5.5 The bad news on climate change

In last year's SOR report we provided a summary of the then-current predictions of climate change. However, events have moved on alarmingly, and an update is necessary.

The suspicion that economic development based on the combustion of fossil fuels is not sustainable has a long history. An example which may be remembered by today's senior executives and councillors was the Club of Rome's dire forecasts, published in the mid 1970s, which predicted the imminent collapse of energy-intensive economies due to failing supplies of fossil fuels and other raw materials. Though the oil price shocks of the 1970s gave these predictions an initial plausibility, they were eventually laughed out of court. It turned out that there was more oil than was then thought, and certainly plenty of coal. Despite current second thoughts about oil and gas supplies, the Club of Rome's forecasts now provide a precedent for laughing at any suggestion that there are limits to fossil fuel consumption.

Laughter, accompanied by the cutting off of research funds, was the major response to James Hansen's 1981 paper on the likely effects of fossil fuel use on the earth's climates. The summary of his paper included the following: 'It is shown that anthropogenic carbon dioxide warming should emerge from the noise level of natural climate variability by the end of the [20th] century, and there is a high probability of warming in the 1980s. Potential effects in the 21st Century include the creation of drought-prone regions in North America and central Asia as part of a shifting of climatic zones, erosion of the West Antarctic ice sheet with a consequent worldwide rise in sea level, and the opening of the fabled Northwest Passage.' These predictions have now been proved correct. In Joseph Romm's words: 'The 1980s warmed, the Northwest passage opened, the drought-prone regions have emerged and sea level rise is a top worry (even if Greenland has emerged as more troublesome than West Antarctica).' Hansen has emerged credible, and the Intergovernmental Panel on Climate Change (IPCC), on whose scenarios discussions about greenhouse response have so far been based, finds itself accused of undue optimism.

Despite Hansen's warning about the potential for rapid melting of ice sheets, the climate change modellers who contributed to the forecasts prepared by the IPCC left ice sheets out of their calculations. The IPCC comprised modellers who, in the main, had a background in atmospheric physics, so they concentrated on atmospheric behaviour under increased insulation. With climate change sceptics laughing, carping and extremely influential with governments, the modellers were under pressure to emphasise their scientific conservatism. The IPCC scenarios identified drought as a major consequence of global warming, and as the evidence from Southern Australia, South Africa, North Africa, Southern Europe and California accumulates these forecasts have been shown to be correct in broad direction but conservative in their prediction of impact. The IPCC scenarios also included warnings of sea level rise which, while correct in direction, were based mainly on the expansion of sea water due to warming and, by omitting ice-melt, understated the likely rise by an order of magnitude. Australians should note that the *Garnaut Climate Change Review* is based on the IPCC scenarios. Chapter 2 of that report, 'Understanding climate science', follows the IPCC in assuming that sea-level rise due to ice melting will occur very gradually over several millennia (p42).

Hansen's original forecast of ice-melt has been confirmed by two sets of observations. One is that the rate of melting of the ice sheets has increased – due not only to warming, but to factors such as the lubrication of the interface between the ice and the underlying rock by meltwater, causing the ice to head more rapidly into the sea. A second, broader source of confirmation comes from the paleontological evidence, which indicates that there have been rapid changes in climate and sea levels which were not taken into account in constructing the IPCC climate change models were estimated even though they were within the very recent geological past, and indeed within the human past. A visit to Kakadu is enough to observe the effects of climate change – here one can see drawings on rock executed many thousand years ago, when the climate was drier and the sea was far away as attested by the animals drawn. A similar experience is available on the Burrup Peninsula in Western Australia, where the ancient sculpted animals are those which dwelt on inland rock-ridges one hundred kilometres inland, not by the seaside. Australian society is making a strong statement about its priorities by encouraging the bulldozing of these ancient carvings to provide sites for LNG plants and fertilizer factories, which in turn will add to the greenhouse gas emissions which will eventually result in the sites being drowned by sea level rise, or more likely flooded by storm surges.

Unlike current change, the changes in climate which increased rainfall in Kakadu and the increase in sea level which created the Burrup Peninsula were not precipitated by human activities, but the fact of them puts the lie to the myth of inherent climate stability. Hansen is not the only scientist to sound the alarm: broadly similar summaries of the evidence are available from other sources such as David Spratt and Philip Sutton's book *Climate Code Red* (Melbourne, Scribe, 2008). The scientific consensus includes the following propositions.

- Climate change from global warming is already under way, driven by human emissions of greenhouse gases.

- It is not a simple steady process, but is likely to be subject to sudden and perhaps irreversible accelerations, for example due to melting of ice caps or release of methane from the tundra.

- The two most worrying consequences of accelerated change are the expansion of deserts into the areas of previously Mediterranean climate, and rises in sea level which could drown the world's ports within a few decades. While humanity may be able to live with – indeed is already living with – the consequences of significant global warming (around 0.8^{o}C averaged across the whole earth since 1850), accelerated change would be disastrous.

- Global warming is due to the accumulation of greenhouse gases, chiefly carbon dioxide.

- The other greenhouse gases – methane, nitrous oxide and various by-products of the chemical industry – are responsible for roughly 15 per cent of the trend to global warming.

- Reflecting its primacy as a greenhouse gas, discussion of climate change concentrates on carbon dioxide. The atmospheric physics of carbon dioxide is complicated because the gas is continuously generated and absorbed in the natural carbon cycle – the human contribution being to put this cycle out of balance.

- The current total concentration of greenhouse gases is around 460 parts per million (ppm) carbon dioxide equivalent, of which 387 ppm is carbon dioxide alone. The carbon dioxide concentration is increasing by 2 ppm a year. The pre-industrial concentration was 280ppm.

- To retain the ice caps – and also to retain any hope of continuing agriculture in the southern Australian wheat belt – the carbon dioxide concentration needs to be returned to less than 350 ppm, and perhaps to 300 ppm. To re-freeze the Arctic sea ice, which seems to be the most sensitive measurable indicator, the concentration needs to dip below 325 ppm.

Though substantial reductions in concentration are required, it will not be necessary or desirable to eliminate all carbon dioxide emissions. The challenge is to bring emissions to within the earth's capacity to cope.