# The Garnaut Reviews' Errors and Material Omissions

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"It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts." Sherlock Holmes (aka Arthur Conan Doyle)

**Preamble**

In 1853-54 there was a serious outbreak of cholera in London's Soho district. The prevailing view of scientists at the time was that cholera - like climate change now - was caused by an invisible miasma in the air, and the Ross Garnauts of that time all deferred to various Royal Societies (e.g. the Royal College of Physicians) as the definitive authorities. John Snow, a doctor who had pioneered the use of chloroform, in 1849 published at his own expense the first book to challenge the conventional wisdom of the authorities of the day, and was duly put down by them. However Snow persevered, and showed how the incidence of cholera in the 1854 outbreak was closely correlated with the nature of the drinking water supplied by the Southwark and Vauxhall water company on the one hand, and the Lambeth company on the other. He eventually won acceptance for his contention that cholera is a water-borne disease, having shown statistically how most cholera deaths occurred in premises taking their water from the first company, which had its water intakes adjacent to sewerage outlets to the Thames, while very few deaths occurred in premises whose water was supplied by the Lambeth company, which in 1849 had moved its intakes up-river from the sewerage outlets.

Snow's pioneering counterfactual analysis has recently been cited in two econometrics textbooks (Angrist and Pischke 2009, Freedman 2010) that explain how multi-variate regression analysis can be used to evaluate competing theories of causation. The full version of this paper (available at www.lavoisier.com.au) shows how such analysis reveals that changes in atmospheric water vapour are a much more powerful explanation of climate change than changes in carbon dioxide levels, because like Snow it uses counterfactuals to show that although the atmospheric concentration of carbon dioxide is ubiquitous (the same everywhere), temperature changes are not, and that in most places changes in atmospheric water vapour have a very much larger – and much more statistically significant – association with changes in temperature . Were he alive now it seem more than likely John Snow would have been as sceptical of airborne carbon dioxide being the cause of changing climate everywhere as he was of miasmic air being guilty of spreading cholera.

Ross Garnaut's Update 5 *The Science of Climate Change* is notable for its avoidance of econometrics and counterfactuals, and concludes (in its section 4.2.2) by invoking the authority of the Royal Society, the National Academies of Sciences (USA), and the Australian Academy of Science with their support for the findings of the International Panel on Climate Change that global warming is caused by airborne carbon dioxide. In an uncanny repeat of the views of the peak authorities in 1850, the IPCC's *Climate Change 2007.The Physical Science Basis* goes out of its way (Solomon *et al.* 2007:28) to dismiss any role in climate change for the emissions of water vapour that are *simultaneous* with emissions of carbon dioxide whenever there is combustion of hydrocarbon fuels.

Yet basic chemistry and physics show that while water vapour emissions are only in the range of 30-50 per cent of $CO_2$ emissions by weight, *in addition* to any moisture content of the fuel, their effect on surface temperature is much larger. A typical formula for combustion of hydrocarbon fuels is

$$C_3H_8 + 5O_2 + 18.8N_2 \rightarrow Energy + 3CO_2 + 4H_2O + 18.8N_2$$

To the best of my knowledge this formula does not appear in any of the IPCC sources relied on by Garnaut, no doubt because it would be very inconvenient to mention that $CO_2$ "pollution" includes rainfall generated by the atmospheric water vapour resulting from the $H_2O$ term, which amounted in 2008-2009 to 17.5 Gt$H_2O$ compared with 31.4 Gt$CO_2$ (for sources see full paper). If the $CO_2$ is a bad, does that extend to $H_2O$ as well?

It follows that the tax on carbon to be proposed by Garnaut's *Update* No. 6 (17th March 2011) will also be a tax on water vapour and thereby, unavoidably, on rainfall. The political implications of that remain to be played out, but it is characteristic of all the Garnaut work on climate change that it dwells only on the supposed external costs of hydrocarbon combustion and never mentions the demonstrably larger benefits of elevated atmospheric carbon dioxide and rainfall – not to mention warmer temperatures – on the world's primary production (see Table 1 for data).

**Table 1**

**Carbon Dioxide and World Cereals Production 1961-2007**

| | 1961 | 2007 | % Increase |
|---|---|---|---|
| Total Atmospheric Carbon Dioxide GtC | 673.01 | 815.10 | 21.11 |
| Anthropogenic Emissions of CO2, GtC | 4.06 | 9.94 | 144.83 |
| Total Land Uptakes of CO2 emissions, GtC | 0.90 | 2.98 | 231.11 |
| Total cereals output, billion tonnes | 0.88 | 2.34 | 167.14 |
| Carbon content (40%), GtC | 0.35 | 0.94 | 167.14 |
| Population, billion | 3.08 | 6.60 | 173.00 |
| Cereals output per capita, tonnes | 0.28 | 0.35 | 24.64 |
| Carbon content per capita (40%), tonnes | 0.11 | 0.14 | 24.64 |

Source: www.globalcarbonproject.org (Le Quéré *et al.* 2009), FAO 2009.

Note: The world's uptakes of atmospheric carbon dioxide are not limited to cereals - other food and fruit crops, livestock, forestry, and fisheries are all contributors.

## Statistics and the Garnaut Reviews

Garnaut's *The Science of Climate Change* is notable as much for what it leaves out as for what it thereby tendentiously includes. The list begins with Garnaut's first "key point":

> Observations and research outcomes since 2008 have confirmed and strengthened the position that the mainstream science then held with a high level of certainty, that the Earth is warming and that human emissions of greenhouse gases are the primary cause. ..The statistically significant [sic] warming trend has been confirmed by observations over recent years: global temperatures continue to rise around the midpoints of the range of the projections of the Intergovernmental Panel on Climate Change (IPCC) and the presence of a warming trend has been confirmed [sic].

Garnaut adds "I asked two leading econometricians (Trevor Breusch and Farshid Vahid), to examine the temperature record from the three authoritative global sources". Actually, there are five, and the three assigned to Breusch and Vahid are not independent of each other, while Garnaut failed even to mention the more comprehensive global coverage of satellite data sets (UAH and RSS). Breusch and Vahid also failed in their primary duty of due diligence by not checking them anyway, which enabled them to find "there is sufficient statistical evidence in the temperature data of the past 130-160 years to conclude that global average temperatures have been on a warming trend". But this factoid depends heavily on the absence of the hot tropics from global temperature sets for the period between 1850 and 1910 (see Fig.1), as it was not until the 1950s that global temperature becomes a valid statistic, for only then did global surface temperature coverage reach 80 per cent, and it is now below that level again, with the disappearance in the Breusch-Vahid data of many surface stations from cold northern Canada and Siberia since 1990. Even in the USA there has been a decline in station numbers (USHCN) from 1421 in 2002 and 1164 in 2007, apparently mostly in cooler northern and high altitude regions. One expects professional statisticians and economists to check the provenance of the data they use, and there is no evidence for that in Breusch-Vahid-Garnaut.

The truth is shown in Fig.2: the linear trend in the UAH satellites' global data from December 1978 to February 2011 has an $R^2$ of 0.345, and indicates a rise of 0.0012 $^oC$ per month since 1978, or 0.0144 p.a., 0.144 per decade, and 1.44$^oC$ per century, well below the 3$^{oC}$ predicted by the IPCC, let alone the 5$^o$C predicted for 2100 by Garnaut (2008:Fig.4.5) if there is no "mitigation" of Business as Usual emissions, BAU). The UAH data do *not* in fact "corroborate" the NASA-Gistemp temperature data for the period when they overlap, with the annual change in the Gistemp series (1979-2010) at 0.0196$^o$C, which is 36 per cent higher than the UAH trend of 0.0144 $^o$C.

Garnaut's 8 *Update Reports* and 2008 *Review* are both in the nature of a Prospectus, inviting the Government and people of Australia to invest in a Carbon Tax that will save them the costs of "dangerous climate change". That means Garnaut's 2008 and 2011 reviews should have disclosed the UAH and RSS satellite data as well as the Gistemp/NCDS/HadleyCRU surface data, even if using the former would have diluted the all too evident advocacy that characterises the Garnaut reviews.

However, there is a much more serious omission of "all the information investors and their advisors would require and expect" in both the Garnaut Reviews when they make this statement:

> **No-mitigation case** – based on no action undertaken to mitigate climate change, and used as a 'reference' to assess the benefits of climate change action that accrue from the climate change impacts that are avoided. By the end of the century the concentration of long-lived greenhouse gases in the atmosphere is **1565** ppm carbon dioxide equivalent (Garnaut 2011:5 and Fig.1, my emphasis).

The present atmospheric concentration of $CO_2$ is 390 parts per million (ppm) of the atmosphere. To this Garnaut adds the atmospheric levels of other greenhouse gases, chiefly methane ($CH_4$) and nitrous oxide ($N_2O$), which are expressed in $CO_2$ "equivalent" amounts that bring the $CO_{2e}$ concentration to between 455 and 465 ppm in 2010. To get from 460 ppm to 1565 ppm by 2100 requires that the rate of growth of $CO_{2e}$ from now until 2100 has to be

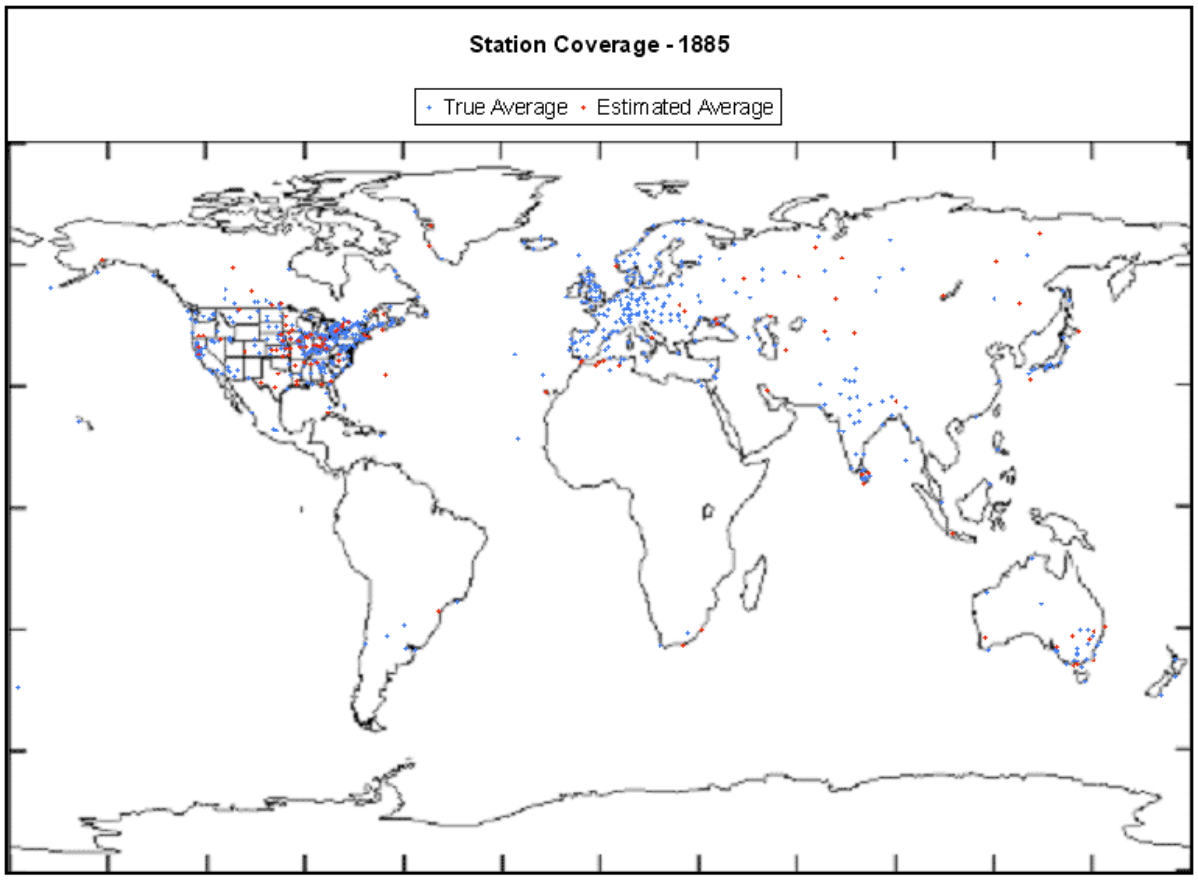
1.0137 per cent p.a. The actual growth of atmospheric $CO_2$ from 1958 to 2010 was 0.295 per cent p.a., and projecting CO2e at that rate (the growth rates of $CH_4$ and $N_2O$ are much lower than that of $CO_2$, see IPCC, Solomon et al. 2007:141) to 2100 produces only 600 ppm of $CO_{2e}$ by 2100, less than 38 per cent of (i.e. 62 per cent less than) Garnaut's 1565 ppm.

At the observed atmospheric concentration growth rate of 0.295 per cent p.a. over the longer period from 1959 to 2009, it will take until **2134** for the pre-industrial level of the atmospheric concentration of 280 ppm to double to 560 ppm; and the 2009 level of 387 ppm will not double until **2244**. Garnaut offers no basis for predicting any *acceleration* in the rate of growth of the atmospheric concentration of CO2e above the actual rate from 1958 to 2010, and, failing that, this is like Lihir claiming in its 1995 Prospectus that it could borrow at one percent above LIBOR instead of the 2-3 percent it did have to pay to its main bank lender, UBS. Had Lihir made that claim, the ASX might well have rejected the Prospectus – and if not, shareholders would have been able to sue Lihir when the truth became apparent.

**Conclusion**

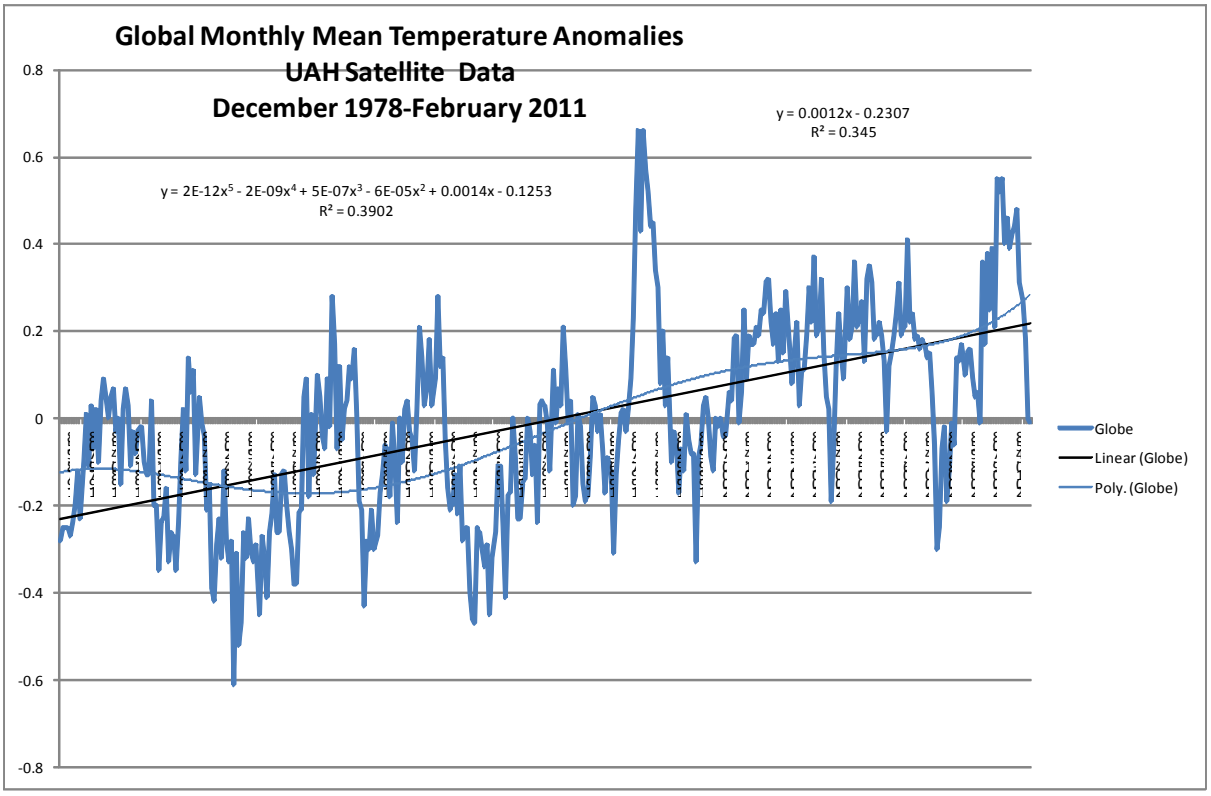
It seems fair to conclude that the Garnaut *Updates* are selling Australia short, by proposing a major new tax on "carbon" based on very serious material omissions of information relevant to all the country's stakeholders, not just its politicians and their far from objective advisers.

Fig.1 The baseline for the "global" temperature 1880-1910 reported in Garnaut's *The Science of Climate Change,* Fig.1




Source: CDIAC.

**Fig. 2 UAH satellite data – Global Monthly Mean Temperatures (Trends are 0.0144 oC p.a., 0.144 per decade, and 1.44 per 100 years)**




Note: the evident wide variability is much more closely correlated with ENSO phases (El Niños in 1998 and 2009 and La Niña in 1984 and 2010), as shown by the better fit ($R^2$) for the polynomial trend line (top left) than for the linear (top right), than with the linear trend in atmospheric $CO_2$.

Source: UAH.