The Economics of Nature

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You will see from this paper that I am an environmental optimist, a rare species these days, but I hope that by the end of it you'll come to understand why.

We don't need to destroy the machines of the industrial revolution, but we do need to change the way we power them.

That premise is based on hard core climatic and economic modelling and it is from this premise that can evolve a fundamentally new way of managing nature - the whole of nature - in the 21st century.

This is the subject of my talk today.

But it is an outcome that can only happen if the leaders of our generation make a determined effort that our stewardship of planet Earth will be the legacy that we will leave for future generations.

It certainly won't happen by wishful thinking.

And just in case we need reminding, this is what we're talking about.

It's the photo taken by the Apollo 6 crew as it came around the back of the moon. It's a photo that helped change our understanding of our place in the universe. A tiny, blue dot in the vastness of space.

Now to business.

It was the machines of the industrial revolution that changed the course of human history.

They freed us from subsistence and they lifted us above nature.

The industrial revolution also drove the green revolution, allowing us to produce and store vast quantities of food.

Our population exploded.

In 1800 there were one billion people on this planet.

By 1960 it had reached 3 billion.

Just 50 years later it doubled again to 6 billion and we expect it will grow to 9 billion within the lifetime of most people here today.

The industrial revolution was built on the harnessing of fossil fuels – the energy embedded in the vast oil, gas and coal reserves that were laid down millions of years ago, when the earth was a very different place.

It has given us health care, aged pensions, fast cars, shops full of food, schools, 4 weeks annual leave, sick leave, television, the internet, coffee shops, dress shops, the list goes on and on.

We are, without doubt, the wealthiest, healthiest and most educated generation.

We have more choices and more opportunity than any generation in history: all because of the machines.

But this success has been at the cost of something else.

That something else is our natural world.

We have already cleared half of the world's rainforests, we've degraded vast river basins, and we stand to lose half of all species on earth.

We don't need to destroy the machines to protect our natural world. But we do need a revolution in our thinking.

We've heard a lot about our current economic circumstances in Australia and globally at this conference.

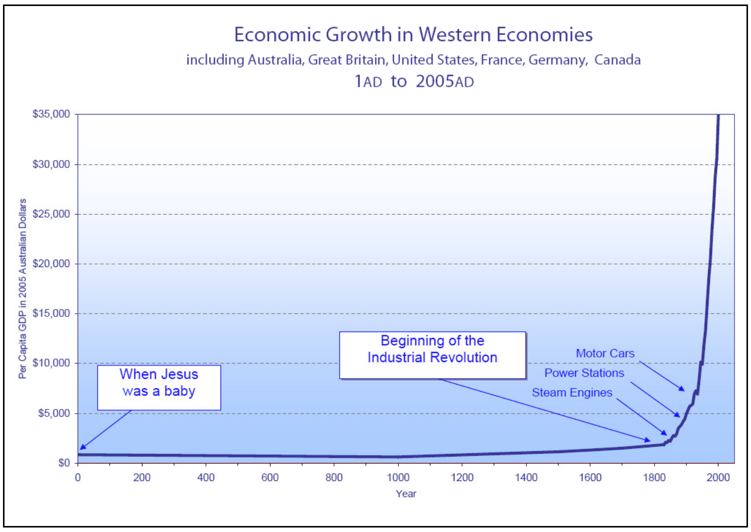
Most of the great environmental challenges of our time cannot be resolved by short term tweeking of the current economic system. They require fundamental reform.

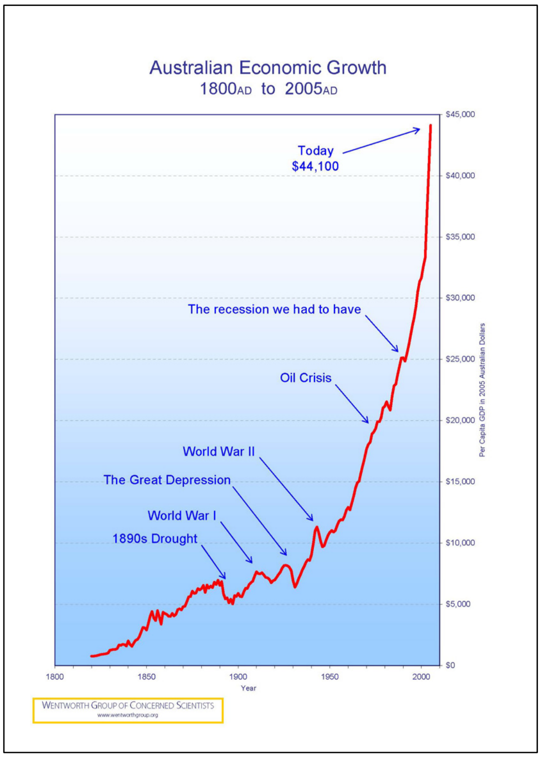
So let me take you back a step.

This graph shows the explosion of personal wealth in western economies since the invention of machines[1].

And it is my view that it also provides the pathway for us to address our long-term environmental problems as well.

Let me explain - here is when Jesus was a baby.





And here, nearly 2,000 years later, is the beginning of the industrial revolution: stream engines, power stations, motor cars.

Just look at the explosion in our wealth since the invention of the machines.

When Australia became a Nation in 1901, average annual incomes had grown to 6,000 dollars in today's money.

But even that was just the beginning.

Today, just 100 years later, it is now over 44,000 dollars for every man, woman and child.

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

All because of machines.

The key to the revolution of the 21st century, a revolution that can change the course of history for all time, lies in our generation accepting the challenge of climate change.

The worlds climate scientists tell us that we need to keep greenhouse gas concentrations in our atmosphere below 450ppm if we are to have a 50% chance of keeping global warming below a critical threshold of 2 degrees above pre-industrial levels[2].

The institutional and technological implications of achieving stabilisation at 450ppm are phenomenal.

Yesterday we heard Gary Banks, long time Chair of the Productivity Commission tell us that climate change will be THE biggest regulatory change the country has ever faced.

Achieving stabilisation at 450ppm requires a global reduction in existing greenhouse gas emissions in the order of 85 percent by 2050, based on a 15% probability[3,4,5].

That's the global average for all nations, developed and developing.

To have any chance of achieving that target, highly industrialised economies such as Australia, on a per capita basis, will have to reduce our existing greenhouse gas emissions in the order of 97 percent by 2050[6].

That figure is based on a 15% risk probability of exceeding the critical 2 degree threshold.

This is no game.

Would you go for a swim at the beach if you were told there is a 15% chance of being eaten by a shark?

Of course you wouldn't.

Well that's the risk the worlds climate scientists are telling us we are now taking with runaway climate change.

It's like a farmer driving past a small grass fire in a paddock, with the weather forecast on the car radio saying "hot, dry northerly winds", and the farmer thinking – "oh, it will probably burn itself out, I'll come back tomorrow".

But Australia is not alone: as Professor Garnaut has said, this is a global problem.

Indeed all the world's industrial economies will need to reduce their emissions by similar amounts Europe and Japan by 93%, the United States by 97%[7].

But in just about every conversation I have had in the past 12 months, people say to me, oh yes I know that, but what about China.

Well indeed, what about China?

Per capita greenhouse gas emission reductions required to achieve 450ppm by 2050

(in CO2 equivalent: includes CO2, CH4, N2O, PFCs, HFCs, SF6, land use change & intl. bunkers)

Country	MtCO2	Rank	% World Total	Tons Per Person	World Rank	Per Capita Reductions (15% probability)
Malaysia	861	9	1.9	37.4	1	98
Australia	509	14	1.2	26.6	2	97
Canada	751	10	1.7	24.4	3	97
United States of America	6,611	1	14.9	23.4	4	97
Indonesia	3,068	4	6.9	14.9	5	95
Russian Federation	1,991	6	4.5	13.6	6	94
Brazil	2,333	5	5.3	13.4	7	94
South Korea	547	12	1.2	11.6	8	93
Japan	1,406	8	3.2	11.1	9	93
European Union (25)	4,982	2	11.2	11	10	93
Myanmar	521	13	1.2	10.9	11	93
South Africa	455	15	1.0	10.3	12	92
Dem. Republic of Congo	408	17	0.9	8.2	13	90
Mexico	682	11	1.5	7	14	89
Iran	435	16	1.0	6.8	15	88
China	4,850	3	10.9	3.8	16	79
India	1,574	7	3.6	1.5	17	47
World	44,347		100.0	7.3		

Phillip Glyde from ABARE told us yesterday that China's energy demands will be four times larger than today - and it's already on par with the United States.

As the Chinese economy powers on into the 21st century, they will need to massively reduce their existing per capita emissions of the same order of magnitude as Australia.

The implication of global stabilisation target of 450ppm for Australia and the world is simple, but profound.

With reductions of this magnitude, on these timescales, no matter which phase in the industrial revolution countries are in, we are going to have to completely decarbonise the world's energy production systems and we are going to have to restore a positive carbon balance in the world's natural landscapes[8] - our forests and our agricultural lands - and we have 40 years to do it.

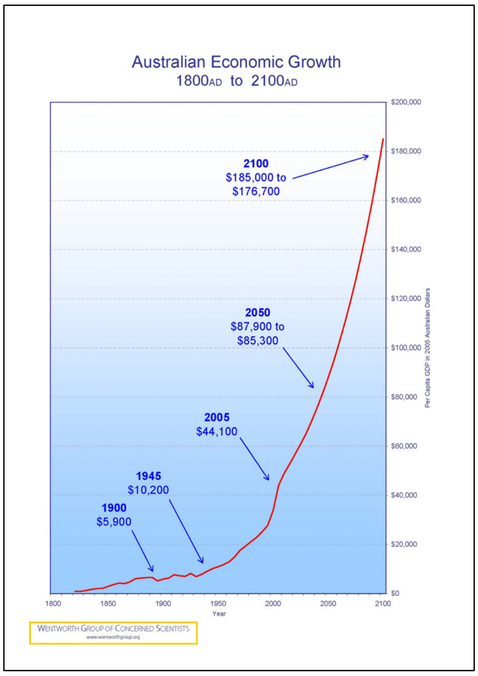
We need to reframe the industrial revolution – we need to build a 21st century economic system that is profoundly different to that of the 19th and 20th centuries.

Yet while the political and technical challenges are enormous, what we are coming to realise is just how economically feasible this is.

It is feasible because in the early years business can make a profit and households can save money when they invest in those technologies such as building insulation, fuel efficiency, solar water heating.

With the exception of currently unproven carbon capture and storage technologies, we actually have all the technologies in place today to fix the problem.

The overwhelming majority of economic models indicate that stabilising atmospheric concentrations around 450 ppm CO2e would involve a 'cost' of 1% of GDP or less by 2050[9].



This graph is based on Treasury projections of future economic growth for Australia.

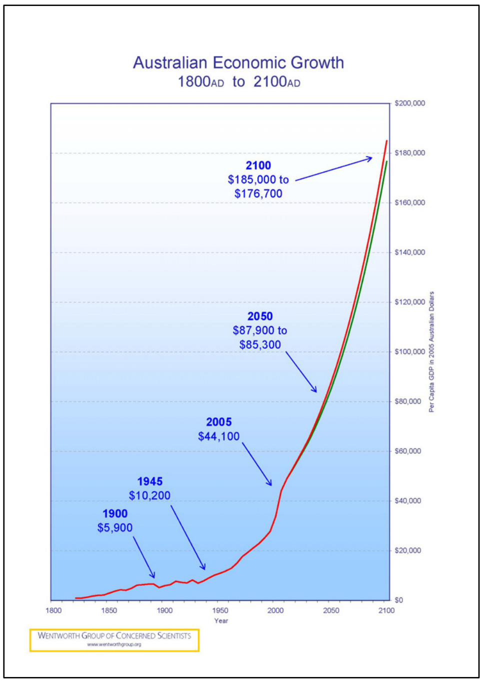
It shows you the explosion in wealth between now and the end of this century if GDP continues to grow in the order of 1.5 per cent per capita per annum[10].

Living standards in Australia will rise from $44,000 per person today, to over $185,000 per person[11].

The **green line** shows you what a 1 to 2% reduction in global GDP really means – the amount needed to stabilise greenhouse gas concentrations at 450 ppm (by 2050)[12,13].

This graph should be on t-shirts because it is a most hopeful message.

It shows that we can stablise the world's climate system without destroying the machines of the industrial revolution, provided we change the way we power them.



A price on carbon will drive the next industrial revolution. It can get us to the '450 by 2050' target, and lead us to a carbon pollution free, 21st century economy.

But as our world gets smaller and nature's resources get scarcer, the implications of this graph go well beyond climate change – it goes to the heart of what humanity is capable achieving in the 21st century – an opportunity to create an economic system that is profoundly different to that of the 19th and 20th centuries.

Let me explain. The solution to climate change has not one, but three components[14]:

1. Energy technology (to produce carbon pollution free energy) – this needs to provide 50% of the solution;

2. Energy efficiency (using less energy and in the process saving money) – that's 25% of the solution.

   And what a wonderful example Melbourne University set last December when the Council resolved to deliver carbon footprint reductions of 50% by 2010 and 100% by 2030.

   The way they will achieve these targets is just clever economics - saving money through energy efficiency and reinvesting the savings into carbon offsets as well as other mitigation measures.

There is a third component to the solution – that is landscape management (we need to let nature help us, because trees and soils absorb carbon) – that's also 25% of the solution.

It is in this last component that lies at the heart of what I call the economics of nature in the 21st century.

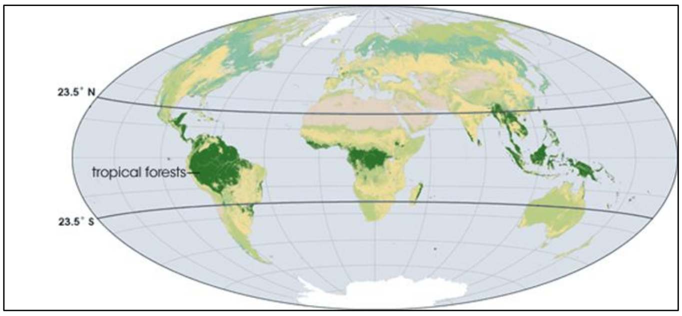
Reducing the destruction of these stores of carbon, by reducing land clearing, and by increasing carbon stocks through revegetation and improving soil carbon, makes landscape management a fundamental part of managing the CO_2 balance in the atmosphere.

Because landscapes absorb vast quantities of carbon, we can design the carbon economics so that for the first, and possibly the only time in human history, we can grow the world economy without destroying nature.

This is an unbelievably important concept.

Carbon economics of the 21st century presents our generation with the opportunity to not only stabilise the world's climate system but to also create an economic system that will conserve the world's biodiversity.

Because rainforests and restored river basins store vast quantities of carbon, healthy landscapes can become more valuable than cleared ones.



Tropical rainforests cover only seven percent of the world's land surface[15], yet they contain almost half of the world's terrestrial biodiversity.

Over half of these forests have already been cleared, and current clearing rates are staggering - 13 million hectares is cleared every year.[16]

But tropical deforestation is not only destroying nature, it is also directly releasing a staggering 8 to 20% of all global carbon emissions.[17]

If the western industrial economies including the US, Europe, and Australia are prepared invest, it will not only provide the world with up to 25 percent of the solution to climate change, it will for effectively no additional cost, also finance the conservation of vast tracts of tropical landscapes.

But the opportunities are not just in the tropics.

For Australia, the story is similar: carbon pricing has the potential to fundamentally change the pricing signals in rural Australia and as a consequence how we manage the Australian landscape.

Properly designed, carbon pricing is capable of creating a self funding mechanism to repair degraded landscapes, such as in the Murray Darling Basin, at a scale that would have been unimaginable 20 years ago.

In conclusion: Our generation is presented with an opportunity to transform the economics of the 21st century and in doing so transform the management of nature and with it, our place in history.

Our parents invested in the economic future of their world with spectacular success.

In the process they have transformed the face of our planet.

In less than a century our civilisation went from flying the first aeroplane to walking on the moon.

If we can go to the moon for an adventure, surely we can build new ways to power our machines to save the world.

Carbon economics – the economics of nature for the 21st century – our century – can be perhaps, the greatest legacy of our generation.

The question is, 'is our generation up to the challenge?'

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Acknowledgement

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Notes and References

[1] Maddison, A., 2003. *The World Economy: Historical Statistics* OECD

[2] IPCC, 2007: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* Table TS.5, p 66.

[3] This is an approximation of the IPCC Table SPM6, which states that a reduction in global CO2 emissions in 2050 (as a percentage of 2000 emissions) in the range of -85% to -50% is required to achieve a CO2e stabilisation in the range of 445 to 490ppm by 2050. The figures correspond to the 15th and 85th percentile of the IPCC's Third Assessment Report (2001) scenarios distribution, which was also used for the 2007 analysis. It is also consistent with Table 8.2 in the Stern Review (p227), based on work by Meinschausen et al, 2006.

[4] Stern, N. 2007. *The Economics of Climate Change: The Stern Review* Cambridge University Press, p227.

[5] Meinschausen et al. 2006. *Multi-gas emission pathways to meet climate targets*, Climate Change, 75: 151-194

[6] These figures are based on a global per capita pollution permit in 2050, based on a 15% probability of reaching the 450ppm target, which in turn gives only a 50% probability of keeping climate change below 2 degrees warming above pre-industrial levels. Further details are in Cosier, P. 2008. The Economics of Nature. State Library of NSW Lecture, February.

[7] Based on figures published by the World Resources Institute, 2007. Climate Analysis Indicators Tool Version 5.0, and IPCC Synthesis Fourth Assessment Report, November 2007. Table SPM.6.

[8] Table TS.5. (reference 2 above) gives the 'best estimate' for holding global temperature increases to below 2.1 degrees over pre-industrial levels, by keeping CO2e concentrations below 450 ppm, and Table SPM.6. (reference 2 above), which gives probabilities of achieving the 450ppm (445-490) CO2e target by 2050 based on the future emissions scenarios used by the IPCC.

[9] Information provided by Steve Hatfield Dodds, CSIRO, 2006. The estimated impact of policy action 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.

[10] Original analysis in: Australian Treasury, 2002. *Intergenerational Report 2002-03* Budget Paper No.5, May 2002, with similar estimates reflected in Australian Government (2007) Intergenerational Report Overview

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[14] McKinsey, 2007. 'A Cost Curve for Greenhouse Gas Reduction' The McKinsey Quarterly, 2007, Number 1

[15] Clark, M.L, Roberts, D. A. and Clark, D. B., 2005. ' Hyperspectral discrimination of tropical rain forest tree species at leaf to crown scales' in Remote Sensing of Environment, Volume 96, Issues 3-4, 30 June 2005, Pages 375-398.

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