



ACET-GLOBAL

Global Warming and Climate Change



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## What Is Global Warming and Climate Change?

We have known since the late nineteenth century that the Earth is kept warmer than it would otherwise be by the presence of trace gases in the atmosphere which trap heat. The “greenhouse effect” was given its name by the Swedish scientist Arrhenius in the 1890s because he recognized that it worked in the same way as the glass in a greenhouse, admitting the sunlight which warms the interior and blocking the infra-red radiation that would carry the heat away. The natural greenhouse effect is a great benefit and is the fundamental reason why the average Earth temperature, of 15°C, is about 33°C higher than the temperature on our Moon (which does not have an atmosphere). The following diagram provides a simple pictorial explanation of the greenhouse effect.

Most people are familiar with one example of the greenhouse effect: the difference in temperature between a cloudy or clear night. After a hot day, a cloudless night is usually considerably cooler than a cloudy night – the difference being that the water vapor in the clouds traps the Earth’s heat in and prevents it being radiated to Space. Water vapor is the major greenhouse gas in the atmosphere. This provides a simple example of the greenhouse effect that is a matter of common experience rather than complex science. [For best results when selecting text to copy or edit, don’t include space to the right of the characters in your selection.]

There are three key terms that require brief definition and explanation to clarify the concepts associated with the enhanced greenhouse effect:

(a) Greenhouse gases are gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth’s surface, the atmosphere and clouds. This property causes the greenhouse effect. Water vapor (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), methane (CH<sub>4</sub>) and ozone (O<sub>3</sub>) are the primary greenhouse gases in the earth’s atmosphere. Moreover, there are several entirely human-made greenhouse gases in the atmosphere, such as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

(b) Climate change refers to a significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcing’s, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. The United Nations Framework Convention on Climate Change (UNFCCC), in Article 1, defines climate change as, “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”. The UNFCCC thus makes a distinction between “climate change”, attributable to human activities altering the atmospheric composition, and “natural climate variability”, attributable to natural causes

(c) Global warming is the common term for climate change due to anthropogenic emissions of greenhouse gases leading to increased global temperatures and other climatic effects such as changes in rainfall patterns and the frequency of severe storms.

## How Serious A Problem Is Global Warming And Climate Change?

The average temperature of the Earth is now warmer than at any time since human records began and much of this increase is due to human activities releasing greenhouse gases to the atmosphere.

The Intergovernmental Panel on Climate Change (IPCC), the leading international body on climate change science, concluded in its Fourth Assessment Report (AR4) in 2007 that mean global temperatures increased by 0.74°C between 1906 and 2005 and most of the observed increase over the 20th century is very likely (i.e. >90%) due to anthropogenic emissions of greenhouse gases from the combustion of fossil fuels, agriculture, and land-use changes. This finding is based on an extensive body of science. The main reports of the AR4 are nearly 3,000 pages long and published in three volumes. To assist the Court in understanding the full context of the causes and impacts of climate change I have attached the body of the, much shorter, Synthesis Report produced by the IPCC as Appendix 2 to this report.

The IPCC projected likely future temperature changes using different scenarios of emissions set out in its Special Report on Emissions Scenarios (SRES), with projected concentration of CO<sub>2</sub> in the year 2100 from 540 to 970 ppm, compared to about 280 ppm in the pre-industrial era and about 368 ppm in the year 2000. Further calculations summarized in Section 5.4 of the attached Synthesis Report give the IPCC conclusion that mean global temperatures will increase from 1990 levels by between about 1°C for a low-emissions scenario and about 5°C for a projection of present trends, the future which will eventuate if current proposals for new fossil-fuel production are approved. The levels of reduction in anthropogenic greenhouse gas emissions that are required to stabilize global temperatures at less than a mean 2-3°C rise are uncertain. It will probably require stabilization of equivalent greenhouse gas concentration of 450 ppm or lower, with further reductions after 2100.<sup>10</sup> The recent summary by the Australian Academy of Science concluded “To have a better than even chance of preventing the global average temperature from eventually rising more than 20 C above pre-industrial temperatures, the world would need to be emitting less than half the amount of CO<sub>2</sub> by 2050 than it did in and Pittock AB (2005), *Climate Change: Turning Up the Heat*, CSIRO Publishing, Melbourne, pp 152-155. 2000. To do this on a smooth pathway, global emissions (which are still rising) would need to peak within the next ten years and then decline rapidly.”

For Australia, the consequences of anthropogenic global warming and climate change have been: an increase in average temperature of 0.9°C since 1910; an increase in the frequency of very hot days; a decrease in the frequency of very cold nights; more frequent, persistent and intense droughts; more frequent heavy rainfall events; decreased winter rainfall, especially in southern Australia; sea levels increasing about 2 cm per decade; and increasingly frequent extreme events such as category five tropical cyclones, severe east coast low pressure systems and intense bushfires. To assist the Court in understanding the impacts of climate change on Australia, I have attached as Appendix 3 to this report the executive summary of a technical report on climate change in Australia published by the CSIRO.<sup>12</sup>

## Main finding

Many aspects of climate are expected to change in a linear fashion as temperatures rise. A growing body of research suggests that many important physical changes and impacts in the climate system during the next few decades to centuries will be proportional to global temperature increase. It is now possible to utilize increments of change in globally averaged temperature—increases of 1°C, 2°C, 3°C, and so forth—as a tool for examining a wide range of climate impacts. In turn, each increase in temperature also can be linked to a carbon dioxide emissions stabilization target around which emission policies could be structured. This framework helps decision makers weigh the potential risks of climate change; however, the costs of achieving emission reductions are not addressed.

In general, each degree C of global temperature increase can be expected to produce:

- 5-10% changes in precipitation across many regions
- 3-10% increases in the amount of rain falling during the heaviest precipitation events
- 5-10% changes in streamflow across many river basins
- 15% decreases in the annually averaged extent of sea ice across the Arctic Ocean, with 25% decreases in the yearly minimum extent in September
- 5-15% reductions in the yields of crops as currently grown
- 200-400% increases in the area burned by wildfire in parts of the western United States

## Adaptation to Climate Change

Adaptation to climate change in developing countries is vital and has been highlighted by them as having a high or urgent priority. Although uncertainty remains about the extent of climate change impacts, in many developing countries there is enough information and knowledge available on strategies and plans to implement adaptation activities now.

Adapting to climate change will entail adjustments and changes at every level – from community to national and international. Communities must build their resilience, including adopting appropriate technologies while making the most of traditional knowledge, and diversifying their livelihoods to cope with current and future climate stress. Local coping strategies and traditional knowledge need to be used in synergy with government and local interventions. The choice of adaptation interventions depends on national circumstances. To enable workable and effective adaptation measures, ministries and governments, as well as institutions and non-government organizations, must consider integrating climate change in their planning and budgeting in all levels of decision making.

## Sustainable Development Planning And Practices

Climate change has the potential to undermine sustainable development, increase poverty, and delay or prevent the realization of the Millennium Development Goals. An effective way to address the impacts of climate change is by integrating adaptation measures into sustainable development strategies to reduce the pressure on natural resources, improve environmental risk management, and increase the social well-being of the poor. Climate change can influence humans directly, through impacts on health and the risk of extreme events on lives, livelihoods and human settlements, and indirectly, through impacts on food security and the viability of natural resource-based economic activity. The workshops and meeting discussed the impacts of climate change on achievement of the Millennium Goals in the different regions

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