Briefing Paper: The Science and Economics of Global Warming

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Peter Cosier
Wentworth Group of Concerned Scientists

Nobody set out to destabilise the world's climate. The people who built the power stations and the motor cars were not evil, they were actually the hero's of their generation. Their machines advanced human welfare and created our modern western civilisation.

However, we have now discovered that the fossil fuels that power the machines are changing our world's weather. To give up the machines means giving away our way of life. It's no wonder people are frightened into inaction.

I believe we can fix this problem, not by turning our backs on the industrial revolution, but by building on what it has created for us. We just need to change the way we power our machines.

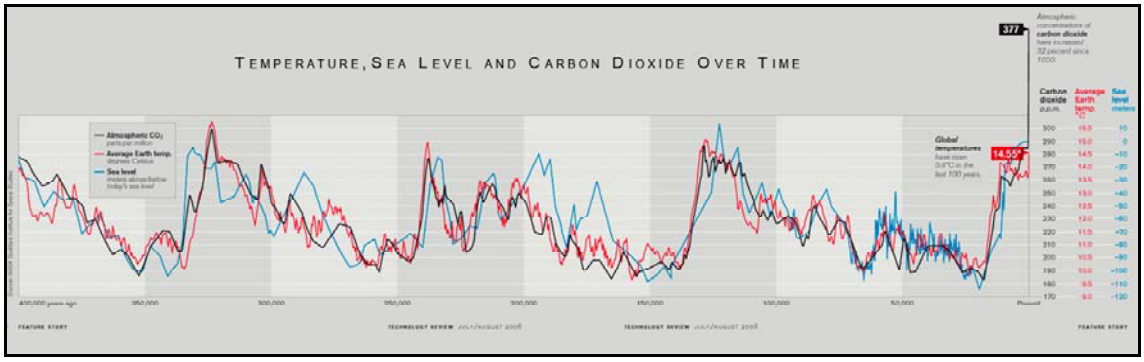
Let me first put my interpretation on the science. Then I want to address the economics.

The Science of Climate Change

The latest International Panel (IPCC) report on the science of climate change released last February, (best estimate) projects our world will warm between 1.8 degrees, even if we act now, and 4.0 degrees by the end of this century, if we do nothing.

Of course, our world's climate scientists may be wrong, but the consequences to our society if their analysis proves to be correct are profound.

These are truly terrifying numbers. Yes, the world has gone through many climate shifts in the past.



Ice cores from Antarctica show these cycles, and the science on why they occurred is now well understood[1]. The red is temperature, the blue is sea level rise and the black is CO2 levels – over a space of 400,000 years. Today's temperature is 14.5 degrees – in the red box to the right.

For example, 120,000 years ago the earth's temperature was about the same as it is today, but 20,000 years ago it was about 4 degrees cooler.

The other surprising fact that struck me when I read the literature is that for the past 10,000 years or so – the time when humans created agriculture, developed our cities, built the industrial revolution, the earth has experienced a peak of relatively warm weather.

So the question that has intrigued me is, OK, the world has been 2, 3 or 4 degrees cooler several times over the past million years, but when was it 2, 3 or 4 degrees warmer, because that's what the scientists tell us global warming will cause? And the answer to that question is staggering.

The last time our planet was one degree warmer was about 300,000 years ago, but that pales into insignificance when you discover that the last time our world was 4 degrees warmer than today is not measured in thousands of years or even hundreds of thousands of years.

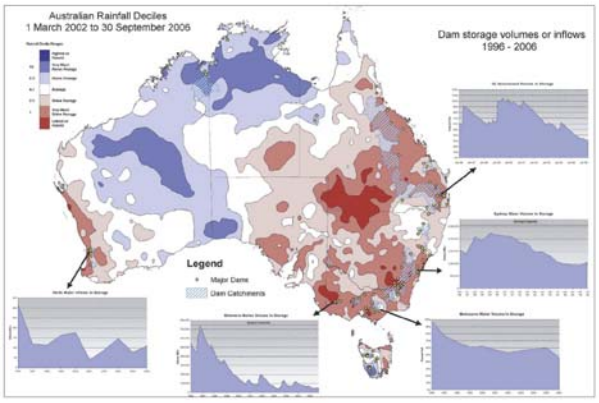
The last time our world was 4 degrees warmer than today was something like 40 million years ago. If we don't take action to address climate change now, climate scientists are telling us that our civilisation could be faced with levels of warming in the next 100 years that our planet has not experienced for 40 million years.

What will our world be like then? The answer is I don't know, but I can tell you what is was like the last time our world was 4 degrees warmer.

Large mammals had not yet evolved, Antarctica was free of ice and covered in rainforest, alligators swam in swamps in the Arctic and sea levels were 70 metres higher than today. It was a vastly different world.

In the past 100 years, Australia has warmed 0.9 degrees.

It appears that southern Australia is now experiencing a step change in its weather patterns[2], and we're already starting to talk about having to move our farms north.



This change in climate in Australia may be part of a natural cycle or it might be caused by climate change or it might be a combination of both.

We don't know for certain, we can't know, but what we do know is that our continent has been getting hotter.

We do know that the recent decline in rainfall is consistent with what the global climate models have predicted would happen in Australia as a result of climate change, and we do know that science is warning us of further uncertainty as a result of climate change.

We are already going to have to adapt to the consequences of climate change that we have set in motion. But the scale of adaptation we will need to take will depend on the speed at which we act to address the problem.

That's the science as it stands today. The overwhelming consensus of scientific opinion is that the world is warming as a consequence of human activity.

This is no longer a debate on whether man's activities are causing the climate to change, it's now a debate about how to address it. This is the greatest challenge of our generation.

It presents us with threats, it also presents us with opportunities. It could herald the end of our civilisation, but it could also drive the next industrial revolution.

Let me now turn to the economics.

The Economics of Climate Change

In October last year, the former Chief Economist of the World Bank, Sir Nicholas Stern released his long awaited report on the Economics of Climate Change[3].

This was a significant milestone in the public debate because, finally, someone looked at the cost of doing nothing, and his conclusions have stunned the business world.

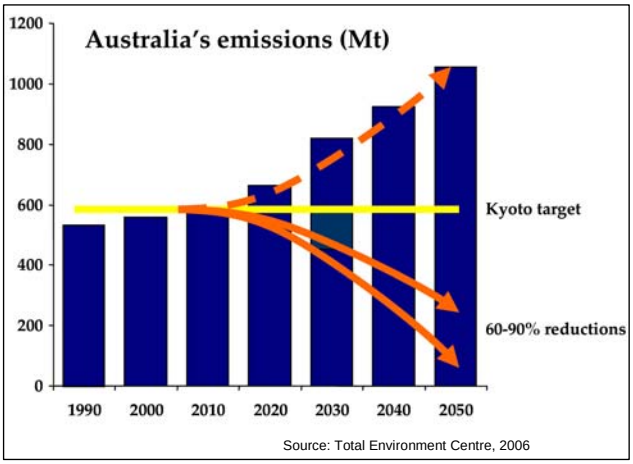
He found that the costs of doing nothing were more than the costs of fixing the problem – far more in fact.

What I now want to show you is that, using conservative economics, addressing climate change is not a conflict between economic growth and the environment.

The world's climate scientists tell us that we need to keep greenhouse gas concentrations in our atmosphere below 450ppm of CO2e if we are to keep global warming below a critical threshold of 2 degrees[4].

Pre industrial levels were 280ppm. Today these levels have reached 430ppm and are rising at more than 2ppm per year.[5] We are already dangerously close.

This graph shows what the world's climate scientists tell us we need to do if we are to have a 50 percent chance of stabilising emissions at these levels and avert serious damage to the world's climate system.



It's a truly frightening graph.

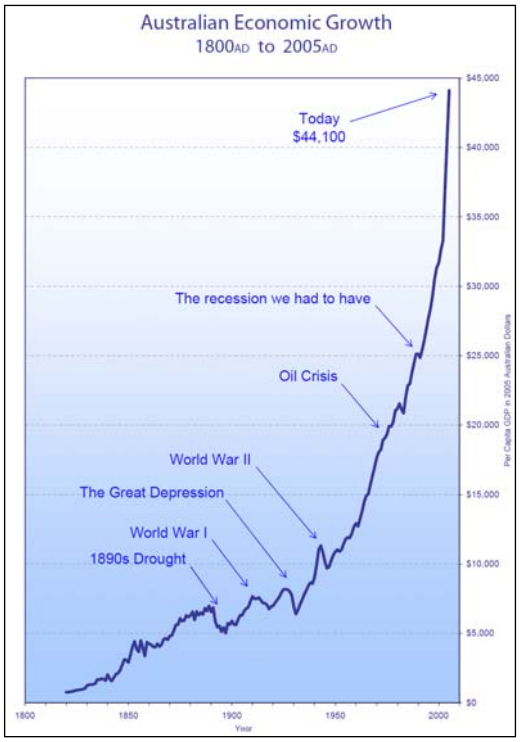
We need to not just stop the explosive growth in emissions, we actually need to cut existing emissions by at least 60 per cent within the next 40 years.

It's no wonder people are frightened into inaction. To give up the machines means giving away our civilisation.

But they need not be frightened. We don't need to turn our back on the industrial revolution, we just need to change the way we power our machines.

Let me put the economics, as this issue affects Australia, in proper perspective.

This graph, which I produced last year, shows you the economic history of modern Australia[6].



It shows the explosion of wealth in Australia since the industrial revolution – how the western world has embraced the democratic capitalist model as the vehicle for human advancement with spectacular success.

By the time Australia had become a nation in 1901, average incomes had reached $6,000 in today's money.

But that was just the beginning. Just look at the economic growth since World War Two.

Today our average income in this country is over $44,000 for every man woman and child.

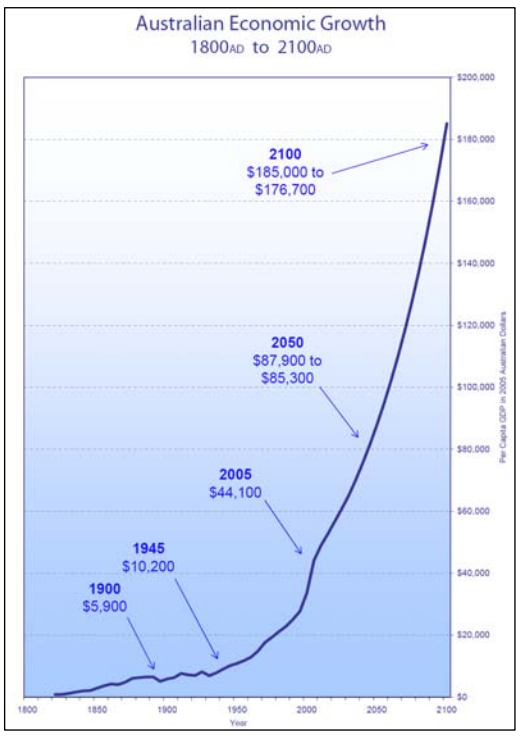
We are eight times wealthier than our grandparents, and we live in a world beyond their wildest imagination.

The Intergenerational Report prepared by the Australian Treasury[7], predicts that, short of any unexpected shocks, this explosion in wealth will continue between now and 2050, at between 1.5 and 2.1 per cent of GDP per annum (per capita).

If the lower rate of 1.5 per cent per annum is projected over the following 50 years, at the end of this century, living standards in Australia will rise from $44,000 per person, to over $185,000 per person.

And as you know, Treasury is a very conservative agency.

That's right, by the end of this century, over $185,000 for every man, woman and child in today's dollars.



Now I know what some business people in the audience are thinking – yes, we've all seen these hockey stick graphs before. But bear with me – remember, to economists, the impact of compound economic growth is well know and underpins many of your long range investment strategies. But most people are not financiers.

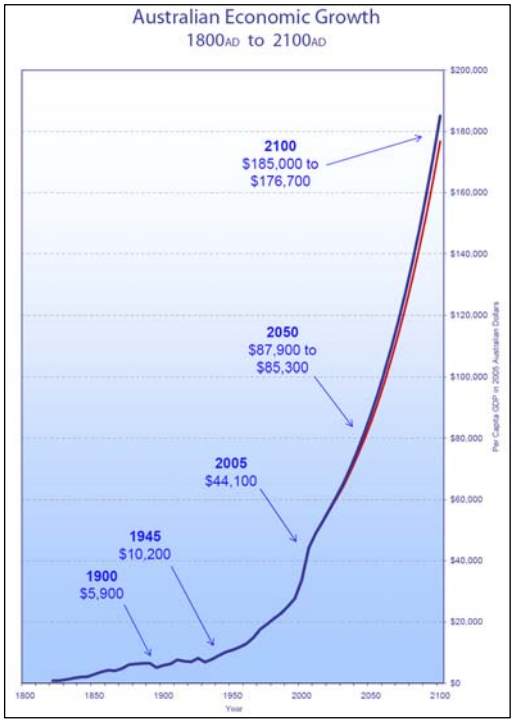
We all need to reflect on this graph for a moment.

No matter how well you understand economics, the impact of these figures are as unimaginable to us today as it would have been unimaginable for our grandparents, at the turn of last century, to conceive the world they were creating for us. But here's the key – our behaviour today is putting all this at risk … and for what?

We're putting it all at risk because we believe it is

wealth or the environment.

This next graph leaves many people stunned – it stunned me when I produced it. In fact I didn't believe it at first – surely it can't be that simple. But it is correct and it has been verified by leading economists in CSIRO[8].



The blue line is, as I said, projected economic growth based on the Treasury projections.

The red line is based on the best available international modelling of the economic impact of deep cuts in global emissions, involving high income countries reducing their greenhouse footprint by at least 60% by 2050[9][10].

When I first presented my findings on how little it would cost to prevent climate change, people were shocked, because they are presented with information on the economic implications to them of the world acting to address climate change.

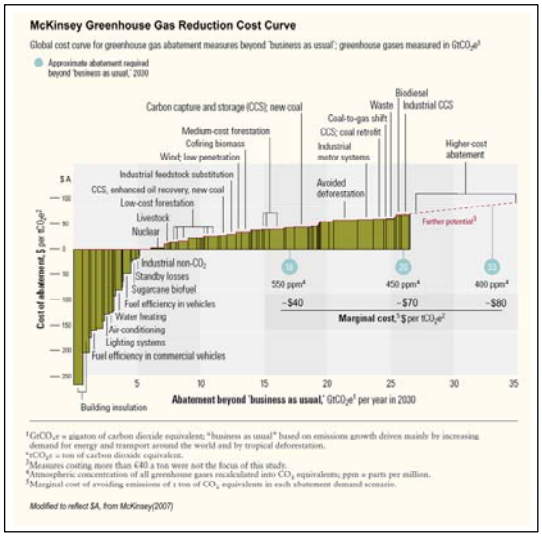
And not surprisingly, they come to the obvious conclusion, what on earth are we arguing about.

This graph presents us with a very powerful morale choice, because destroying nature and risking our climate for the sake of an infinitesimally small amount of economic growth is not heroic – it is greed and it puts at risk everything we have built.

Stern said it 6 months ago, the IPCC said it again last month, deep long range cuts to CO2e emissions are affordable.

So how is this possible?

This cost curve for greenhouse reduction produced by the accounting firm McKinsey earlier this year helps explain this apparent paradox[11].



It estimates that the cost of achieving the 450ppm target by 2030 will induce a carbon price of $70 tonne of CO2e – the number 28 in the blue circle.

This graph shows two things.

Firstly, we can achieve the 450ppm target by 2030 without wrecking the economy as some would have us believe – if we act now - and the reason for this is that if efficient market instruments are used, business will actually make a net profit in the early years, because of all the cost effective actions that a price will induce – those on the left hand side of the graph – building insulation, fuel efficiency, air conditioners and water heating systems, standby losses.

With a price on carbon, somebody will make money out of these opportunities – these are the low hanging fruit.

The second thing this graph shows is that, as you move further along the curve, the costs do increase, but the telling fact is that, with the exception of currently unproven carbon capture and storage technologies, we have all the technological solutions in place today to fix the problem.

When you look at the McKinsey cost curve in association my GDP growth curve you should now appreciate why: electricity and fuel prices will inevitably rise, but the rise is likely be so small that in 10 or 20 years time the extra price will still be lower than the increase in wages. That's right, with the right policies, implemented early, electricity and fuel prices will continue to decline relative to incomes even with a heavy greenhouse gas reduction target[12].

We can protect the world's climate system and we won't even notice the cost.

But the science is warning that we are running out of time.

As I said earlier, the most recent science suggests that the danger level for atmospheric carbon concentrations is 450 parts per million carbon dioxide equivalent. Currently we are at 430 parts per million, it's increasing at over two parts per million a year and it's accelerating.

We have between 5 and 10 years before we reach dangerous levels of greenhouse emissions. That's right, 5 to 10 years – not 20, 50 or 100 we thought was the case just a few years ago.

The debate on the science is over, but the science is now telling us that action is urgent.

The message is that the carbon pollution problem is fixable and Australians are really good at fixing things. So, the sooner we put a price on carbon pollution in Australia, the sooner our engineers and scientists can help the world get on and fix the problem, and the sooner our industry can position our national economy to take advantage of this reality.

Conclusion

The vast majority of Australians accept we need to play our part in fixing this global problem and we are prepared to pay a financial price to do so.

The analysis I've presented here demonstrates just how small a price we need to pay to make our contribution to stabilising the world's climate system – provided we act now.

The great challenge for our parent's and grandparent's generations was to build a new society out of the ashes of the Great Depression and two horrific World Wars. They were spectacularly successful.

Today our great challenge is to save this world from ourselves.

Acknowledgement

This paper was prepared with advice from Dr Steve Hatfield Dodds, CSIRO Economist and President of the Australian Society of Ecological Economics, and Ms Fiona McKenzie, Policy Analyst, Wentworth Group of Concerned Scientists.

Footnote: The estimated impact of policy action presented in this paper is based on the results from eleven international models, reported by Grubb et al 2006. Nine of the eleven models indicate emission reductions are likely to result a GDP gap -1% or less relative to levels without emissions reductions by 2050. A number of models indicate no impact (a zero GDP gap), and two suggest economic gains, reflected in higher rates of economic growth with emission reductions, due to factors such as enhanced productivity from more rapid turnover of energy-related physical capital. Results from these nine models are more dispersed in the second half of the century, with GDP gaps ranging from +3.5 to -3.0 percent, with most between 0 and -1%. The estimate presented assumes the GDP gap rises to -1.5 by 2100. The impact on Australia is assumed to be three time the world average, implying a GDP of -3% by 2050, rising to -4.5% by 2100. This ratio is more conservative than the impact ratios suggested by ABARE (2006), which generally indicates impacts on Australia that are around twice the average world impact.

The Stern Report finds that temperature increases are likely to have non-linear impacts on living standards, with increases on 2°C above pre-industrial levels reducing per capita economic income by around 1.5%, and increases of 4°C reducing incomes by around 6%. Applying these estimates to Australia suggests GDP per capita with policy action with be higher than without action from

around 2080 – if we assume Australian policy action is three times more costly than the world average. If we assume policy action is 1.5 times as costly, policy action results in higher incomes from 2055.

References:

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[2] Wentworth Group, 2006. 'Australia's Climate is Changing Australia' www.wentworthgroup.org
[3] Stern, 2006: Stern Review: The Economics of Climate Change. www.hmtreasury.gov.uk/independent reviews/stern review economics climate change
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[5] Gohar and Shine, 2006. data provided to The Stern Review, Dept. Meteorology, University of Reading
[6] Based on the work of Angus Maddison, 2003. The World Economy: Historical Statistics OECD
[7] These graphs are based on the Australian Treasury, 2002. Intergenerational Report 2002-03 Budget Paper No.5, May 2002. In May 2007, the treasurer released an updated report, predicting similar future economic growth projections.
[8] Prepared with assistance from Dr Steve Hatfield Dodds, CSIRO Economist and President of the Australian Society of Ecological Economics
[9] Ahammad, H., A. Matysek, B.S. Fisher, R. Curtottie, A. Gurney, G. Jakeman, E. heyhoe and D. Gunasekera, 2006. Economic impact of climate change policy: The role of technology and economic instruments, ABARE Research Report 06.7, ABARE, Canberra
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[12] Hatfield Dodds and Adams, 2007. 'Beyond the Double Dividend: Modelling the impacts of achieving deep cuts in Australia's greenhouse gas emissions." AARES 2007 Conference Paper