Assessment of Minister Wong's Written Reply

to

Senator Fielding's Three Questions on Climate Change

By

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Background

Emissions trading legislation, such as the "Carbon Pollution Reduction Scheme" (CPRS) bills that are currently before Parliament, rest upon the assumption that human greenhouse emissions, especially carbon dioxide, (i) are pollutants, and (ii) are causing dangerous global warming. Neither of these assumptions are supported by empirical evidence, and both have been under scientific challenge for many years by a large body of qualified and independent scientists.

Cognisant of these facts, Senator Steve Fielding has posed three direct questions to the Minister for Climate Change, Senator Penny Wong, in order to clarify whether or not evidence exists that human carbon dioxide emissions are causing dangerous global warming, as alleged by the UN's Intergovernmental Panel on Climate Change (IPCC).

Minister Wong agreed to address these questions, first, through discussion at a meeting held between the Senators, ourselves and ministerial science advisors Professor Penny Sackett (Chief Scientist) and Professor Will Steffen (Director, ANU Climate Change Institute); at this meeting, an 11-page background presentation was made by Drs. Sackett and Steffen. And, second, by form of written reply, which was provided to Senator Fielding on June 18th.

We provide in this paper an assessment of Minister Wong's written reply to each of Senator Fielding's three questions. A more exhaustive paper covering these questions, and other issues arising from the meetings between Senator Fielding and Minister Wong, is covered in the paper titled "Minister Wong's Reply to Senator Fielding's Three Questions on Climate Change – A Commentary".

QUESTION 1

Is it the case that CO_2 increased by 5% since 1998 whilst global temperature cooled over the same period (see Fig. 1)?

If so, why did the temperature not increase; and how can human emissions be to blame for dangerous levels of warming?

The government's response to this question queried whether global average temperature is an appropriate indicator of global climate, and listed circumstantial evidence for regional planetary warming.

1. What is the most appropriate measure of planetary climate?

1.1. The government's reply says "*When climate change scientists talk about global warming they mean warming of the climate system as a whole, which includes the atmosphere, the oceans, and the cryosphere*", and then adds "*in terms of a single indicator of global warming, change in ocean heat content is most appropriate"*.

1.2. We agree that in an ideal academic discussion, and were accurate historical data available, ocean heat content might be a better criterion by which to judge global warming than would be atmospheric temperature. Use of this indicator was first pressed strongly by Pielke (2007, 2009) as a test of the dangerous warming hypothesis, but it has not been widely publicized by the IPCC.

1.3. In any case, however, Senator Fielding's question was predicated upon the history of IPCC's public advice, which has consistently used the UK Hadley Centre near-surface air temperature record since 1850 as a measure of global warming. This near-surface air temperature record is the one that dominates in IPCC and government policy papers and discussion, and is the criterion of judgement that both politicians and the public are familiar with.

1. 4. As illustrated in Fielding (June 15, Fig. 1), the Hadley temperature record does not exhibit warming after 1998.

2. Natural variability in air temperatures

2.1. The government asserts that "*at time scales of around a decade, natural variability can mask the atmospheric warming trend caused by the increasing concentration of greenhouse gases*".

2.2. It is widely agreed that there is considerable natural variability in air temperature on decadal timescales and longer. It is the IPCC who have previously denied the effect of natural variability.

For example, the 2001 Summary for Policymakers claimed, based on computer model simulations, that the climate system has only a limited internal variability. In turn, this claim was, and is, used to underpin the argument that carbon dioxide forcing is the only plausible explanation for the late 20th century warming trend.

For the government to now invoke natural variability as an explanation for the elapsed temperature curve is to destroy the credibility of their previous arguments for carbon dioxide forcing.

2.3. The government also claims that "*in terms of the climate system as a whole, only about 5 percent of the warming since 1960 has taken place in the air*".

2.4. Using the Hadley CRU temperature record, the rise in air temperature since 1960 has been about 0.5°C. Translating the 15×10^{22} J of additional heat in the upper 700 m of ocean since 1960 into a temperature rise, we find that this corresponds to an increase in upper ocean temperature of only 0.15°C.

Thus, using these metrics, air temperature increase since 1960 has been more than three times greater than ocean temperature increase.

3. Ocean heat content

3.1. The government alleges that "*in terms of a single indicator of global warming, change in ocean heat content is most appropriate*".

3.2. In reality, given present instrumental networks, ocean heat content is an unrealistic metric to use to judge climate change.

A 0.15°C increase in average ocean temperature (see 2.4) is not statistically significant when viewed against the known limited precision of the XBT instruments, and the temporal and spatial paucity of observations before the deployment of ARGOS buoys.

There remains controversy about the calibration of the ARGOS buoys, which we discuss in our more detailed paper.

4. Ice, snow and frozen ground

4.1. The government describes a number of regional changes in ice and snow distribution, and comments, without citation, that "*overall the amount* [global implied] *of ice, snow and frozen ground has declined*".

4.2. So far as we are aware, no accurate inventory exists of the worldwide volume of modern ice and snow, let alone over the millennial history that is required in order to judge whether observed modern changes are unusual. As Idso & Singer (2009, p. 136) note, "*global data on glaciers do not support claims made by the IPCC that most glaciers are retreating or melting*".

In the absence of such historical records, descriptions of melting ice in particular areas are indicative only of a negative precipitation:melt mass balance in those areas, and circumstantial

so far as global change or the cause of melting are concerned. In attributing areas of melting to a human greenhouse effect, the government is making the common error of failing to distinguish between the occurrence of warming and the identification of its cause.

4.3. As the government notes, different trends occur in different areas. For example a post-2000 retreat of Arctic sea-ice parallels a similar melting that occurred in the 1930s, whereas at the same time sea-ice around Antarctica has increased to an all time high of >1 million km^2 above the long-term average. Apart from the small region of the Antarctic Peninsula there is no evidence of warming over Antarctica and the Southern Ocean.

4.4. The latest available data indicates - in the context of the large annual cycle of variation, and the observed decline during 2007 and 2008 - no global trend in sea-ice cover. Arctic sea ice extent today is similar to that in 1979, when satellite observations commenced, and at the same time sea-ice cover around Antarctica is currently enhanced in area.

4.5. Finally, there is no particular reason to view contemporary values of sea-ice cover as representing a climatic ideal.

Historical records point to much less sea ice over the Arctic Ocean during the 1920s and 1930s, and to several prior openings of the Northwest Passage. And, of course, Greenland was much warmer in the 10th and 11th centuries when there were approximately 3,000 individual settlements and farmlets. As the cold of the Little Ice Age set in thereafter, none of these settlements survived beyond 1550 and some sites remain frozen today.

5. The basis of the IPCC assessment

5.1. The government asserts that "*The argument presented in Q1 above is not new and has been thoroughly refuted by a very wide range of observations*".

5.2. No argument is presented in Question 1. Rather a simple question and its supplementary are asked.

5.3. The government also points out that IPCC's 4AR (Summary for PolicyMakers, p. 5) concluded that: "*Warming of the climate system is unequivocal, as is now evident from observations of increases in average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea-level*".

5.4. The IPCC passage that is quoted is an underwhelming conclusion which was apparent long before the IPCC even existed, and anyway says nothing about the cause of any warming. Scientists have known for more than one hundred years that earth's climate has warmed since the depth of the Little Ice Age during the 17th century. Indeed, the climate system had already undergone considerable warming before the establishment of a global network of observing

stations in the late 19th century, which first allowed for the systematic monitoring of near-surface air temperature.

The key questions are not whether the climate system has warmed during the 20th century, but rather (i) whether the warming terminated in 1998 (Question 1); (iii) whether the warming was unusual in rate and magnitude (Question 2); and (ii) the degree to which the warming might have been caused by human carbon dioxide emissions (Questions 2 and 3). These questions are those that were posed by Senator Fielding, and they remain unanswered by the government.

QUESTION 2

Is it the case that the rate and magnitude of warming between 1979 and 1998 (the late 20th century phase of global warming) were not unusual as compared with warmings that have occurred earlier in the Earth's history (Fig. 2a, 2b)?

If the warming was not unusual, why is it perceived to have been caused by human CO2 emissions; and, in any event, why is warming a problem if the Earth has experienced similar warmings in the past?

The government responded, citing ice-core data, that today's magnitude and rate of temperature change was unusual, that the last 2,000 years of climatic history is more relevant to humans than deep-time history, that strong evidence exists that post-1850 warming was caused primarily by human greenhouse emissions, and (after Garnaut) that the costs of adapting to climate change in Australia may be more expensive than attempting to abate it.

6. Rate and magnitude of change

6.1. Judgements about rate and magnitude of temperature change through deep time, i.e. prior to instrumental measurement, have to be made using proxy data (such as temperature-related oxygen isotope measurements) for particular sites or regions.

Global warming between the last glacial maximum and the Holocene varied according to region. Ice cores from Vostok, Antarctica suggest a temperature rise of about 12^{o}C; from Greenland the ice cores suggest much greater warming still. In contrast, isotopic analysis of sea bed cores from the warmest oceans around Indonesia suggests a temperature rise of only 2-4^{o}C in tropical regions (and note that a 1^{o}C increase in tropical ocean temperatures is accompanied by a natural increase in of about 7% in global evaporation and precipitation).

6.2. Figs. 2a, b of Fielding (June 15th) reproduce data from two such proxy deep-time temperature records. As explained in their captions, these records show that the rates (1-2^{0}C/century) and magnitudes (about 0.8^{0}C warming since the last cold phase of the Little Ice Age) of historical climate change fall well within prior natural limits.

This is especially the case if the Dansgaard-Oeschger (D/O) events referred to by the government are taken into account, irrespective of the debate (which continues) as to the degree to which such climatic events are worldwide or restricted to particular regions.

6.3. D/O events are sudden, step increases in the northern Atlantic and Greenland region temperature of more than 10^{o}C over decades, followed within centuries by rapid cooling again.

The Arctic is a region where more infrared radiation is emitted to space than is absorbed from incoming solar radiation. This local radiation imbalance is corrected by the transport of energy from the tropics to sustain local temperatures. Sudden increases in local temperatures arise from changes in this equator to pole energy exchange, which is modulated by a combination of changes in wind pattern, changes in ocean currents and changes in atmospheric circulation. Such changes in poleward energy transport are similar to an El Nino event, and are at least hemispheric in scope. Indeed, the typical Atlantic D/O climatic patterning is present in some Antarctic ice cores.

7. Climate record of the last 2,000 years

7.1. The government writes that "*in terms of timescales of importance for humans, the last 2,000 years are most relevant, because this is the period over which our civilisations have developed*".

This statement reflects simple anthropomorphic bias, for there is nothing "typical" or "special" about the climate of the last 2,000 years. Understanding climate change in context requires the study of climatic records that cover at least hundreds of thousands of years.

7.2. The government reproduces an IPCC figure of Northern Hemisphere air temperatures over the last 1800 years. This figure represents a variety of proxy (mostly tree ring) temperature histories that are joined together with the (UHI-influenced) 20th century temperature record and a speculative further " *'committed' additional temperature rise due to the thermal inertia of the ocean*".

7.3. One of the proxy temperature series plotted is the infamous "hockey stick" reconstruction of Mann et al. (1999). This reconstruction is discredited (e.g., McIntyre & McKitrick, 2003, 2005, 2009).

7.5. Disturbingly, the government continues to exhibit the "hockey stick" graph on its website at: http://www.climatechange.gov.au/science/faq/question2.html

7.6. In general, the proxy reconstruction of ancient temperatures only provides a smoothed representation of the temperature trends and that at a local or regional level. The interpretation of tree rings, etc cannot discriminate the same detail as direct observations of temperature.

Thus it is poor practice to append a global instrumental record to the young end of a series of proxy geological records. Such a construction amplifies recent temperature trends without scientific foundation.

7.7. Abundant historic and geological data shows that warming events associated with the Minoan, Greco-Roman and Medieval Warm Periods occur on a millennial, perhaps solar, climatic cycle (Bond et al., 2001; Singer & Avery, 2008), and were at least as warm as the late 20th century warming. These warmer periods were interrupted by the colder Dark Ages of the middle first millennium and the Little Ice Age of the second millennium, and such climatic rhythmicity must be controlled by major variations in equator to pole energy transport, i.e. is not primarily driven by carbon dioxide variations.

8. The greenhouse effect

8.1. The government asserts that "*The greenhouse effect is a well-understood physical phenomenon, like gravity*".

8.2. The greenhouse effect is indeed a real phenomenon that lends itself to measurement. The intrinsic nature of gravity, however, is not understood. In contrast, the intrinsic nature the greenhouse effect is well understood; but it is often misrepresented, as it is in the government's summary statement.

8.3. A fuller explanation and discussion on the greenhouse effect is provided in our more detailed paper.

9. Empirical relationship between change in radiative forcing and global air temperature

9.1. The government reports that a general relationship between radiative forcing and temperature rise can be derived by an "*analysis of the climatic shift between the last ice age and the present warm period*", and that "*this relationship includes all feedbacks within the climate system in an empirical way that is derived without using models*".

9.2. Analysis of the climate shift between the last ice age and the present warm period cannot give a quantitative relationship between the change in radiative forcing and the resulting change in global air temperature.

This is so because the influences of Earth's orbital changes versus the feedback effect as Earth warmed, and the oceans expelled more carbon dioxide, are not known.

9.3. Furthermore, if carbon dioxide forcing is as powerful as is being suggested, then the question has to be asked: "Why did each of the interglacial warming events of the past ~500,000 years stabilise at about the same temperature?" For several recent interglacials were significantly warmer than the Holocene interglacial (e.g., Watanabe et al., 2003), which should require the Earth to have already have passed the so-called tipping point of irreversible warming on more than one occasion.

9.4. As we understand it, the paper that first formalised the concept of a "CO_2 forcing parameter" in the fashion referred to by the government was that by Hansen et al. (1988).

Hansen et al.'s forcing parameter has no physical basis in measurement. Rather, the assumption was made that the ~100 ppm post-industrial increase in carbon dioxide was directly responsible for the increase in global temperature of 0.6^0C that has been measured over the past century.

9.5. Over the 20th century, both cooling and warming phases were concurrent with rising carbon dioxide levels, and the 1988 paper was published 13 years after a 33 year ***cooling*** trend that was paralleled by an ***increase*** in carbon dioxide concentration. Essentially, in the 46 year period from 1942 to 1988, when the paper was published, saw 33 years of cooling and only 13 years of warming concurrent with increases in carbon dioxide, yet the models used a forcing parameter that directly related only the warming to concentration increases.

Also, in calculating the carbon dioxide forcing parameter no allowance was made for the likely contribution that the urban heat island effect made to the (thermometer) measured warming.

9.6. Therefore, (i) there is no valid basis for the assumed carbon dioxide forcing parameter, (ii) the parameter has a built in warming overestimate, and (iii) climate CGMs that apply the parameter are inaccurate.

10. Costs of adaptation could be high: but not as high as those of unnecessary precaution

10.1. The government asserts that "*The Garnaut Review also found that the climate change impacts on infrastructure will have a significant effect on Australia's output and consumption of goods and services, and that the costs of adaptation could be high*".

10.2. The Garnaut Report, like the heavily criticized Stern report that preceded it (Carter et al., 2006), contains no credible science assessment but simply uncritically accepts IPCC science advice as a given. For that reason alone, the economic analysis in the report is of little value.

First, the report presumes that late 20th century warming will continue unabated throughout the 2ist century, which is already known to be wrong.

Second, the report adopts a precautionary approach in a situation where the potential hazard – future warming or cooling - is quite unknown.

The pitfalls of adopting a precautionary approach to an assumed hazard, rather than a prudent approach to known hazards, are explained in our fuller paper.

QUESTION 3.

Is it the case that all GCM computer models projected a steady increase in temperature for the period 1990-2008, whereas in fact there were only 8 years of warming were followed by 10 years of stasis and cooling. (Fig. 3)?

If so, why is it assumed that long-term climate projections by the same models are suitable as a basis for public policy making?

The government pointed out that the model averages plotted in many IPCC diagrams result in a smoothing of the simulated natural variations that are present in individual GCM model runs. This has the effect of suppressing the episodic short periods of cooling that are simulated by most models.

11. Natural climate variations

11.1. It is indeed clearly the case that individual GCM model runs simulate natural variability in a way which includes the depiction of periods of several years to a decade or so of cooling within a temperature projection that nonetheless progressively rises.

But in concluding that "*GCMs can and do simulate decade-long periods of warming or even slight cooling embedded in longer-term warming trends*" the government is implying that the lack of warming since 1998 is caused by a natural cooling forcing of sufficient strength to temporarily overcome the assumed longer-term carbon dioxide-forced warming.

11.2. Hitherto, the IPCC (e.g. 3AR, 2001) has argued that the climate system possesses only limited internal variability, which is why carbon dioxide forcing came to assume especial significance in their eyes.

11.3. The climate system varies on a range of timescales from the interannual (El Nino-La Nina) through the decadal (e.g., Pacific Decadal Oscillation, North Atlantic Oscillation), the multi-centennial (eg, the Mediaeval Warm Period-Little Ice Age) to multi-millennial (glacial-interglacial). The shorter timescale oscillations are manifest as internal variability, and are not incorporated in the GCMs.

So even if the models do simulate some variability in global temperatures, they cannot be doing it for the correct reason, and any short-term variability that they happen to predict "right" must be either by chance or for the wrong reasons. And that individual GCMs may project periods of cooling as long as 10 years has no necessary bearing on the cause of the current cooling trend.

11.4. We conclude that there is no reason to call upon carbon dioxide forcing to explain the recent limited warming that occurred between 1979 and 1998, and that the computer-based projections that show progressive warming through the 21st century are highly misleading scenarios to provide to policymakers.

In essence, to now acknowledge that there is significant internal variability to the climate system is to destroy the plausibility of anthropogenic global warming alarmism.

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