

A CRITIQUE OF THE IPCC REPORT ON RENEWABLE ENERGY (2011A)

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This document has been regarded as confirming the widespread belief that renewable energy can replace fossil fuels and more or less meet world energy demand by 2050. The Press Release says, “Close to 80 percent of the world’s energy supply could be met by renewables by mid-century... a new report shows.” (IPCC, 2011b.) Thus the report is likely to be accepted as an authoritative and definitive statement that transition to renewable is possible, does not require significant social change, and is affordable.

However there is a strong case for regarding the report as remarkably unsatisfactory and as not establishing the main conclusion attributed to it. This case is detailed at <http://ssis.arts.unsw.edu.au/tsw/IPCCcrit.html> Following are the main points made.

- The report does not show that renewable sources can meet future energy demand, or a large fraction of it. It is not that its attempt to show this is unsatisfactory; the point is that it does not offer a case; it does not attempt to show what proportion of demand could be met by renewables. The report merely presents the results of some studies which state conclusions about renewable energy’s potential, without attempting to assess their worth. It is argued below that the main such study, on which the WG3 report relies heavily, is deeply flawed, is of little or no value and does not establish its claims.

The report should be a detailed analysis of the potential and limits of renewable energy, deriving conclusions about what proportion of demand it can meet, and demonstrating these conclusions via evidence and transparent assumptions and reasoning that others can work through to assess how well the conclusions follow or are established. The reader should be able to examine an argument to satisfy himself that the conclusion is valid, that it can be seen to follow from the reasoning, (or to decide how well it has been established, what assumptions are weak, where better evidence is needed etc.) The report does not engage in a discussion which enables such an assessment.

- The actual conclusion regarding renewable potential the Report’s states is as follows.

“More than 50% of the scenarios project levels of RE deployment in 2050 of more than 173 EJ/y reaching up to over 400 EJ/y in some cases.” (SPM, p.20, see also p. 18.) More than half say renewable could provide more

than 27% of energy. (IPCC, 2011a, Summary for Policy Makers, pp. 4, 15.)

Note firstly that this conclusion is not saying that 80% of 2050 demand can be provided. Note secondly that it is not a conclusion the IPCC's WG 3 has come to; it is a summary of the conclusions the selected studies have come to. The 173 EJ/y median renewable contribution foreseen is around 20% of the 2050 demand we seem to be heading for.

- There is no critical examination of the 164 studies considered. It is not explained how they were selected. It is said that they were not randomly selected. There is no reference to any of (the few) studies that I am aware of as having been published doubting the capacity of renewable energy to meet demand. (These include Hayden, 2004, Trainer, 2007, Bryce, 2010, Moriarty and Honnery, 2010, Trainer 2010a.) A satisfactory review would have presented the details from an IPCC working group reporting on their thorough critical examination of all, or a representative selection of, the reports to determine whether their quantitative conclusions were sound or plausible and whether the difficulties had been dealt with. There is no analysis of this kind.
- Several crucial difficulties and problems confronting renewable energy supply are either not dealt with adequately, or not mentioned at all. It is argued below that some of these are not likely to be overcome.
- The report depends heavily on one of four selected studies. This is the source of the claim that 80% of energy could come from renewables by 2050. It will be argued below that this study is remarkably superficial, unconvincing, mistaken and misleading.
- Even if the Report's main claims are accepted, this is of little consolation. Even if renewables could supply 27% of energy by 2050, then catastrophic climate change is very likely. World energy demand is heading towards a doubling by 2050 so if one quarter of it could be met by renewables then the other three quarters would still have to be met by fossil fuels (unless breeders or fusion can deliver about 750 EJ/y by then, and meet all present non-electrical demand.) The IPCC's graphs (Summary Chapter 1, p. 10) show that CO₂e is heading for an average estimate of 65 GT/y by 2050. If renewables cut this by 75% by 2050 we would still have around 50 Gt/y of emissions, far more than the present amount.

In 2007 the IPCC 4AR said emissions must be cut to between about 6 and 13 Gt/y. But it is very likely that we will soon recognise that emissions to the atmosphere must be totally eliminated by 2050. (Hansen, 2008, Meinshausen et al., 2009.) If we don't do this we will go past the emission budget limit. (Carbon Capture and Storage can't solve the problem, because it is very unlikely that only 80 – 90% of emissions from stationary sources can be captured. Metz, 2005, Trainer, 2011a.) Therefore even if renewables can provide one quarter of demand as the IPCC says, that would fall far short of solving our energy and greenhouse problems. Yet the report conveys an air of optimism regarding the capacity of renewables to solve our problems.

OMISSIONS: THE MAIN CONCERN.

There are a number of very important problems to do with renewable energy supply with which the report does not deal at all, or deals with superficially, or fails to draw significant conclusions about.

There is no discussion of the crucial problem of meeting demand in mid winter, when demand can peak and solar resources can be negligible or non-existent. Firstly, in order to meet peak demand with a safety margin (e.g., for breakdown of some units) up to 1.3 times as much coal-fired generating plant might have to be built as would meet average demand. (The Australian ratio of plant to average demand is 1.78.) Secondly the crucial problems for renewable supply are set by winter. Winds are stronger then but solar resources are at their weakest. Central receiver output at the best US sites would average around 50% of summer output (NREL, 2010), but in some years a monthly average can be 40% lower than the long term average for that month.

Combining these two factors, a peak high in demand and peak low in energy availability, might double the amount of capacity that seems to be required when calculations are based on average demand and average radiation levels. This factor has significant implications for the amount of plant required and therefore for total system capital cost.

However there is a much bigger problem, on which the report does not comment. The greatest challenges set by variability of wind and sun concerns the gaps of several days in a row when there might be no sun or wind energy available across large regions, including continents. There are several studies documenting the magnitude and seriousness of these common events. For instance Oswald et al, (2008) show that over the whole of Ireland, UK and Germany for the first 300 hours of 2006, i.e., in mid winter, the best time of the year for wind energy; 1, for six days there was almost no wind input in any of these countries. For half this period, i.e., 6 days, there was almost no wind input in any of these countries. For about 120 continuous hours UK capacity averaged about 3%. During this period UK electricity demand reached its peak high for the whole year, at a point in time when wind input was zero. Throughout this period the solar input would also have been negligible. The considerable capital cost implications of having a back up system capable of substituting for just about all wind capacity (noted by Lenzen, 2009) are rarely focused on.

The IPCC discusses integration at some length and its summaries seem to align well with Lenzen's review (2009, p.19) which confirms the previously generally understood conclusion that wind cannot contribute more than 25%, probably 20%, of electricity required. These integration limits mean that wind plus PV might contribute at best only 55% of electricity, i.e., only 14% of all energy. The Report does not deal with the question of from which sources the other 86% is to come, apart from biomass.

There is discussion of the crucial energy storage issue, reviewing (superficially, some) options, but it does not help much in assessing the possibility of a global renewable energy supply system. Such a system would have to rely heavily on extremely large scale storage of electricity, which is not possible at present and is not foreseen. The report does not contradict this view. The formidable difficulties are recognised briefly (Chapter 8, p. 41), in a sentence which actually says it is questionable whether solutions will be found.

There is a table stating embodied energy costs for renewable technologies, but no much-needed discussion enabling more confident conclusions regarding this unsatisfactory field. There is reason to believe that a thorough accounting would indicate costs that are much higher than have been assumed, in the case of PV by a factor of 10. (Lenzen, et al., 2003)

THE HEAVY RELIANCE ON THE GREENPEACE REPORT, THE ENERGY (R)EVOLUTION.

Chapters 2 to 7 and 9 review a great deal of valuable evidence and discussion, including on the nature of technologies and the quantities of energy these “could/might” provide. However the most remarkable feature of the whole report, and its most objectionable aspect, is the focus in Chapter 10 on four selected studies, one of which is very optimistic and is the source of the claim the Report is identified with, i.e., that 80% of world energy in 2050 can come from renewables. The study in question, the 2008 Energy (R)evolution, by Greenpeace, is, to be as polite as possible, extremely challengeable. (For a critique of this report, see Trainer, 2011b.) It fails to deal with several crucial issues, makes implausible and poorly supported or unsupported assumptions, and above all simply presents a desired/imagined 2050 scenario which is not derived and not shown to be possible. Despite the glaring inadequacies in the Greenpeace Report the IPCC offers no critical or evaluative comment on it.

CAPITAL COSTS.

The report’s conclusions regarding the capital costs of mitigating climate change are also unsatisfactory, highly challengeable and in my view, quite misleading. Again the Working Group does not attempt to calculate possible costs but quotes those stated in the four selected studies selected in Chapter 10. In the Summary for Policy Makers a total is briefly given without derivation or discussion, and is apparently taken from Greenpeace. The 2010 version of the Greenpeace document (Teske, et al., 2010) give the figure of \$17.9 trillion to 2030 or \$600 billion p.a., but no derivation or references are given. It is not explained that an investment cost would have to be paid every year into the future, as plant requires constant reconstruction or replacement at about 25 year intervals. In Trainer 2010a and 2011a estimated capital costs for a world renewable energy supply are derived. They are in the region of ten times as great as the above figure, and an even greater multiple of the present ratio of energy investment to global GDP. (Birol, 2003.)

It should also be kept clearly in mind that the appropriate focus for a discussion of world energy supply is the amount all the world’s people could use. Australians are heading towards a 2050 per capita use of 500-600 GJ/y given current growth rates. If 10 billion people were to live as we would then be living, global energy production would have to be maybe 6,000 EJ/y, twelve times as great as it is now. If the IPCC wants us to feel confident that renewables can provide for us they need to explain how they can provide not the 27% or 50% of 500 EJ/y the report is being taken to claim, but 25-50 times as much.

CONCLUSIONS.

Although the Report is a large and valuable compendium of information, it simply does not throw much or reliable light on the crucial question of the extent to which we are likely to be able to rely on renewables in 2050. It is being regarded as providing strong reassurance but this is not justified. The Report is seriously misleading, reinforcing optimism regarding the potential of renewables to enable continuation of energy-intensive societies, and in reassuring people that there is no need to think about vast and radical structural and cultural change.

It is difficult to understand why such a problematic report has emerged. What we want to know, and what this Report will be taken to have settled, is the extent to which we can run on renewables. But the hundred or so authors referred to have not worked on that question; they have only reported on, and apparently endorsed, what a selection of others have said. They have not critically examined what those others have said in a process intended to determine whether they are correct. Above all they have been content to allow their Report's take-home message to come from the transparently problematic Greenpeace Report, without giving it any critical attention. These are not satisfactory scientific ways of proceeding.

This critique is not intended to have any implications regarding climate science. It is not to do with the claim that human activity is a significant cause of dangerous global warming. However it does raise concerns regarding the credibility of the IPCC and its processes. It is greatly to be hoped that the IPCC's conclusions on climate change do not derive from analyses such as those evident in this report. It would be disturbing in the extreme if its climate claims were based on the selection of "scenarios", relied heavily on one, and carried out no critical examination of their worth.

It is also important to stress that this has not been a rejection of renewable energy. The *Simpler Way* (Trainer 2010b, 2011c) stands for a shift to full reliance on it as soon as possible, and for the claim that we can live well on it...but not in energy-intensive societies.

So what's the solution? The point is that for consumer-capitalist society there isn't one. The argument in Trainer, 2010b and the core theme in *The Simpler Way* (Trainer, 2011c) analyses is that global problems are basically due to the commitment to grossly unsustainable levels of consumption and to limitless economic growth. The problems cannot be solved by trying to provide the quantities of energy that a consumer-capitalist society for 10 billion would require. Consumer society is generating other major problems in addition to energy and climate, including the poverty of billions, the destruction of the ecosystems of the planet, resource conflicts, and deteriorating social cohesion. These problems cannot be solved unless there is vast and radical transition a *Simpler Way* of some kind. This IPCC WG3 Report reinforces the dominant faith that there is no need to think about this perspective on our global situation.

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