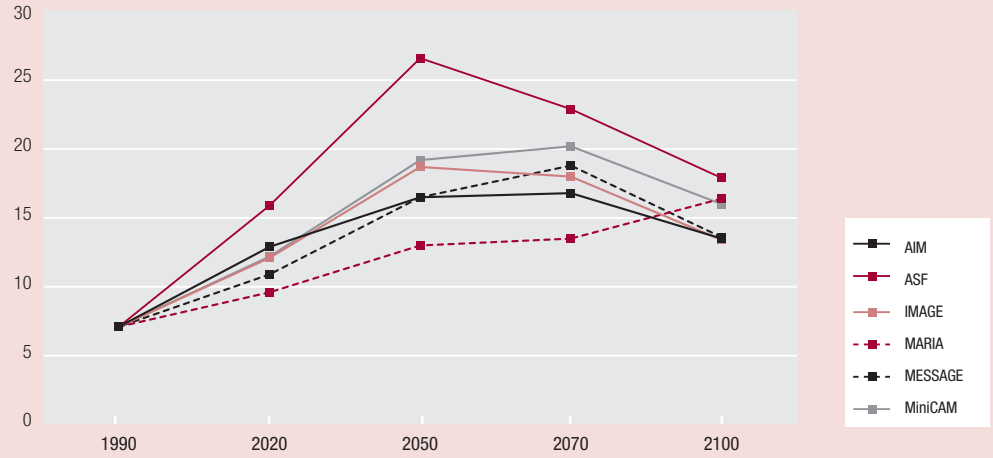
The second point to note from Figure 1 is that historically there are some very large fluctuations in climate. Some of the climate events are changes from –9 to 3 degrees over tens of thousands of years. So we have had very rapid climate change in the past. We have some evidence of just how destructive these types of events can be.

The third point to note is that since man has been pushing carbon dioxide into the atmosphere we do get a clustering of reasonably high temperatures in the very near recent past. So we need to ask: how do we change the human-induced climate effects, independently of what's happening in the natural cycle?

**Figure 2**

Global, Regional, and National CO2 Emissions

Source: Emissions Scenarios, Intergovernmental Panel on Climate Change, 2000




## Policy shouldn't rely on accurate prediction

If we probably couldn't have predicted the past 25,000 years, how well can we predict the future? This question really matters if you're designing policy. Many policies – like Kyoto – are based on some sort of predictions of the future.

Figure 2 shows you some model predictions from the Inter-Governmental Panel on Climate Change. These are predictions that were made in 1990, extending 100 years into the future.

The first point of Figure 2 is that by 2050 the variation in carbon emissions is between 13 gigatonnes and 26 gigatonnes. That is an enormous variation over a period of just 50 years.

The second point to note is that even over a period of ten years the differential is somewhere between 8 gigatonnes and 12 gigatonnes. So even over the period up to today, some of these models were completely wrong.

Now, if you were designing your policies to hit a precise target today based on the 1990 predictions in Figure 2, the costs of meeting that target depend on where you otherwise would have been. If the truth is in one of the high-range scenarios in this graph, then the fixed-target approach to policy could be very, very expensive – far more expensive than the benefits. Then again, if you were targeting one of the low-range scenarios in Figure 2, the policy could be inexpensive.

So the second lesson to take away on climate change policy is this:

**Sensible climate policy – policy that costs no more than the expected benefits – should not require an accurate prediction about the future.**

Any policy that requires you to know what's going to happen is a very dangerous policy to undertake.

## Policy responses should account for uncertainty

The first possible policy response to all this is to do nothing. And the argument for doing nothing is that the problem is small, and avoiding it might be expensive. That's a fairly common comment that you hear in the press.

But what if the problem is larger and avoiding it is cheap? What if it turns out there is a serious problem and we could have fixed it easily? That we've missed an opportunity? I think that would be a big mistake for policymakers to make.

Some people argue for more drastic action. The argument here is that the problem is enormous, and avoiding it is cheap. But what if the problem is small? What if it turns out that climate change is far less important than a problem like malaria in developing countries, far less important than bird flu, far less important than many of the development issues that we need to face in the world? And what if it costs an enormous amount to do something about it? Then we've really got our priorities messed up in a policy context.

The debates in the public press, the debates on television, the debates among politicians, are about choosing either to do nothing or to do something drastic. A prudent policy will avoid both these extremes. We've got to look for an answer somewhere in the middle.

## Create institutions for carbon constraint

The government needs to create institutions. That's what governments do. You need to create clear property rights over a long period of time, so that you can design a system of incentives. We're not talking about the period of ten years into the future, for which the Kyoto Protocol is designed. We're talking about a period of 50 to 100 years into the future. We need property rights commensurate with the time horizon of the problem.

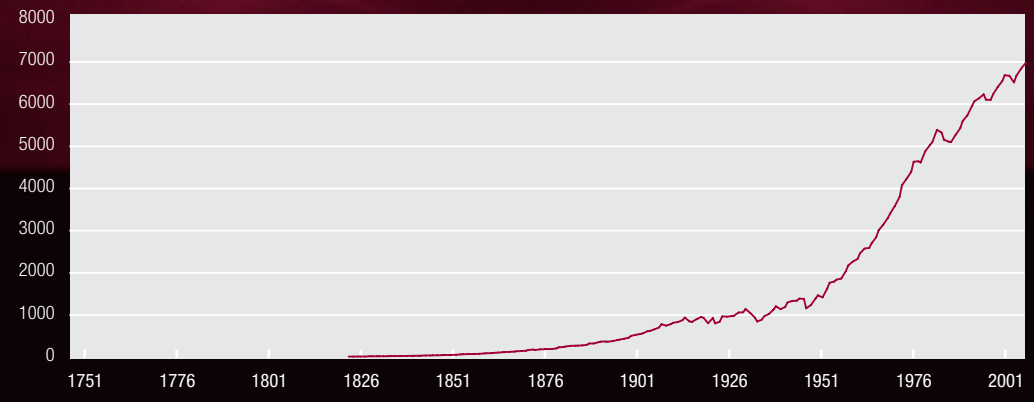
We ought to create a capacity for individuals and companies to manage their own climate risk. Everybody expects the governments to manage climate risk. That's very, very dangerous in my view. We also want to encourage the emergence of new technologies, because ultimately, technology is

## The $CO_2$ surge

How much carbon dioxide (CO2) are we pumping into the atmosphere from burning fossil fuels? Figure 3 shows you that today we're pumping roughly 7 gigatonnes of carbon per year into the atmosphere. Now that is an enormous amount of carbon if you look at the historical record. It could be that that has no impact on the climate whatsoever, if you're a sceptic. The chances are, though, that we could be setting ourselves up for a serious problem if this line rises ever higher.

Warwick McKibbin

**Figure 3**
Total CO2 emissions from fossil fuels, 1751-2002 (million metric tons of carbon)
Source: Trends: A Compendium of Data on Global Change for 1751-2000, 2003; authors' calculations for 2001-2002




what will reduce carbon emissions. And we have to encourage low-cost adaptation.

The government also needs to manage the demand for carbon-emitting activities. If the technological breakthrough takes 50 years to arrive, then we could have 50 years where energy-use could be very wasteful. So we've got to worry about the demand side, even if we think that we know the technology is coming in ten years.

We've got to also worry about compensation. We are talking about restructuring the global energy system here. That means we may be talking about some very large winners and losers, globally and locally.

And we also have to acknowledge that this current problem is a problem of industrial countries. The developing countries should give a firm commitment to participate, but at the same time they shouldn't be bearing the costs.

This all points to national institutions, not global institutions.

So the third lesson to take away on climate change policy is this:

**Government's role is to impose a long-run carbon constraint.**

We do not need a constraint designed for ten years or five years or two years from now. We need a long-term constraint, with institutional structures and incentives designed to reduce emissions in a way that lines up the costs with the benefits.

To get this, we need markets.

### Designing the right markets

We need long-term signals for carbon prices based on long-term goals. These are the things that will drive investment decisions by industries and households. Industries, especially in developing countries, are making decisions right now on energy systems. They may lock in the wrong technologies – high-fossil-fuel technologies. Now is the time to avoid that if we can. So at some point we need a long-term carbon target.

At the same time, we need to ensure that in the short term we set the costs of using carbon close to what we think are the benefits of avoiding climate change. And here is where I want to use markets. Not to give us the price in the short term, but to deliver the optimal abatement given a fixed price.

What's been done so far? We've got the Kyoto Protocol – a globally centralised response. Countries have got together, decided together what their targets should be and what the timetable should be for meeting those targets, and have implemented this – under the threat, presumably, of sanctions if you don't participate.

This approach surrenders national sovereignty, which is why the United States, Australia and developing countries have avoided taking on binding targets. Some countries have been happy to surrender national sovereignty, and they're currently part of the Kyoto Protocol.

Another problem I have with the Kyoto Protocol – as you could gather from my earlier comments –

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is that the horizons are too short. The period from 2008 to 2012, which is where the targets are binding, is far too short for most of these sorts of decisions that we need to make as a society. And after 2012 we have absolutely no idea what's going to happen. After 2012 there's a very large black hole.

The most basic problem with Kyoto is that it's based on targets and timetables. The first question you have to ask is, what is the correct target for each country in the world? And we don't know that. We certainly don't know what it is in ten years' time. We have some idea where it might be in 50 years' time or a 100 years' time. How quickly should we hit that target? What is the optimal time period?

The Kyoto process involves short-term targets and timetables held together by the threat of implausible international sanctions. It imposes an unknown cost to guarantee an emissions outcome.

Now people will argue that we permit trading in the Kyoto Protocol. We've fixed a target in every country, but if it's very expensive in Australia we can trade permits with the Russians and make the cost lower.

Such "cap-and-trade" systems are very popular, and a lot of people in Australia – at the state level in particular – are talking about implementing cap-and-trade systems. They use sulphur dioxide as an example. In the US, sulphur dioxide trading has worked very well to reduce sulphur emissions. The trouble is the carbon dioxide problem is different to the sulphur dioxide problem. If we pick a short-term target and then permit trading, cap-and-trade systems will minimise cost. My argument is that we don't really want to aim at a short-term target. We should be aiming at the short-term cost.

The fourth lesson to take away on climate change policy is this:

**Markets are an essential part of any approach. But frequently they are thought about after the strategy is designed and then are used to minimise the costs of a flawed policy.**

Financial markets perform an incredibly valuable role. But a lot of what financial markets do is actually minimise the costs of bad policy. Poorly designed markets work poorly. And I can tell you the Kyoto Protocol is a very poorly designed market from many economic, political and philosophical points of view.

## Do we have alternatives?

It's very easy to bag the Kyoto Protocol, but are there better ways?

Economics gives us lots of different ways to deal with environmental problems. We've got carbon taxes, we've got subsidies for technologies, we've got mandatory targets for renewables. Each of these approaches has its own strengths and it also has its own weaknesses. So what we want to do is take the best parts of each of these strategies and create what's called a hybrid.

What we want to do is like a tax. The beauty of a tax is that you can actually pitch the cost, the tax, close to what you think the benefits are if you can measure the benefits. So that's why taxes are good. The reason people don't like taxes is because you get lots and lots of revenue transferred away from the industry who have to pay the tax to the government and then the government gets to use that revenue for other purposes. It's not so much the price change that industry don't like; it's the massive revenue transfers.

What we want to do is also like a permit system. The beauty of permits is that when you put a permit-trading system in place it works like a tax, once you get a market price. But the revenue goes to the owners of the permit, not to the government. So people have the incentive to change their behaviour for two reasons. The first is that they now face a different price. The second is that if they own permits, they can make a profit.

And what we want to do has many of the advantages of subsidies. We want to encourage the search for technological solutions. Now, the current strategy in Australia at the federal level, and also in the US, is very much technologically driven. It says: "Let's subsidise technologies. Technology is the answer. Let's throw a couple of hundred billion dollars at various industries and the answer will be forthcoming." Now I agree that we should be subsiding technologies, but I don't think the government should pick whose technologies get subsidised. I think we want to change the relative prices so that the prices of renewables, of new technologies, of all sorts of sequestration technologies, are actually changed to give more incentive for those technologies to emerge.

## The McKibbin-Wilcoxen blueprint

My colleague Peter Wilcoxen and I have a system that deals with each one of these positives. We call it the blueprint. It's aimed at achieving emissions reductions at least cost over time. It's like a target and timetables approach, but without the timetables.

The blueprint has two components. One is that we impose a long-term goal for the economy. The second is that we regularly line up the short-term costs with what we think the science is telling us about the expected environment benefits as we value them at the time.

## Reaching the long-term goal through long-term permits

To meet the long-term goal, each national government would introduce long-term emission permits. The government would require energy producers to have an annual emission permit for every tonne of carbon that they embody in their energy, if they sell it domestically or if they import it. If they export, they don't need an emission permit.

You give permits out, throughout the society. A long-term permit allows you one unit of emission


PHOTO: ISTOCK

per year for a very long period – for a period, I would argue, of a minimum of 100 years. It's given out at the very beginning. I would argue that half of the permits should go to industry. And every consumer in Australia gets a couple of long-term permits to compensate them in case the price of their energy goes up. You compensate them up-front for the infinite future change in energy prices.

These permits aren't traded internationally. In the domestic market you can buy them or sell them or lease them, but the physical quantity is fixed at the beginning, just like real estate. The price is set by the market. These are long-term property rights.

## Aligning short-term costs and benefits through permit prices

On top of our long-term rights, our blueprint has each national government aligning costs and benefits through annual permits. In any given year the government is allowed to sell as many annual permits as required to cap the price of carbon for ten years at a time. The government stands in the market capping the cost of carbon at a price that's close to the benefits.

The annual permits allow one unit of emissions per year. They're supplemental to the long-term permits. The government sells these as required to hold the price. And the price is either fixed by international treaty, if it's a global system, or it's set by the government this year, saying that for the next ten years carbon prices will be, say, $3 per tonne.

## Understanding the concept

So what's the concept? The concept here is that the long-term permits are the medium-term goals, without a timetable. The short-term permits are what it costs the economy every year in terms of carbon. So we can move from the short-term, low-cost path to the longer-term target, using profit incentives to reduce emissions wherever it's cost-effective. And that's the whole idea: to manage the uncertainty.

The way monetary policy works these days is very similar to what I'm talking about. In monetary policy we have a long-term government bond market. The long-term government bond is set by government fiscal deficit, so there's effectively a fixed supply of these things. The market prices them, and out of the market comes a price for the long-term interest rate. But the short-term interest rate is set by the central bank, and the liquidity moves up depending on how much the market needs. And here we have exactly the equivalent: the long-term interest rate is the long-term permit; the short-term interest rate is the short-term permit.

## The advantages

Each system is run individually. So the Australian system would be run using Australian institutions. Everyone has an incentive for this system to work because it generates wealth.

What are some of the other advantages? One is that the government gives out the initial permits and then steps away. And all the government gets in the short term or over time are the additional marginal permits required to guarantee the price. So it's a tax at the margin, but it's actually a permit system for most of the revenue.

The major political advantage of the blueprint is that we create a nationally-based system. The US and developing countries no longer have to argue that they can't participate. They maintain their own national sovereignty. The Chinese system is the Chinese system: they run it themselves; they manage it themselves.

And if you think about this long-term permit market, it's like a futures market. Any time we get information on the climate, if there's a climate event or there's some other event, the futures price will move instantly. And so people who are making long-term decisions can react immediately to that. Even if it takes a government ten years before they reset the annual price, there is still a very strong price signal in the market. But the government has to manage that short-term adjustment.

The other advantage of this system, which I think is important, is that this long-term market allows individual risk management. If you're an energy producer you can use these very long-term permits to hedge against your long-term investment risk. That's a big deal for Australia. It's a very big deal for countries like India and China, who can use these long-term permits to attract foreign direct investment to come in and build up their energy systems at lower risk. So the amount of foreign direct investment that this sort of activity can generate in developing countries is potentially very large.

For countries to join this system is very straightforward. You set up your own system, and you set up the uniform price which has been agreed by the major countries who are doing this. Most importantly, existing permit holders have no incentive to keep out new players, as they do under Kyoto.

In short: governments ought to create institutions that cap the short-term cost of emission control, but that allow long-term carbon price discovery, that enable individual risk management, that provide profit-based incentives for technologies to emerge, and that provide incentives to manage demand.

More information on this topic is available on the CEDA website: **ceda.com.au/ace**

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