

DOCUMENT 1: letters to Dr Pachauri

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Letter of 6 August 2002 from Ian Castles to Dr. Rajendra Pachauri

Dr. Rajendra Pachauri,
Chairman,
Intergovernmental Panel on Climate Change

Dear Dr. Pachauri,

1. Thank you for your interest in my criticisms of the IPCC *Special Report on Emissions Scenarios* (SRES), and for inviting me to put my concerns in writing. I am taking the liberty of sending copies of this letter to others who joined in discussions on climate change issues with you in Canberra on 23 and 24 July, and also to a 'mailing list' of my colleagues in the international statistical community, government agencies and universities who follow my ongoing correspondence about the use and abuse of statistics in public debates about globalisation, poverty and the distribution of incomes both within and between countries. I will of course forward any comments that you or the SRES authors may have on my criticisms to all of those to whom I am copying this letter.

Credentials

2. As mentioned in our discussions, I was formerly the Australian Statistician (1986 to 1994) and head of the Australian Department of Finance (1979-86). I am a former President of the International Association of Official Statistics (IAOS), a section of the International Statistical Institute (ISI), and have been a consultant to several national statistical offices and international organisations on a range of statistical issues.

Statistics of Global Poverty and Inequality

3. Following the release of the UNDP's *Human Development Report 1999* (HDR 1999), I made extensive statistical criticisms of the treatment in that report of trends in global poverty and inequality. At the request of the 2000 meeting of the UN Statistical Commission (UNSC), those criticisms were examined by an group of expert statisticians constituted as the Friends of the Chair of the Commission. The report of the group, which is available at <http://www.un.org/Depts/unsc/stat-com/2001docs/2001-18e.pdf>, upheld my more serious criticisms. In particular, the Friends of the Chair of the UNSC held that HDR 1999 had made a 'material error' (i.e., one which left the reader with 'a fundamentally distorted view of the phenomenon being described') in relying on national accounting aggregates converted into \$US at current exchange rates to compare living standards between countries.

4. The HDR Office of the UNDP accepted the report, and has made major improvements in statistical presentation and reporting in subsequent issues of the HDR.

5. Both the SRES and the Contribution of IPCC Working Group III (WG III) to the Third Assessment Report (*Climate Change 2001: Mitigation*) cite incorrect statements from pre-2000 issues of the HDR in support of claims about the international distribution of incomes. Some of these statements involve exactly the same 'material error' as that referred to in paragraph 3 above. Thus the WG III Contribution includes the following:

'The distributional dimension of global poverty was illustrated vividly by the *Human Development Report 1989* (*sic* - the first HDR was published in 1990), in the form that came to be known as the

champagne glass [reproduced as Figure 1.4 in the IPCC Report]. This representation of global income distribution shows that in 1988 the richest fifth of the world's population received 82.7% of the global income, which is nearly 60 times the share of the income received by the poorest fifth (1.4%). More recent statistics indicate that inequality has widened further since then and that in 1999 the richest quintile received 80 times the income earned by the poorest quintile (UNDP 1999)' (section 1.3.1).

6. Another paragraph in the same section of the Contribution of WG III cites statements in the World Bank's *World Development Report 2000* in support of similar claims about high and rising global inequality. The Australian Treasury has published a detailed critique of this analysis by the Bank, and has cited statements included in this analysis as examples of 'material errors in the use of statistics' ("Global poverty and inequality in the 20th century: turning the corner", 2001, pps. 24-26, 34-40, available in pdf on the Treasury website at www.treasury.gov.au).

7. The SRES cites the UNDP's HDR 1993 in support of the proposition that 'The poorest 20% of Bangladesh's population ... earn per capita incomes that are a factor of 700 lower than that of the 20% richest Swiss population' (section 4.4.4.1). This comparison is invalid, because it is based on the assumption that the poor Bangladeshi family has converted the whole of its income into foreign currency, and spent it on goods and services at average world prices rather than Bangladeshi prices.

8. The same false assumption underlies the claim that 'When measured across the four SRES regions in 1990, income per capita differences are nearly 40 to 1 (between ASIA and OECD90)' (SRES, section 4.4.4.1). The difference in average incomes between these two regions, properly measured, was less than 10 to 1 in 1990, and has since contracted significantly. Thus the projected growth of real average incomes in the ASIA region (i.e., developing Asia) between 1990 and 2100 that is assumed in the A1 scenarios (an increase by a factor of about 140 to 1) and the B1 scenarios (an increase by a factor of more than 70 to 1) would take incomes in that region to far higher levels than the present OECD90 average, and possibly to higher levels than the OECD90 average in 2100. (This latter comparison is more problematic, because of the difficulty of allowing for the 'Gerschenkron effect').

9. The rates of growth in global GDP presented in the SRES significantly understate the true increases in GDP that underlie the emissions projections. This is because the regions that are expected, by assumption, to achieve the highest rates of economic growth in the twenty-first century are significantly underweighted in the calculations of global GDP. An indication of the possible extent of understatement can be derived by comparing the IMF's estimate of the average annual rate of growth in world GDP between 1994 and 2003 at market exchange rates (2.8 per cent) with the corresponding estimate of this growth measured on the correct basis using purchasing power parities (3.6 per cent). In per capita terms, calculation of the growth rate on the discredited exchange rate-based method used in the SRES yields an average annual increase over this decade of only 1.4 per cent, compared with an increase of 2.2 per cent on the correct purchasing power-corrected basis (IMF, *World Economic Outlook*, May 2002, p. 157).

10. On the basis of estimates by Angus Maddison which are used in the SRES itself in other contexts, average real incomes in the United States increased by a factor of perhaps 5 to 1 in the nineteenth century, and average real incomes in Japan increased by a factor of almost 20 to 1 in the twentieth century. Thus the historical record gives no support to projections that in the course of the twenty-first century there could be increases in average incomes in the entire continent of Asia by a factor of 140 to 1 - or even of 70 to 1, which is the assumption underlying the scenario yielding the *lowest* projected level of emissions. Yet it is upon such fantastic assumptions that the IPCC's projections of emissions, and therefore of temperatures, are predicated.

The B1 IMAGE Projections

11. The B1 IMAGE projection is of particular interest, because this is the marker projection that yields the lowest increase in temperature between 1990 and 2100 - between 1.4 degrees C. and 2.5 degrees C. for the seven climate models, with a projected increase averaged over those seven models of 1.98 degrees C. from 1990 and of 1.82 degrees C. from 2000 (*Climate Change 2001: The Scientific Basis*, Appendix II, Table II. 4).

12. According to the SRES Terms of Reference (SRES, Appendix I), the process for developing the scenarios was to be: 'First, key input assumptions would be provided to modelers', and 'Second, modelers would be asked to construct emissions scenarios based on the input assumptions provided'.

13. In this case, the opposite process was followed. The B1 IMAGE modelers (1) *assumed* an extraordinarily rapid growth in annual global emissions of carbon dioxide from the burning of fossil fuels (an increase of 1.6 billion tonnes between 2000 and 2010, and a further increase of 1.5 billion tonnes between 2010 and 2020, compared with increases of only 0.8 billion tonnes in the 1980s and of 0.7 billion tonnes in the 1990s); (2) allocated the whole of the very large increases in these emissions in both decades to developing countries; and (3) used the model to estimate the levels of income, energy use and emissions of other greenhouse gases and aerosols that might be associated with the assumed levels of fossil carbon dioxide emissions.

14. In the current decade, for example, the results of the B1 IMAGE model are predicated upon *assumed* increases in emissions of exactly 0.8 billion tonnes both in the ASIA and the ALM (Africa, Latin America and the Middle East) regions. In other words, the modellers assumed that increases in emissions in *each* of the SRES developing regions (ASIA and ALM) would be greater in the current decade than the increase for the world as a whole between 1990 and 2000.

15. These assumptions are patently unrealistic, even for a 'high emissions scenario'. They translate into increases in per capita emissions of fossil carbon dioxide of 24% in ASIA and of 46% in ALM. On this basis, the output of the B1 IMAGE model suggests that GDP per head could rise by around 50% in both regions.

16. In the case of the ALM region, it is already certain that such a growth in incomes will not occur. In the IMF's *World Economic Outlook May 2002*, it is estimated that real GDP per head declined in this region in 2001 and that there will be a further decline in 2002 (p. 163). Even if the IMF's rather optimistic 'world medium-term baseline scenario' for the years 2003 to 2007 were to be realised (p. 224), it would require a further increase of no less than 40 per cent in real GDP in 'ALM' in the succeeding three years to achieve the increase in decadal GDP projected in the B1 IMAGE scenario. If the modelers had followed the procedure laid down in the SRES terms of reference, they would have 'fed in' a much lower rate of growth in GDP as a 'key output assumption'. They could then have concluded that fossil carbon emissions in this region will not increase by anything like 0.9 billion tonnes.

17. The projected growth in Asian GDP in the current decade may well be realised, but with a far slower growth in carbon dioxide emissions than is assumed in the B1 IMAGE projection. There is no obvious reason why the rapid decline in 'emissions intensity' in ASIA in the 1990s should not be maintained during the current decade. Again, if the procedure for scenario development laid down in the SRES terms of reference (paragraph 11 above) had been followed, a fast rate of decline in emissions intensity in this region would have been a 'key input assumption'. The output of the model would then have revealed that carbon emissions would not need to increase by anything like 0.8 billion tonnes.

18. In short, the B1 IMAGE projection, which belongs to the 'storyline and scenario family' that features 'rapid change in economic structures toward a service and information economy', 'reductions in material intensity', 'the introduction of clean and resource-efficient technologies' and 'global solutions to economic, social and environmental sustainability', is itself a 'high emissions scenario' - at

least in the early decades of the century. It assumes that there will be a sharp reversal in the downward trend in global fossil fuel emissions per head that occurred in the last two decades of the twentieth century. This seems unlikely: under the 'reference' scenario in the World Energy Council Commission Report *Energy for Tomorrow's World* (1993), global carbon dioxide emissions per head were projected to *decrease* by 7% between 1990 and 2020. It is significant that the WEC study, unlike the SRES, was based on purchasing power parity estimates of GDP.

Recommendations

19. I believe that it is important that governments be advised as soon as possible that the economic projections used in the IPCC emissions scenarios are technically unsound, having been derived by converting national GDPs in nominal values into a common currency using exchange rates. This procedure is not permissible under the internationally-recognised *System of National Accounts*, and was recently rejected by an expert group in a report to the UN Statistical Commission. The practice of using exchange rate conversion is especially inappropriate in relation to projections of physical phenomena such as emissions of greenhouse gases and aerosols.

20. In the introduction to the first edition of his book *Global Warming: The Complete Briefing* (1994), Sir John Houghton, then Co-Chairman of the Scientific Assessment Working Group of the IPCC, said that 'scientists have a responsibility to communicate the best possible information about the likely magnitude of climate change, along with clear statements of the assumptions made and the level of uncertainty in the estimates.' As there was no clear statement of the assumptions underlying the projections of the likely magnitude of climate change in the IPCC's Third Assessment Report, I consider it vital that governments be advised that the *lowest* of the SRES projections assumed that GDP per capita would increase to more than 70 times its 1990 level in Asia (excluding Japan) and to nearly 30 times its 1990 level in Africa, Latin America and the Middle East, by the end of the century. Contrary to statements made in the SRES, these projections imply that real incomes in the whole of the developing world will be many times greater than those in the richest countries in the world today.

21. As I mentioned in our discussions, it would also be desirable to seek the involvement of national statistical offices and of the International Statistical Institute in the new emissions projections that I understand are to be prepared for the IPCC's Fourth Assessment Report.

23. I hope that these comments are helpful to you. I repeat my congratulations to you on your appointment as Chairman of the IPCC, and wish you well in your difficult but important task.

Sincerely,

Ian Castles
National Centre for Development Studies
Australian National University

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Letter of 29 August 2002 from Ian Castles to Dr. Rajendra Pachauri

Dr. Rajendra Pachauri,
Chairman,
Intergovernmental Panel on Climate Change

Dear Dr. Pachauri,

In my letter to you of 6 August, I said that I believed that it was “important that governments be advised as soon as possible that the economic projections used in the IPCC emissions scenarios are technically unsound, having been derived by converting national GDPs in nominal values into a common currency using exchange rates”.

The pernicious consequences of using this false method of measuring output are apparent in the analysis of greenhouse issues in the *World Development Report 2003*, released by the World Bank last week.

For example, the Bank argues that “non-OECD countries use ... 3.8 times as much energy per dollar of GDP [as OECD countries], and claims that “This disparity suggests looking for ways that developing and transition countries can increase efficiency and reduce fuel costs - with reduced GHG emissions as a welcome side-benefit ...” The Bank goes on to wonder “why these apparent ‘win-win’ situations are so elusive”, and decides that the answer lies in two types of institutional failure: “distortions in energy policy [which] benefit special interests”, and the neglect by firms and households of profitable ways of saving energy “because it is simply too much trouble to pursue them” (p. 177).

There is a simpler answer to the question that the Bank poses. The assumption of a huge margin of difference in energy intensity between OECD and non-OECD countries which the Bank is seeking to explain is false. The ratio of use of energy per unit of GDP in non-OECD countries to that in OECD countries, calculated using PPPs rather than the spurious exchange rate conversion basis favoured by the Bank (and the IPCC), is not 3.8:1 but 1.2:1.

On the same page of WDR 2003, the Bank wonders what will happen when people “aspire to the current lifestyle of a prosperous country”, and puts forward some “simple arithmetic” to show why the Bank supposes this to be impossible:

“Among the prosperous countries, Norway has one of the lowest rates of CO₂ emissions per capita from energy, owing in part to ample use of hydro-power. Yet if the global population of 2050 emitted CO₂ on average at this rate, the total would be about 2.5 times current global emissions, which would greatly exceed the planet’s absorptive capacity.”

The argument is grossly misleading for a number of reasons. But the key point that it illustrates is the Bank’s failure to understand the basis of the IPCC emissions projections, the lowest of which assumes that developing countries will not only aspire to but will in fact achieve far higher living standards than that of the most prosperous countries today.

Pasted below is the text of an article which appears under my name in this morning’s *Canberra Times*, under the heading “Greenhouse emissions calculations quite wrong”. It puts the view that the IPCC should base its climate projections on realistic assessments of future greenhouse emissions, based in turn on realistic projections of the future of the world economy, rather than on the quantifi-

cation of fantastic “storylines”.

With best wishes,

Ian Castles

Text pasted in:

In January last year the Intergovernmental Panel on Climate Change (IPCC) released its latest projections of prospective global warming. The key finding was that “globally averaged mean surface temperature is projected to increase by 1.4 to 5.8°C over the period 1990 to 2100”.

The statement led to widespread alarm. Most commentators, including many scientists, interpreted the IPCC’s new projected range as a *forecast* of massive rises in global temperatures, but the IPCC made projections, not predictions, by feeding hypothetical levels of future greenhouse emissions into climate models. The output of such models cannot be better than the input assumptions upon which they are based.

The simulated temperature increases in the IPCC’s lowest emissions scenario ranged from 1.4 to 2.5°C. Some assumptions incorporated in this scenario were conservative, but it also assumed an extraordinarily high rate of economic growth in the developing world.

Specifically, the IPCC assumed that the volume of goods and services produced per head in 2100 would be more than 70 times 1990 levels in developing countries in Asia, and nearly 30 times 1990 levels in other developing countries. Far from marking the lower bound of likely outcomes, such astronomic increases are extremely improbable.

The reasoning that produced these assumptions was as follows. Productivity in the rich countries is likely to continue to increase.

In 1990 average incomes in these countries, on the exchange rate-converted basis used in the IPCC projections, were 40 times higher than in Asian developing countries and 12 times higher than the average of developing countries elsewhere. If this gap is to be substantially closed by 2100 on these assumptions, this century must be an era of unprecedented growth.

In fact, average incomes in developing countries are three or four times higher than the IPCC assumed. By adopting the long-discredited method of converting incomes into a common currency using current exchange rates, the IPCC modellers greatly overstated the size of the development gap, but there are two more fundamental objections to the modellers’ argument.

First, living standards in the developing countries in 2100 will depend on their *actual* economic growth during the coming century. No significant country has ever achieved a 20-fold increase in output per head in a century, let alone the 30-fold or 70-fold increases projected by the IPCC for most of the world’s population.

Secondly, and paradoxically, the IPCC’s model-builders are hostile to wealth *per se*. They are obsessed by the belief that growth in productivity and affluence inevitably leads to unacceptable growth in greenhouse emissions. For example, they argue that “if governments support the development of rapid-growth sectors, the tendency may be to promote long-term economic growth, increase household income and consumption, and hence increase GHG emissions”.

They even claim that “protectionist policies may ... reduce national economic efficiency, which dampens economic growth and tends to restrict growth in GHG emissions”.

These concerns are misplaced. Economic growth maximises the output of goods and services for a *minimum* expenditure of scarce resources. Conversely, reductions in economic efficiency tend to increase the volume of resources required to produce a given volume of final output, and therefore *raise* the level of GHG emissions.

In Britain, the first developed economy, average carbon dioxide emissions exceeded 2.5 tonnes of carbon per head of the population in 1880, before the motor age began.

Now Britain produces at least five times the volume of goods and services per head as in 1880, but *per capita* emissions of carbon dioxide have not increased at all.

According to economic historian Angus Maddison, average incomes in China are now higher than in Britain in 1880, but China's carbon emissions are only 0.6 tonnes of carbon per head - less than a quarter of the levels in late-Victorian Britain.

And China's emissions per unit of output are less than half their levels of twenty years ago.

Global carbon dioxide emissions per head from the burning of fossil fuels reached a peak of over 1.2 tonnes per head of population in 1979. They have since declined by nearly 10 per cent.

It is not true that the *per capita* emissions of rich countries will necessarily increase as they become still richer. No country in western Europe today emits the 3.2 tonnes of carbon per head that Britons emitted in 1913, and *per capita* emissions in the United States, Canada, Germany, France, the Netherlands, Belgium and Sweden are now lower than the peak levels reached in the 1970s or earlier.

None of the high-income countries of the Organisation for Economic Co-operation and Development now emits the volume of carbon per head that the failing Communist regime in East Germany was emitting in the late 1980s, and poverty-stricken Communist North Korea emits more carbon dioxide per head than South Korea (and most other OECD countries).

It is true that *per capita* emissions in most developing countries will increase as the world's poor get richer, but this will be happening in a world in which emissions in many rich countries will continue to decline.

Sadly, there is a serious risk that poverty will escalate in many of the poorest countries, especially in sub-Saharan Africa. The real problem is that the people of these countries may remain very poor, not the impact on the world's climate if they and the rest of the developing world become very rich.

The IPCC should base its climate projections on realistic assessments of future greenhouse emissions, not on the quantification of improbable 'storylines' that assume that all of the world's problems except climate change will be magically overcome.

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Letter of 28 October 2002 from David Henderson to Dr Pachauri

Dear Dr Pachauri,

The former head of the Australian Bureau of Statistics, Ian Castles, who is an old friend of mine, wrote to you on 6 August, and later on 29 August, to raise a number of issues concerning the projections that are set out in the 2001 Special Report on Emissions Scenarios. In replying, you have said that you will be making in due course a full response to him.

I would like to take further two of the arguments that Castles has made.

FIRST, there is the issue of whether comparative cross-country GDP data should be given at market exchange rates or in purchasing power parity (PPP) terms: in the scenario projections, the former procedure was followed.

Ian Castles has made the case, here as in other contexts, for choosing the PPP basis instead. In this he speaks for the general body of economists and economic statisticians who are working with these data; and as you know, the OECD, the IMF and other agencies moved some years ago to the use of PPP-based weighting systems for their projections. But reading Ian's letters to you, I was puzzled to know how and why the choice of market exchange rates would affect the SRES scenario projections of total GDP and GDP per head for the 'Annex 2' countries over the period 1990-2100, projections which he views as unrealistically high. Why (I asked myself) should GDP projections for one group of countries alone be affected by their relative position, in relation to the rest of the world, in the base year from which the projections start out?

Having now looked at the scenarios, I think I have found an answer to that question.

The answer lies in the fact that the scenario projections start from an assumption that the 'Annex 2' countries – broadly, the developing countries - will progressively and substantially gain ground over time, in terms of GDP per head, with respect to the 'Annex 1' group (which comprises the core OECD countries and the economies in transition). Each of the scenarios takes as a point of departure an estimate of the extent of this catching up, or convergence, over the whole period from 1990 to 2100.

With this procedure, the choice between market exchange rates and PPP rates in the base year can make a substantial difference. This is because with the former, as opposed to the latter, there is significantly more ground to be made up: the initial divergence, the 'gap', is greater. Hence projected GDP in the poorer countries has to grow faster in order to achieve the postulated degree of convergence in later periods – with corresponding implications, other things being equal, for energy use and for CO2 emissions.

To illustrate this, one can compare the 1990-2100 projections in the B1 IMAGE scenario, which is one of the 'markers', with how these projections would have looked if the same working assumptions had been made but with Angus Maddison's PPP-based 1990 data as the point of departure. (Here I use Maddison's fine book, *The World Economy: A Millennial Perspective*, though with appropriate regrouping of countries).

The B1 IMAGE scenario projects for the Annex 1 countries an increase in GDP per head, between 1990 and 2100, by a factor of just over 5. It further assumes that by 2100 the ratio of per capita GDP in those countries

to that of the Annex 2 countries will have fallen to just over 1.8. In the 1990 base year this ratio (using market exchange rates) is put at 16.7. In order to move from this initial ratio of 16.7 to the postulated 1.8 in 2100, given the projected growth in the Annex 1 group, the total GDP of the Annex 2 countries is projected to rise, between 1990 and 2100, by a factor of just under 65.

Suppose now that we make the same assumptions about the gap in 2100 (the 1.8 ratio) and the growth in per capita GDP in the Annex 1 countries (the factor of 5), but start in 1990 from Maddison's PPP-based estimates for that year. With these, the 1990 ratio of GDP per head in the Annex 1 countries to that of the Annex 2 countries is 6.3 only, as compared with 16.7. To bring this figure down to 1.8 by 2100 would require (if my arithmetic is correct) an increase in the total GDP of the Annex 2 countries, over the period 1990 to 2100, by a factor of only 24.5, as compared with just under 65.

The use of PPP data as the 1990 starting point of the scenarios would therefore have brought with it significantly lower projections for GDP growth in the Annex 2 countries, and hence lower figures for their CO2 emissions. This in turn might have affected the leading and much-quoted conclusion of the whole IPCC Third Assessment, namely, that the prospective extent of global warming, as between 1990 and 2100, could be put in a range of from 1.4 to 5.8 degrees C.

It seems to me that for this reason alone – though there are a number of other substantial questions that could be raised in relation to it – there is a good case for reviewing the whole scenario exercise. This brings me to my other point.

SECOND, Ian Castles has suggested that in the next IPCC Assessment national and international statistical agencies should be brought in and represented. I agree with him: it is high time that these agencies involved themselves in the process. But I would take the argument further. I think that the central economic departments of state – treasuries, ministries of finance, ministries of economics, and organisations such as the US Council of Economic Advisers – should likewise be taking an active part. Their expertise is pertinent, and the economic stakes are high enough to require their attention. They should not remain on the sidelines.

I am sending copies of this letter, on a personal basis, to a number of friends and acquaintances across the world with whom I have been discussing these and related issues, a few of whom are connected either with national statistical offices or with central economic departments of state. I am also sending it to two persons whom I have not met, because of their current roles and responsibilities. One of these is Henry Derwent, who led the British delegation to the recent COP8 meeting in Delhi, and the other is Professor Glenn Hubbard, who is Chairman of the US Council of Economic Advisers and of the OECD's Economic Policy Committee.

Last, I attach a summary CV by way of orientation.

With best wishes for your exacting role and tasks.

David Henderson
(Westminster Business School, London)