Addressing the great moral challenge to our generation

Speech to the Parliament by Hon Greg Combet MP, Minister Assisting the Minister for Climate Change, 12th August 2009

This week the Senate will vote on the most important piece of environmental and economic legislation that has been introduced into this Parliament - the Carbon Pollution Reduction Scheme (CPRS).

It is important to remind ourselves why the Government is introducing this significant reform. The scientific case for action on climate change is clear. The climate system is warming. Human-induced emissions of greenhouse gases are responsible for most of the warming. Warming will continue

And unless the world dramatically reduces global greenhouse gas emissions, changes in the climate will have serious consequences for society, economy and the environment.

This science has been thoroughly tested and verified. These statements are based on careful analysis of hundreds of papers in the peer-reviewed scientific literature.

They are supported by the findings of the Intergovernmental Panel on Climate Change, the 2009 Copenhagen Conference, the United States Global Change Research Program, and the world's leading scientific societies including the UK Royal Society and the US National Academy of Science.

Those who wish to dispute these findings must do so in major peer-reviewed journals if they want their opinions to have weight in the scientific community or persuade policy-makers.

Publication in newspapers and blogs is not a substitute for the careful processes of scientific rigour. The challenge is serious and there is no excuse for inaction.

Greenhouse gases

The basic physics of the greenhouse effect have been well understood for more than one hundred years. Greenhouse gases are a natural part of the atmosphere. Without the natural greenhouse effect average surface temperatures would be 33 ºC lower.

Carbon dioxide concentrations varied between 172 and 300 parts per million over the last 800,000 years [1]. The records demonstrate a close relationship between carbon dioxide concentrations and temperature.

Burning of fossil fuels, destruction of forests and agricultural practices have caused carbon dioxide concentrations to rise by 37 per cent, methane by 150 per cent and nitrous oxide by 18 per cent [2]. Most of this increase in greenhouse gas concentrations has occurred during the lifetime of those sitting in this House.

In 2008 carbon dioxide concentration reached 383 parts per million, which is far in excess of anything observed during the existence of humans on the planet [3].

Observed warming

Over the past century the global average surface temperature has risen by 0.74 ºC. Temperature rises have occurred on all continents and over the ocean. Thirteen of the fourteen warmest years on record occurred between 1995 and 2008 [4]. In Australia

there has been a warming of 0.9 ºC since 1950[5]. Warming would have been greater had not small aerosol particles in the air from industrial pollution caused some counteracting cooling of the atmosphere.

Air temperatures are subject to natural variability due to influences such as El Nino cycles, variation in solar activity and large volcanic eruptions. Because of this natural variability, it is not possible to draw conclusions about long term climate change trends from ten to fifteen years of data.

Claims that global warming has stopped because no trend in air temperatures can be observed in the period since, say, 1998 are scientifically and statistically invalid

Further, when we consider warming we must look at the entire climate system. The climate system includes the atmosphere, the oceans, ice and snow, and the land.

Most of warming since 1960 (about 85 per cent) has happened in the oceans. In the period from 1961 to 2003 the heat content of the ocean increased by 160 thousand trillion Mega-Joules [6]. This is a very large amount of heat, enough to melt 479 thousand billion tonnes of ice.

There have already been massive changes to sea ice, ice sheets, snow cover and frozen ground. Arctic sea ice extent has declined since 1979, while summer sea ice extent has decreased dramatically. The average Arctic sea ice extent for July 2009 - last month - was 8.81 million square kilometres, about 87 per cent of the 1979-2000 average for July, representing a loss in area the size of the Northern Territory [7].

Sea ice extent in Antarctica has increased by one per cent per decade due to changes in wind patterns linked to ozone depletion and climate change. This is likely to be a short lived increase with models projecting Antarctic sea ice will reduce by almost a quarter in total extent and a third in total volume by 2100[8].

Most of the world's ice is in the vast ice sheets of Greenland and Antarctica. Greenland is melting rapidly, losing ice at the rate of about 200 cubic kilometres per year. Antarctica is also losing mass, though not yet as rapidly. Warming of the oceans and melting of land-based ice causes sea levels to rise. In the last century average global sea level rose by 17 centimetres [9]. Sea levels have continued to rise over the last decade, at an increased rate.

Finally, warming of the climate system can be seen in changes in temperature sensitive natural ecosystems. Already, Australia is experiencing shifts such as encroachment of eucalypts into subalpine grass lands and early flowering dates for many plants.

This wide and diverse body of carefully documented evidence has led scientists to conclude that warming of the climate system is 'unequivocal.'

The warming is caused by human activities

The warming of the last fifty years cannot be explained by natural factors. On the contrary, the science shows that emissions of greenhouse gases from human activities very likely caused most of this observed warming.

Some have suggested that the current warming is a 'bounce back' from the Little Ice Age - a period of cooler temperatures in the northern hemisphere from the 17th to early 19th centuries.

It is questionable whether this qualifies as a scientific explanation at all, since it offers no physical explanation for the warming. In any case, the Little Ice Age was a regional phenomenon, not a global one (there is no evidence for a Little Ice Age in the southern hemisphere) [10].

Others have suggested changes in solar irradiance are responsible. However "the warming power" of the additional greenhouse gases in the atmosphere from human activities is about 20 times greater than that of the increase in total solar irradiance from 1750 [11].

Similarly, there is little evidence to support suggestions that changes in cosmic rays are responsible for warming. There is no demonstrated physical mechanism by which cosmic rays could influence climate. And there is no correlation between cosmic ray intensity and recent temperature change [12].

In summary, despite prolonged and careful examination by scientists, no natural causes can explain the observed warming. Indeed, if only natural changes were considered it is likely the Earth would have cooled during the 20th century In addition, the amount of warming observed to date is consistent with the additional greenhouse gases and aerosols in the atmosphere due to human activities.

Climate scientists use a range of indicators or 'finger prints' to study the human influence on climate. These are characteristics we would expect to see if warming was caused by an increase in greenhouse gases concentrations but not if other causes were responsible.

For example, increased greenhouse gas concentrations should lead to warming of the lower atmosphere (or troposphere) and cooling of the upper atmosphere (or stratosphere). This is exactly what has been observed. On the other hand, increased solar irradiance should lead to warming of the upper as well as the lower atmosphere [13].

We can therefore say with a very high degree of confidence that greenhouse gases have been the main driver of the global warming trend since the mid-20th century, while a range of natural processes have affected - and continue to affect - shorter-term variability.

For practical purposes we can be sure that human activities are responsible for warming.

The future

The massive stores of heat in the world's oceans means climate change cannot be reversed for many centuries [14]. Even if greenhouse gas concentrations were to be stabilised at their present levels, a further warming of the atmosphere of at least 0.6°C would inevitably follow.

However, if we fail to control global greenhouse gas emissions global average atmospheric temperature could rise by up to 5 or 6°C above 1990 levels by the end of this century [15].

These are dramatic temperature increases. To provide a point of comparison, the difference in average global temperatures between the last ice age and today is about 5°C.

These temperature changes would be accompanied by significant and ongoing rises in sea level, heat waves, bushfires and droughts, disruptions to ecosystems including the extinction of many species, disease threats, and social and geopolitical destabilisation.

Sea level impacts

Sea level rise is directly related to increased temperature through thermal expansion of the ocean and melting of land-based ice.

In 2007 the IPCC concluded that sea levels could rise between 18 and 76 cm by 2100, allowing for the break-up of land-based ice sheets. Further research over the last two or three years suggests this may be an underestimate [16] [17] [18].

Sea level rise of up to 1 metre by 2100 cannot be ruled out. Increased sea levels will combine with storm surges and other extreme events such as king tide to flood low-lying coastal areas and erode coastlines.

Even an apparently modest sea level rise of 50 cm would cause extreme sea level events to occur hundreds of times more frequently along many parts of the Australian coastline [19].

More than 700,000 residences across Australia are estimated to be at threat from the effects of climate change including storm surges and extreme weather events [20].

Globally, mega deltas and low lying islands are particularly vulnerable to sea level rise and could be uninhabitable by 2100. Many of the most vulnerable of these are in our neighbourhood - the Asia-Pacific region [21].

Heat-related impacts

The heatwave in south-eastern Australia in January and February this year illustrates our vulnerability to extreme heat events. This heatwave set new record temperatures and had observable impacts on human health, infrastructure and ecosystems.

During this heat wave, the Basslink Interconnector experienced shut down when temperatures exceeded its design limits, reducing power supplies to Melbourne. Rail lines buckled causing delays in transport. In Victoria there were 374 additional deaths [22].

Climate change will result in more heatwaves. Bushfires are expected to become more intense, and the interval between them will shorten [23]. The mega fires in Canberra in 2003 and Victoria in 2009 are consistent with these expected changes in fire regimes.

Impacts on water resources

Climate change is already affecting our water resources and larger impacts can be expected in the future.

Rainfall in south-west Western Australia dropped by about 15 per cent in the 1970s and has not recovered. Stream flow into Perth's dams between 1976 and 2000 almost halved as a result [24].

There is evidence that greenhouse gases emitted by human activities are responsible for half the decline in rainfall in south-west Western Australia [25]. There is also evidence

that reduced rainfall in south-eastern Australia - Victoria and the southern part of South Australia - cannot be explained by natural factors alone [26] [27].

Projections indicate that water availability will continue to decline in major areas of Australia. This has large implications for water availability in our major cities and agricultural centres including the Murray Darling Basin. Under a worst case scenario irrigated agriculture in the Murray-Darling Basin would virtually disappear by 2100 [28].

Ocean acidification

About one quarter of human emissions of carbon dioxide is absorbed by the oceans [29]. While this provides a brake on the rate of climate change, it has serious consequences for marine ecosystems because the dissolved carbon dioxide acidifies the oceans.

Coral reefs face the double threat of increasing sea surface temperature causing coral bleaching and acidification reducing their ability to grow.

Increasing acidification will cause severe disruptions to marine ecosystems in general, and will endanger many of the world's fisheries [30].

World Heritage Properties

17 of Australia's World Heritage Properties, listed for their outstanding cultural and natural values, will experience increased risks from climate change [31].

The threats to our largest World Heritage area - the iconic Great Barrier Reef - from increased ocean temperatures and acidity due to carbon pollution are severe. The Great Barrier Reef is home to important biodiversity and contributes around $5 billion and around 60,000 jobs to Australia's economy.

Kakadu National Park represents a unique combination of outstanding ecological and cultural values, both of which are threatened by climate change. Rising sea levels are already causing salt water intrusion into low-lying freshwater wetlands.

Human Health

Climate change will have numerous and far-reaching health impacts. Assuming no adaptation, there could be an additional 5000 heat related deaths in our five largest cities by 2050 [32].

Climate change will also change the geographical range of mosquito-borne infectious diseases. Climate change and population growth are likely to increase the number of people living in areas suitable for supporting Dengue fever by up to 1.4 million by 2050 [33].

Economic impacts

Climate change impacts will have far-reaching economic implications.

It is not possible to calculate the full economic costs of future climate change impacts. However, the 2008 Garnaut Review provided a partial estimate. Garnaut concluded that the limited range of impacts he was able to consider would result in costs amounting to 8 per cent of gross domestic product by the end of this century in the event of unmitigated climate change [34].

The full cost to the economy from the entire range of climate change impacts and their flow-on effects would be much higher.

Feedbacks and tipping elements in the climate system

Of major concern is the growing realisation that climate change can be accelerated beyond current predictions by reinforcing 'climate feedbacks' - that is, climate change feeds on itself to enhance the rate of warming [35]. One feedback of concern is the possible release of hitherto stable carbon stores to the atmosphere, for example by the thawing of carbon-rich frozen soils.

A tipping point is where the climate is effectively flipped into a new state with no way to recover. Some of these flips can occur rapidly with little advance warning.

It is possible that a temperature threshold will be crossed later this century that will see the eventual disappearance of the Greenland ice sheet. If this happened, it would lead to 7 meters of sea level rise. Such a change would be irreversible in any timeframe meaningful for human societies [36].

Conclusion

In March this year over 2000 leading scientists gathered at a conference in Copenhagen found that many aspects of climate are changing near the upper boundary of IPCC projections.

Unabated emissions will cause major societal and environmental disruptions for our children and those that follow.

In July in Italy, leaders of the world's 20 largest emitting economies, including Prime Minister Rudd, agreed that the science is compelling and that urgent action needs to be taken.

The Government is helping shape a global solution. We are working to achieve at the UN Conference in Copenhagen in December a new and effective long term approach on global cooperation.

The Government recognises that a global agreement stabilising greenhouse gases at 450 parts per million of carbon dioxide equivalence or lower is in Australia's national interests.

Even if we do achieve an ambitious new global agreement, the climate will continue to change. The Government has put in place the first steps to prepare to adapt to this challenge and there is much more as a nation that we shall need to do to make us resilient to the climate change risks that will confront our society, economy and the environment.

To drive the carbon intensity of economy down and to contribute to the global effort, the Government has committed to challenging emissions reductions targets.

If there is a comprehensive agreement capable of stabilising greenhouse gases at 450 parts per million of carbon dioxide equivalence or lower, then the Government is committed to a target of reducing emissions by 25 per cent of 2000 levels by 2020.

The Carbon Pollution Reduction Scheme constitutes the foundation stone of Australia's ability to reach those ambitious national emissions reductions targets.

It is being supported by other measures including the expanded Renewable Energy Target and on energy efficiency.

Inaction on climate change is inexcusable. The Government is committed to action. The leader of the opposition agrees with the climate change science. He agrees we need a price on carbon in the economy. He supports the Government's emissions reductions targets. It is now up to him to get his party to support the CPRS legislation in the Senate.

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