# Chapter 8 Costing climate change

Alan Moran

The IPCC's three voluminous 'Fifth Assessment' Working Group reports and their slimmed-down Summaries for Policymakers were completed in 2013 and 2014. To condense the findings of what is said to be the work of 803 authors, the IPCC estimates that a doubling of atmospheric carbon dioxide (CO 2) will cause warming between 1.5°C and 4.5°C. Perhaps in response to seventeen years in which the planet has defied the warming forecasts of climate models, the lower boundary was reduced in the latest assessment. This did not however prevent the decibels of commentary about adverse implications being cranked up.

Highly respected climate scientists put the likely warming below the bottom of the IPCC range. Writing in this volume, Richard Lindzen estimates the maximum warming possible for human induced greenhouse gases is 1 ° C, while Beenstock, Reingewertz and Paldor find that the relationship between greenhouse gases and warming is spurious except perhaps in the short term.[1]

Entertainers urge us to reduce consumption of non-renewable energy in order to forestall adverse effects of global warming. Ironically some of these exhorters have carbon footprints many times those of common folk— Bono's 2010 world concert tour is estimated to have generated emissions equivalent to the annual level of 6,500 British people.[2]

## How much will climate change hurt?

The key questions are, 'How much damage will emanate from the likely atmospheric doubling of carbon dioxide and other greenhouse gases?' and, 'What is the cost of measures to prevent this doubling?' The IPCC puts the qualitative costs of warming in the following foreboding terms:

- Each degree of warming is projected to decrease renewable water resources by at least twenty per cent for an additional seven per cent of the global population.
- Climate change is likely to increase the frequency of droughts.
- Heavy rainfalls are likely to become more intense and frequent.
- In response to further warming by 1 ° C or more by the mid-twenty-first century and beyond, ocean-wide changes in ecosystem properties are projected to continue, with implications for food security.
- Urban climate change risks, vulnerabilities, and impacts are increasing across the world in urban centres of all sizes, economic conditions, and site characteristics. Climate change will have profound impacts on a broad spectrum of infrastructure systems (water and energy supply, sanitation and drainage, transport and telecommunication), services (including health care and emergency services), the built environment and ecosystem services.
- Climate trends are affecting the abundance and distribution of harvested aquatic species, both freshwater and marine, and aquaculture production systems in different parts of the world but with benefits in other regions.
- Without adaptation, local temperature increases in excess of about 1 ° C above pre-industrial is projected to have negative effects on yields for the major crops (wheat, rice and maize) with increased global food prices by 2050.

In fleshing out these generalities, the IPCC maintains that climate change is already impacting on natural and human systems. It says these effects include changing precipitation, melting snow and diminishing crop yields.

The Working Group II report sees additional costs being derived from the following key risks:[3]

- Risk of death, injury, ill-health, or disrupted livelihoods in low-lying coastal zones and small island developing states and other small islands, due to storm surges, coastal flooding, and sea-level rise.
- Risk of severe ill-health and disrupted livelihoods for large urban populations due to inland flooding in some regions.
- Systemic risks due to extreme weather events leading to breakdown of infrastructure networks and critical services such as electricity, water supply, and health and emergency services.
- Risk of mortality and morbidity during periods of extreme heat, particularly for vulnerable urban populations and those working outdoors in urban or rural areas.
- Risk of food insecurity and the breakdown of food systems linked to warming, drought, flooding, and precipitation variability and extremes, particularly for poorer populations in urban and rural settings.
- Risk of loss of rural livelihoods and income due to insufficient access to drinking and irrigation water and reduced agricultural productivity, particularly for farmers and pastoralists with minimal capital in semiarid regions.
- Risk of loss of marine and coastal ecosystems, biodiversity, and the ecosystem goods, functions, and services they provide for coastal livelihoods, especially for fishing communities in the tropics and the Arctic.
- Risk of loss of terrestrial and inland water ecosystems, biodiversity, and the ecosystem goods, functions, and services they provide for livelihoods.

Studies to assess and quantify these concerns include the official ones conducted by large teams of experts. The most prominent of these are the UK report by Nicholas Stern and the Australian report by Ross Garnaut.[4] The latter was followed up by other reports, including the 'Strong Growth Low Pollution' modelling by the Treasury.[5]

As authors, this listed 84 Treasury officials in addition to officers from other agencies.

While arguing that 'the analysis should not focus only on narrow measures of income like GDP', Stern suggested the cost of human induced climate change under business-as-usual would be 'the equivalent of around a twenty per cent reduction in consumption per head, now and into the future'. Combatting this, he said, would cost only one per cent of GDP. Stern received a peerage for the report which Her Majesty's Government has archived.

Like Stern, Garnaut provided a number of cost estimates, including one of up to twelve per cent. He maintained 'all of the detailed assessments of the economics of climate change indicate that the main costs of climate change, and therefore the main benefits of mitigation, accrue in the twenty-second, twenty-third centuries, and beyond.'[6]

Garnaut included many individual features in his warming-induced damage estimates, though the detailed costs were not well supported. Thus, he argues that the additional expense for repairing roads and bridges could cost over one percentage point of GDP but offers no substantiation for these assertions. Oddly, he also argues that other cost increases will ensue from reduced tourism partly due to a highly implausible collapse of the Great Barrier Reef but also because of higher electricity costs and a loss of international tourism (in the reference case international travel to Australia is projected to increase substantially).

Projecting a series of 'climate refugee' scenarios, Garnaut also sees a need for increased defence spending with an additional cost amounting to 0.2 per cent per annum. However, the IPCC has now downgraded such fears. In 2005 the IPCC had global warming creating '50 million "climate refugees" by 2010' (later deferred to 2020). It now says that such fears, 'are not supported by past experiences of responses to droughts and extreme weather events and predictions for future migration flows are tentative at best.'[7]

Richard Tol has pointed out that the Stern and Garnaut reports were not peer reviewed. Tol has now been demonised for withdrawing his name as an author of a key IPCC chapter that he claims the Summary for Policymakers had distorted. That Summary argues, 'the incomplete estimates of global annual economic losses for additional temperature increases of 2 degrees Celsius are between 0.2 and 2.0 per cent of income … Losses accelerate with greater warming but few quantitative estimates have been completed for additional warming around 3 degrees Celsius or above.'[8]

The IPCC's estimates of costs from inaction to prevent climate change are, nonetheless, considerably lower than those offered by the British and Australian semi-official government reports.

The IPCC Assessment lists only four studies since 2008 that estimate economic losses due to climate change. One, by Maddison and Rehdanz , is based on 'self-reported happiness' and therefore fails key scientific verifiability tests.[9] Of the others, Nordhaus suggests a loss of GDP of 2.5 per cent with a 3 ° C warming[10]; a second— by Bosello, Eboli and Pierfederici— puts the GDP loss at 0.5 per cent for a 1.9 ° C warming[11]; and a third, by Roson and van der Mensbrugghe, estimates a GDP loss of 1.8 per cent for a 2.3 ° C increase and 4.6 per cent loss for a 4.9 ° C warming[12]. The studies are summarised in Table 1.

There is considerable water-muddying within the IPCC's Fifth Assessment Report about possible scenarios where much higher warming takes place. But policy has to stay grounded with the more plausible possibilities. The world is replete with remote dangers that might just occur and providing for all of these would take up most of global income.

The bottom line is that the cost of global warming that might result from human activities, as reported by the IPCC, is very small. Moreover, the economists estimating these costs have done so on the basis of some highly unreliable evaluations of damage from climate change.

Thus the costs attributed to losses from reduced agricultural output and productivity, rising sea levels, re-allocation of tourist facilities, river floods and so on are compiled on a static basis. The costs assume people will not modify their behaviours in response to the forecasted gradual changes in temperature, precipitation patterns and tides. Responses to such changes have taken place in the

past and should be far more easily accommodated with the more accurate measurements we enjoy today.

**Table 1: Estimates of welfare loss due to climate change**

| Study | Warming (°C) | Impact (%GDP) | Method | Coverage |
|---|---|---|---|---|
| Nordhaus (2008) | 3.0 | -2.5 | Enumeration | Agriculture, sea level rise, other market impacts, human health, amenity, biodiversity, catastrophic impacts |
| Maddison and Rehdanz (2011) | 3.2 | -11.5 | Statistical | Self-reported happiness |
| Bosello, Eboli and Pierdederici | 1.9 | -0.5 | CGE | Energy demand; tourism; sea level rise; river floods; agriculture; forestry; human health |
| Roson and van der Mensbrugghe (2012) | 2.3<br>4.9 | -1.8<br>-4.6 | CGE | Agriculture, sea level rise, water resources, tourism, energy demand, human health, labor productivity |

Source: D. Arent and R. S. J. Tol, "Chapter 11: Key Economic Sectors and Services," Working Group II contribution to the Fifth Assessment Report, Climate Change 2014: Impacts, Adaptation, and Vulnerability, IPCC (Draft, 2014), accessed 17 July 2014, http:// ipcc-wg2. gov/ AR5/ images/ uploads/ WGIIAR5-Chap10_FGDall.pdf , 74. Table 10-3.

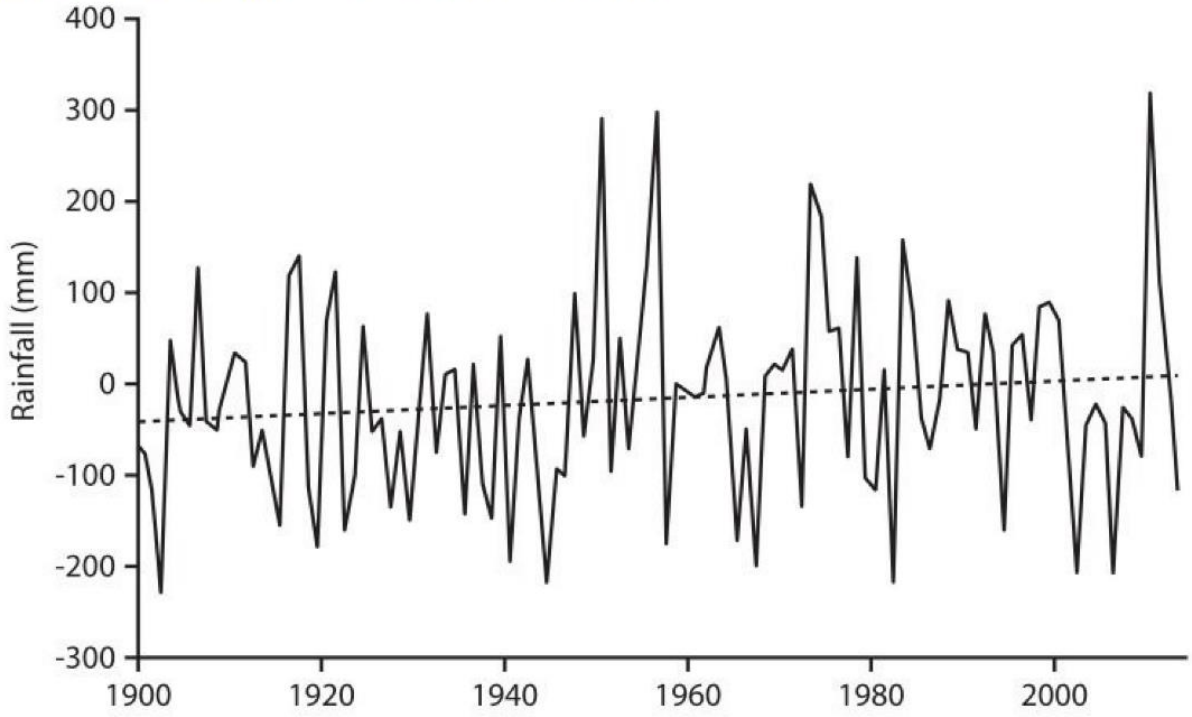
In addition, some of the outcomes that the IPCC is projecting are highly dubious. In the IPCC's Fifth Assessment Report, there are allegations of desertification of south east Australia's Murray-Darling Basin and of declining yields of major cereals. Both are readily rebutted.

The first stemmed from a politicisation of the process that interpreted drought, the pattern of which is well understood by Australia's more careful scientists, with a permanent change. The drought has broken and the alarmist scientists promoting the theory have been made to look foolish.

The drought costs estimated by the IPCC owe much to the Garnaut report, which compiled greater losses than the IPCC from climate change as part of its narrative. Garnaut put Australia's costs from a 5 ° C warming by the end of the century at eight per cent of GDP. His report put losses from agriculture at twenty per cent of the total and those losses were predominantly in the Murray-Darling Basin, home to over one-third of Australian farm output and the nation's major irrigation area. According to Garnaut, half of the present day production in the basin would be lost by 2050 and by the end of the century it would no longer support irrigated agriculture. Such projections are total fantasies.

There is no empirical evidence of the Murray Darling turning into the barren region that Garnaut projects. Rainfall measured by Jennifer Marohasy appears in Figure 1.

**Figure 1: Murray Darling Basin annual rainfall, 1900-2007**




Source: K. Stewart, "IPCC Dud Rainfall Predictions for the Murray-Darling Basin," KensKingdom, 4 April 2014, accessed 17 July 2014, http:// kenskingdom.wordpress.com/ 2014/ 04/ 04/ ipcc-dudrainfall-predictions-for-the-murray-darling-basin/ .

Drought years in the noughties, as at the turn of the nineteenth century and the 1940s, have been followed by high levels of rainfall and damage through flooding. After half a century of carbon emissions with, according to the IPCC and other warmists, each decade showing higher average temperatures, some corroboration of the impending desertification of south-east Australia should surely be evident. In fact the main threat to irrigated agriculture has come from governments taking water from farmers and allocating it to 'environmental flows.'

The suggestion that yields from major crops are declining as a result of climate change is equally spurious and not supported by empirical evidence.

The following discussion with the IPCC's Chris Field (' one of two lead authors') was broadcast by the Australian Broadcasting Commission:

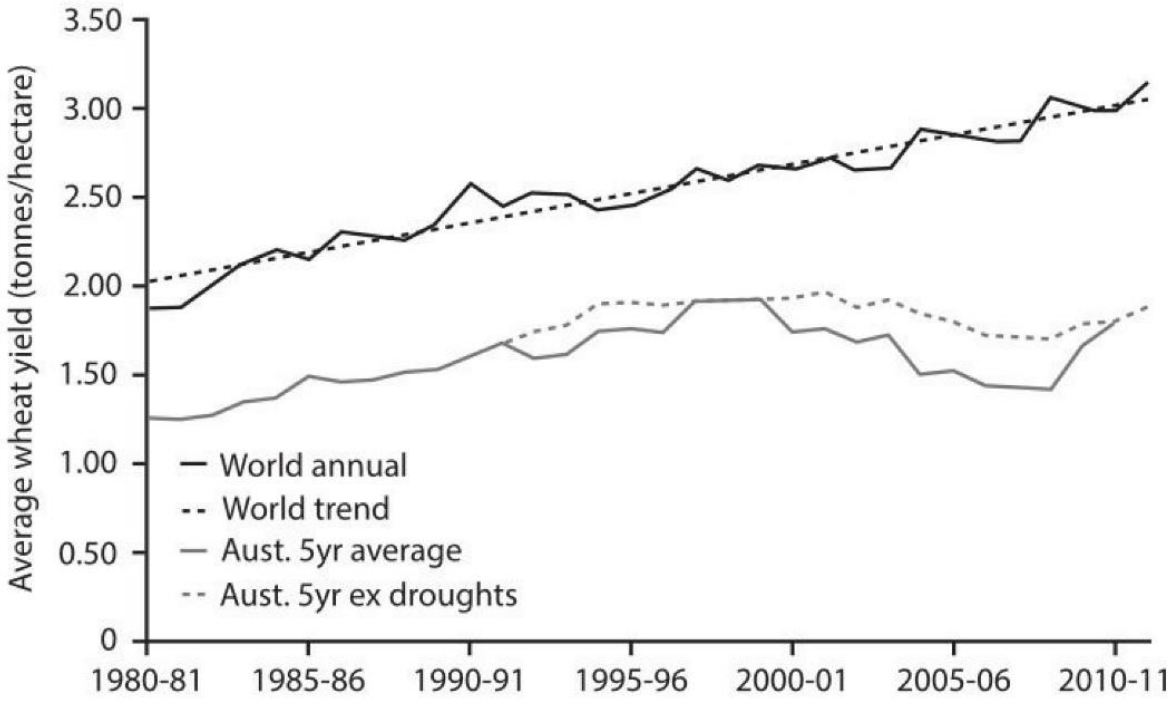
> CHRIS FIELD: Year-on-year, yields have increased by something like two per cent. But they've been increasing by less than that recently, and based on a number of very careful, thorough statistical analyses, researchers are now able to see that for at least two of the world's major food crops, wheat and maize, the increases in yields year-on-year have slowed, partly as a consequence of climate change. So the drag, the anchoring effect of climate change in making it more and more difficult to increase yields is something we're seeing at the global basis. I'm sure there are some places where there are still yield increases, but there are other places that are offsetting those where yields are decreasing. This idea that we're seeing slower-than-expected yield increases is emerging at the global scale.
>
> SARAH FERGUSON: But we're not just talking about— this isn't any longer about modelling; this is about already-observable facts?

> CHRIS FIELD: Absolutely. That's one of the really different things about this report than what the IPCC has said in the past. The impacts of changes that have already occurred are widespread and consequential.[13]

At least with respect to wheat, this is a highly contested view. Exhaustive research by Wilcox and Makowski has found that although higher temperatures mean reduced yields, 'the effects of high CO2 concentrations (> 640 ppm) outweighed the effects of increasing temperature (up to 2 degrees Celsius) and moderate declines in precipitation (up to 20 percent), leading to increasing yields.'[14]

Globally, yields of the major crops have increased at the same rate for decades with no signs of a fall-off. Figure 2 below illustrates global and Australian wheat trends (Australian yields declined for a number of country -specific reasons). These and other doubtful measurements of human induced climate driven change by the IPCC indicate that its estimate of slender economic loss from climate change is an exaggeration.

**Figure 2: Australian and global wheat yield trends**




Source: A. Lake, "Australia's declining crop yield trends I: Donald revisited" (paper presented at the 16th Australian Agronomy Conference, University of New England, New South Wales, 14-18 October 2012), accessed July 10, 2014 http:// www.regional.org.au/ au/ asa/ 2012/ agriculture/ 8163_lakea.htm .

## How much will abating climate change hurt?

IPCC Working Group III seeks to assess the costs incurred from stemming human induced greenhouse gas emissions.[15] It does so by quantifying the array of taxes, spending and regulatory measures that it considers necessary. The spin of its Summary for Policymakers is evident in its various injunctions, many of which use disturbances claimed from climate change as an agent for income redistribution. The report includes the following points:

- Limiting the effects of climate change is necessary to achieve sustainable development and equity, including poverty eradication.

- Effective mitigation will not be achieved if individual agents advance their own interests independently.
- Issues of equity, justice, and fairness arise with respect to mitigation and adaptation.
- Climate policy intersects with other societal goals creating the possibility of co-benefits or adverse side-effects.

These boilerplate advocacy statements are accompanied by optimistic estimates of the costs which the IPCC has estimated will emanate from the measures it proposes to curtail greenhouse gas emissions.

The highly complex Table 2 summarises modeling of a number of different costs of climate emission reductions and their variations . As is conventionally the case, the modelling is simplified to exclude transitional losses, and the costs of thousands of different taxes and regulatory measures are assumed to be robust and stable.

In the table, to achieve emission concentrations at 450 parts per million in 2050 (row 2), the cost is put at a cumulative 3.4 per cent of world income levels. This cost rises to 4.8 per cent in 2100.

The 2050 cost would increase by 138 per cent (to 4.7 per cent) if carbon capture and storage (CCS) is unavailable.

## Table 2: IPCC Estimates of abatement costs

| | **Consumption losses in cost-effective implementation scenarios** | | | | **Increase in total discounted mitigation costs in scenarios with limited availability of technologies** | | | | **Increase in mid-and longer term mitigation costs due delayed addition mitigation up to 2030** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [% reduction in consumption relative to baseline] | | | [percentage point reduction in annualised consumption growth rate] | [% increase in total discounted mitigation costs (2015-2100) relative to default technology assumptions] | | | | [% increase in mitigation costs relative to immediate mitigation] | | | |
| **2100 concentration (ppm $CO_2$eq)** | 2030 | 2050 | 2100 | 2010-2100 | No CCS | Nuclear phase out | Limited solar / wind | Limited bio-energy | ≤55 $GtCO_2$eq | | >55 $GtCO_2$eq | |
| | | | | | | | | | 2030-2050 | 2050-2100 | 2030-2050 | 2050-2100 |
| **450 (430-480)** | 1.7 (1.0-3.7) [N:14] | 3.4 (2.1-6.2) | 4.8 (2.9-11.4) | 0.06 (0.04-0.14) | 138 (29-297) [N: 4] | 7 (4-18) [N: 8] | 6 (2-29) [N: 8] | 64 (44-78) [N: 8] | 28 (14-50) [N: 34] | 15 (5-59) | 44 (2-78) [N: 29] | 37 (16-82) |
| **500 (480-530)** | 1.7 (0.6-2.1) [N: 32] | 2.7 (1.5-42.) | 4.7 (2.4-10.6) | 0.06 (0.03-0.13) | | | | | | | | |
| **550 (530-580)** | 0.6 (0.2-1.3) [N: 46] | 1.7 (1.2-3.3) | 3.8 (1.2-7.3) | 0.04 (0.01-0.09) | 39 (18-75) [N: 11] | 13 (2-13) [N: 10] | 8 (5-15) [N:10] | 18 (4-66) [N: 12] | 3 (-5-16) [N: 14] | 4 (-4-11) | 4 (-4-11) | 16 (5-24) |
| **580-650** | 0.3 (0-0.9) [N: 16] | 1.3 (0.5-2.0) | 2.3 (1.2-4.4) | 0.03 (0.01-0.05) | | | | | | | | |

Source: IPCC, "Summary for Policymakers," Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Cambridge: Cambridge University Press, 2014), 16.

It would increase a further 7 per cent and 6 per cent respectively if nuclear is phased out, and wind and solar are limited to 20 per cent of energy supply. And it would increase a further 64 per cent if bioenergy fuels are not available, bringing a total of 8.6 per cent by 2100.

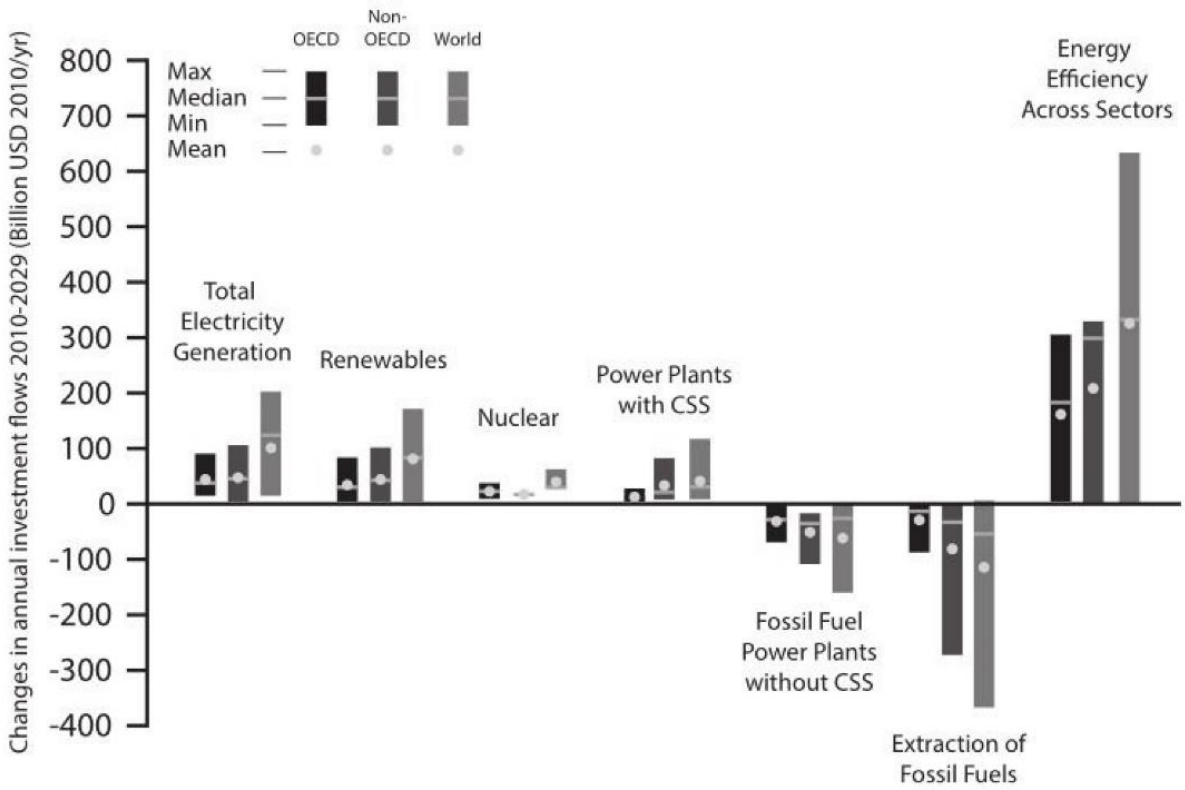
With emissions held at 550 parts per million (ppm), baseline costs are stated as 1.7 per cent. Hence, just as the costs of business-as-usual (Table 1) are small, so too are the estimated costs entailed in radically transforming the global economy to achieve the sought after abatement.

The implausibility of this, even with all the yet-to-be-developed technologies, is magnified once the uncertainties of these technologies' performances are factored in. One notable mirage technology is carbon capture and storage (CCS), a program bankrolled in large part by the Australian Government which has recently considerably reduced the funding allocation for the program.

Even if the envisaged new or improved technologies were to be costless, the IPCC's estimated losses to the global economy from the forced shift away from fossil fuels are greater than the costs of business-as-usual. Compounding this unfavourable deal is the question of the reliability of the avoidance cost estimates. Economic assessments of minor changes to economies or policy shocks can be modelled with passable degrees of accuracy. But the IPCC modelling attempts to estimate what amounts to a total reorganisation of production, transport and living conditions and to project these a century into the future.

An example of the economic reorganisation entailed is quantified in Figure 3, which shows over the coming fifteen years extraordinary improvements from unknown increases in energy efficiency, a collapse in spending in fossil fuel extraction and a massive reduction in power station investment. These projections also cover the developing economies which are even more resistant to suicidal economic policies than OECD countries.

**Figure 3: Forecasts of future energy investments**




Source: "Summary for Policymakers," Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Cambridge: Cambridge University Press, 2014), 28.

The highly improbable conjecture is that between 2009 and 2029 $ 550 billion a year extra will be invested in energy efficiency and $ 540 billion less invested in fossil fuel extraction and fossil fuel plants without CCS. The estimates also suggest over $ 100 billion a year will be spent on the totally unproven technology of CCS fuel plants with a further $ 180 billion a year on renewables, which forecasts by the IPCC and official government sources acknowledge will remain three times the cost of coal based electricity generation.

It seems that, having been forced to acknowledge that the much feared global warming has only a trivial effect on real levels of human welfare, the IPCC has to ensure that the estimated costs of its pursuit of the New Jerusalem are not too great. Forcing a radical transformation of society by banning the use of oil and coal and demanding that we reduce energy consumption and shift to horrendously expensive renewables and mythical technology like carbon capture and storage is depicted as a cake walk. Seemingly, only politicians' myopia is standing in the way of a near costless conversion of the global economy away from energy involving high emissions of carbon dioxide.

Just as the government-funded Stern and Garnaut reports produced estimated costs of global warming far in excess of those of the IPCC, these sources also estimated the costs of restraining emissions to be even lower than IPCC expectations. The Stern Report sought reductions in global emissions of CO2 by 80 per cent of current levels by 2050.[16] Stern argued that the economic cost will be 1 per cent of world GDP, 'which poses little threat to standards of living given that the economic output in the OECD countries is likely to rise by over 200 per cent and in developing countries by more than 400 per cent' during this period.[17]

Neither Stern nor Garnaut has plausibility. Both reports used a near-zero-interest-rates approach to evaluating future costs. Stern used 0.1-1.4 per cent and Garnaut used 1.35-2.65 per cent. A low discount rate means future benefits appear higher than they should be. As the Nongovernmental International Panel on Climate Change argues,

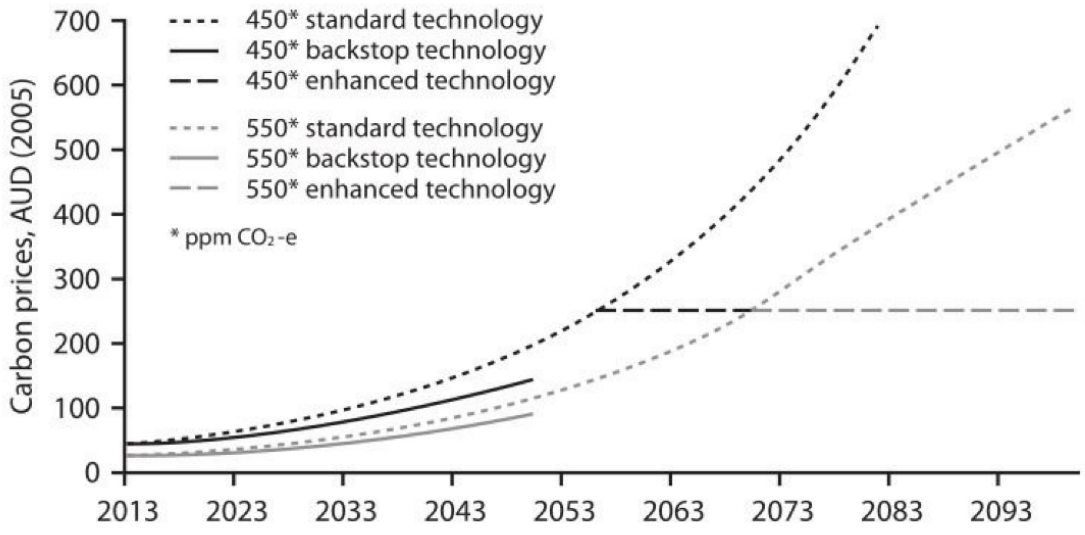
> Discounting is a standard tool of policy analysis on issues ranging from financing public facilities to education and fighting crime. How can climate change be exempted from the use of an analytical tool that is required in all other debates? And if the purpose of reducing greenhouse gas emissions is to benefit future generations, it must be compared to other investments that would do the same thing. Nearly any investment in capital and services that raises productivity and produces wealth benefits future generations. Making investments in emission reductions that yield less than the return on alternative investments in fact impoverishes future generations … [18]

The modelling Garnaut commissioned resulted in the prices of CO2 for the different scenarios shown in Figure 4.

The prices are assumed to level off once they reach $250 per tonne (in 2014 prices about US $285) because it is assumed that technology that is not presently conceptualised will cut in at that price.

Near future carbon prices are estimated to be rather greater than these by the OECD.[19] In US 2007 dollars, the carbon prices necessary for countries or blocs to meet the global goals in 2020 exceed $110 per tonne if each country focused only on its domestic emissions including those from agriculture. If final demand were to be incorporated (' including final demand' in Table 3) the tax would still be $80 per tonne.

**Figure 4: Price per tonne of carbon dioxide for different emission restraints**




Standard technology refers to the technologies currently in existence
Backstop technology refers to methods that control carbon pricing
Enhanced technology refers to the technologies that do not yet exist

Source: R. Garnaut, *The Garnaut Climate Change Review: Final Report* (Cambridge: Cambridge University Press, 2008), 251.

The per capita costs of carbon taxes of this magnitude are considerable. For Australia, with emissions of some 18 tonnes per capita (similar to the US and Canada) a tax of $75 per tonne would cost $1350 per head unless it were to be able to be imposed on all sources, in which case it would be around $250 per head (US and Canada are comparable).[20] These direct costs of a carbon tax understate the true costs since they exclude the costs that are incorporated in the goods and services we buy.

Surveys have indicated that few people, even those voicing concerns about global emissions, are willing to pay these sorts of sums to bring about emission reductions. For Australia, the research firm Galaxy found that only 4 per cent of respondents said they were willing to outlay over $1000 per year to reduce greenhouse emissions (42 per cent said they would outlay over $300 per year).[21]

Of course , saying one would outlay funds and actually outlaying them is different— people, rich and poor, resist tax outlays even if they consider them to be valid.

**Table 3: Carbon prices in multiple carbon markets scenarios, 2020 (USD 2007/tonne of $CO_2$ equivalent)**

| Region | Partial | Incl. agriculture | Incl. final demand | Incl. agriculture & final demand | Incl. non-$CO_2$ | Incl. non-$CO_2$ & agriculture | Incl. non-$CO_2$ & final demand | All sources |
|---|---|---|---|---|---|---|---|---|
| Australia & New Zealand | 75 | 74 | 60 | 60 | 35 | 20 | 31 | 18 |
| Canada | 117 | 112 | 79 | 77 | 57 | 46 | 43 | 36 |
| EU & EFTA | 86 | 83 | 52 | 51 | 28 | 21 | 22 | 17 |
| Japan & Korea | 259 | 257 | 187 | 185 | 178 | 165 | 132 | 124 |
| Other European Annex I countries | 21 | 21 | 11 | 11 | 3 | 2 | 3 | 2 |
| USA | 64 | 59 | 47 | 45 | 26 | 22 | 22 | 19 |
| **World*** | **114** | **111** | **81** | **79** | **60** | **52** | **46** | **41** |

*World carbon prices are calculated as an average over acting countries, and weighted by emissions reductions.

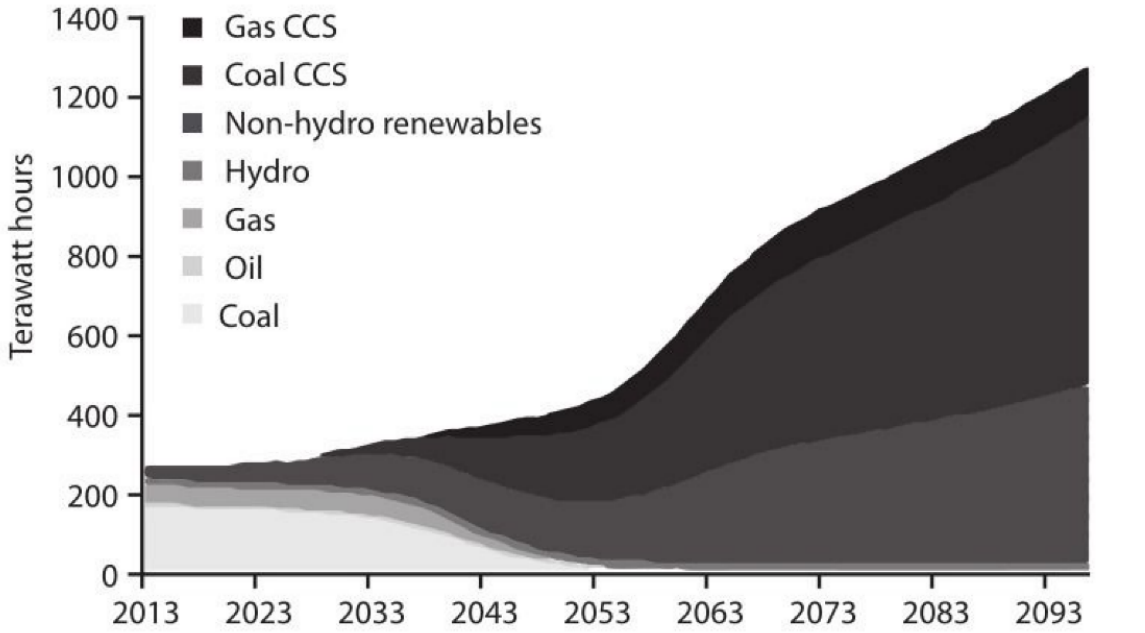
Source: E. Landzi, D. Mullaly, J. Chateau and R. Dellink, "Addressing Competitiveness and Carbon Leakage Impacts Arising from Multiple Carbon Markets: A Modelling Assessment," *OECD Environment Working Papers*, No. 58 (2014), 25.

According to Garnaut, non-hydro renewables and CCS will account for 90 per cent of electricity generation in Australia by 2050. If supply increases by only 20 per cent on the 2014 level of 220,000 GWh, reaching 264,000 GWh, at a current carbon intensity of 0.87 tonnes per MWh, this translates into 230 million tonnes of CO2.[22] With carbon priced at $250 per tonne, the additional cost of electricity would be $ 57,500 million, or, for a population which might by then be 30 million, close to an average of $2,000 per capita. And this is only for electricity, which is responsible for less than half of total emissions.

Direct effects on household energy consumers aside, Garnaut trivialises the costs of achieving Australia's required 80 per cent emission reductions, which would necessitate abandoning existing technology and substituting it with totally unproven technologies. The mix of technologies differs from scenario to scenario, but Figure 5 is typical of the mix Garnuat forecasts.

Noteworthy is that by 2050 virtually all electricity is assumed to be generated from technologies that either don't presently exist or are massively more expensive than those of today.

**Figure 5: Australia's electricity generation technology shares, 550 ppm scenario**



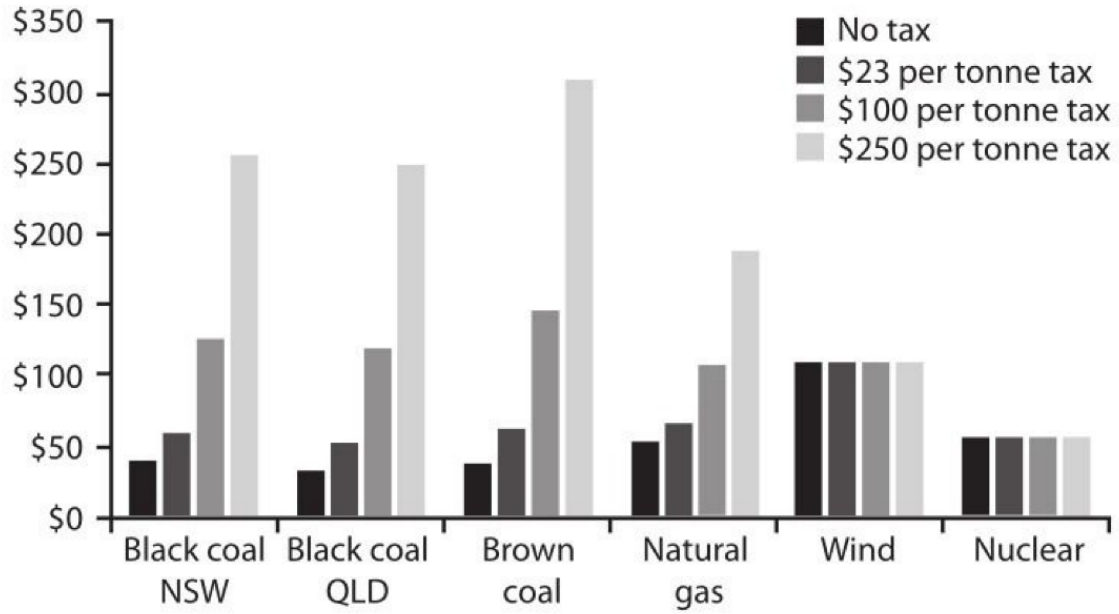

Source: Alan Moran

Critical in estimating the costs is the CO2 price necessary to drive the changes. This depends on the ease of substituting carbon emitting energy for other forms of energy or replacing energy by other goods and services. If the necessary tax were as low as $ 100 per tonne, this would treble Australia's wholesale electricity price. Figure 6 illustrates this for Australian electricity supplies.

The only experience of that sort of price shock, which is far less than the IPCC considers necessary, was the quadrupling of oil prices during the 1970s.

However, that brought moderating effects through substitutions from oil to coal and gas and it led to increased oil discoveries. Climate change policy would prevent similar developments.

**Figure 6: Tax-inclusive ex-generator electricity costs**




## Conclusion

Just as economic assessments place a relatively low cost of quantifiable damage from climate change, most studies also place a low cost on emission reduction measures. Confidence in such outcomes is clearly not shared by the developing countries which rejected as draconian the measures proposed at Copenhagen in 2009. Nor is the continued resistance of developed countries (with the possible exception of the EU) to take actions involving carbon taxes an indication that there is widespread belief in the low costs promised.

The bottom line is that if global warming is taking place, even the IPCC is forced to acknowledge that it will not be very harmful. According to their own cited studies, the costs are less than a year's annual growth in global GDP. Attempts to suppress emissions of greenhouse gases, even if politically feasible in a multilateral world of nations with different interests, would, on IPCC estimates, cost more than any damage the emissions may be causing. And the costs of such radical action would appear to be grossly understated by the IPCC.

Moreover, the political feasibility of near unanimity of action— without which the abatement assumptions unravel—were shown to be impossible at Copenhagen in 2009 where the increasingly powerful Sino-Indian bloc refused to be persuaded by the threats and blandishments of the EU and its allies. Stand-outs of any significant producer against imposing de facto energy taxes on its businesses would mean that energy-intensive industries will migrate to the lower taxed venue and negate the emission reductions.

Assertions that dire consequences will befall us decades or even centuries into the future make rattling good stories, but when they are unaccompanied by any supporting evidence they have to be treated with caution if they entail high present day costs.

Long range forecasts are fraught with uncertainties and the costs of taking action to obviate a risk must be considered alongside the costs of the risks themselves and the possibilities of taking such

action in a world of sovereign states with different interests. And in the case of climate change, the costs as measured are said to be modest.

Even the threefold increase in the costs of energy requires highly optimistic assumptions about low cost replacements for current energy sources. Energy is the most basic of economic resources behind wealth and living standards even though it represents only 5 per cent of GDP (much of which is its distribution costs).

Shifting to the envisaged lower productivity power plants —wind, carbon capture and storage, and solar— means a major reduction in capital productivity, which alongside innovation is the key driver of overall productivity increases.

Finally, the complacency of the IPCC and some other official reports in advocating a near abandonment of current fossil fuels rests on long term forecasts. In addressing the pitfalls of these, one only has to look back to the momentous year of 1914.

A hundred years ago, who would have forecast the fall of the European empires, the rise and fall of communism , the rise of China and India, widespread international air travel, the internet and so on? Back then the few who would have forecast dramatic climate change a century hence would have been proved wrong.

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