

A chronology of some major climate science/policy milestones

1800–1910	Industrial Revolution; at the beginning of this period, level of CO ₂ in the atmosphere is about 290 parts per million (ppm) according to the ice core record; technological advances include coal-fired energy with related emissions and means for expanding land clearing; sanitation and medical advances promote population growth.
	<small>* This chronology refers to CO₂ (carbon dioxide) not CO₂-e (CO₂-equivalent, which includes other greenhouse gases), as the measure of greenhouse gas emissions.</small>
1896	Following the work of John Tyndall in 1861 showing that diatomic molecules absorb infrared radiation, Swedish scientist Svante Arrhenius publishes first calculations that planetary temperatures depend on greenhouse gases, speculating that human activity burning fossil fuels creates 'extra' CO ₂ that might make the earth's temperature rise significantly over time.
1939–1945	World War II; nations expand their mission begun in the 1920s to control and exploit world oil supplies, adding more emission sources. Following World War II and technological innovations, resource exploitation, forest clearing, and population expansion explode.
1930s	Scientists suggest anthropogenic global warming is underway driven by more CO ₂ and other greenhouse gases in atmosphere due to human activities. This was known then, and until 1990s, as 'the greenhouse effect'.
1950s	With computer technology, scientific advances allow modelling of the atmosphere, and understanding of climate feedback that accelerates warming or cooling trends, plus the realisation that oceans would not be absorbing all the CO ₂ produced by humans.
1960	Detection of annual rise of CO ₂ in the atmosphere and measurement at 315 ppm.
1967–1968	Calculation that doubling CO ₂ will raise temperatures by several degrees; understanding that polar ice sheets could collapse and elevate sea levels.

1970	<p>First World Environment Day signals strong upsurge of environmental interest and understanding. In the United States the creation of the National Oceanic and Atmospheric Administration (NOAA) creates world's biggest funder of climate research. Scientists begin organising and disseminating risk messages about human impacts on climate.</p>
1972	<p>Further research of proxy records (ice cores mainly) confirm possibility of rapid climate change within a millennium (later brought down to decades).</p>
1975	<p>Discovery of damage to the ozone layer and the beginning of a 10-year battle for an international agreement to restrict human-induced causes is a precursor to global climate negotiations, with many of the same sceptics and societal challenges evident as would appear in responses to the theory of the greenhouse effect. That ozone-depleting chemicals and ozone itself can contribute to the greenhouse effect is shown in the next year.</p>
1970s	<p>Better understanding gained of other possible influences on climate, including sunspot and orbital cycles.</p>
1979	<p>Second oil 'energy crisis' results in an upsurge in renewable energy technology, efficiency measures, smaller cars, calls to lower consumption—showing the feasibility of these technologies and behavioural changes (this understanding and these technologies were still influential in the late 1980s).</p> <p>First report on the greenhouse effect by US National Academy of Sciences says it is 'highly credible' that doubling atmospheric CO₂ will raise average global temperatures by 1.5–4.5 °C; World Climate Research Program launched.</p> <p>Election of Ronald Reagan as US President (and Margaret Thatcher as UK Prime Minister) starts two decades of backlash against environmental understandings and activism. It has been noted that a related set of beliefs dominated Anglo/American countries—United Kingdom, United States, Canada, Australia: neo-liberal market ideologies underpinned by beliefs in limitless resources and a self-adjusting natural world.</p>
1980	<p>The Australian Academy of Science organises a conference to review the thinking of leading scientists on the greenhouse effect.</p> <p>Playboy magazine covers the threats posed by the greenhouse effect, extensively quoting Australian scientists.</p>

1981	Scientific prediction is made that greenhouse warming ‘signals’ would emerge from background ‘climate noise’ by 2000 and be measurable; 1981 declared ‘warmest year on record’.
1985	<p>Villach, Austria: United Nations Environment Programme/World Meteorological Organisation (UNEP/WMO) scientific conference yields major public pronouncement by scientists linking anthropogenic increases in greenhouse gases with global warming—showing consensus within climate science community and calling for international action to curb emissions; a 541-page report is produced in 1987. The conference statement acts as a catalyst for global action. It opens: ‘As a result of the increasing concentrations of greenhouse gases, it is now believed that in the first half of the next century a rise of global mean temperature could occur which is greater than any in man’s history.’</p> <p>Antarctic ice cores show that CO₂ and temperature went up and down together during the ice ages.</p> <p>Scientific calculation that disruption—with ice-melt fresh water—of the North Atlantic ocean circulation (the warming Gulf Stream) can bring sudden and dramatic climate change in the Northern Hemisphere (i.e., paradoxical cooling).</p>
1986	<p>CSIRO Division of Atmospheric Research briefs Australian federal and state Environment Ministers’ Council (ANZECC) on the risks posed by the greenhouse effect.</p> <p>CSIRO, with support from Australian governments, initiates two conferences—‘Greenhouse ’87’ and ‘Greenhouse ’88’—that are credited with spurring Australian public understanding of greenhouse to world-leading proportions.</p>
1987	<p>Montreal Protocol of the Vienna Convention achieves international agreement to curb ozone emissions and is cited as an example that international agreement on atmospheric pollution is possible.</p> <p>First CSIRO national conference on greenhouse/climate change in Australia.</p>
1988	News coverage of greenhouse effect escalates; framed as risks in response to record heat and drought in the United States and elsewhere. Testimony to US Congress by leading NASA atmospheric scientist James Hansen that he was 99 per cent certain climate change had begun, based on the series of warm years in the 1980s. In Australia, media coverage also in response to second CSIRO and Commission for the Future conference and political/public discourse on the topic.

Intergovernmental Panel on Climate Change (IPCC) established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to advise national governments on best available scientific evidence on climate change causes, consequences, and response strategies, based on peer-reviewed publications; to report to second world climate conference in 1990 (first IPCC report).

1988 Toronto 'Conference on the Changing Atmosphere' attended by scientists, economists, and national leaders; call for action describes human activities as a vast, unplanned experiment upon the planet.

Level of CO₂ in the atmosphere reaches 350 ppm.

1989 'Declaration of the Hague' by 24 nations including Australia recognises global significance of climate change and calls on all nations to participate in a Framework Convention in 1992.

Labor federal government under Bob Hawke takes a leading role internationally on climate change.

April: Federal government sets up a National Climate Change Program with a National Greenhouse Advisory Committee of scientific advisers and a Prime Ministerial Working Group to assess achievable targets, and set priority research areas and objectives.

The Global Climate Coalition is founded by fossil fuel companies, and other corporations with economic interests in the status quo, to 'fight back' against climate science and proposed action.

1990 First IPCC Assessment Report, made to the second world climate conference in Geneva; Australian scientists play prominent roles on the panel of 170 scientists assessing the published science at this time, backed by 200 scientists conducting peer review of the draft report. First IPCC report notable for its direct and clear language of certainty and risk.

Initiation of ecologically sustainable development (ESD) working groups under Hawke government. A unique attempt to develop sustainable policy in nine sectors of the economy in 'accord' style roundtable discussions by main societal sectors including environmental and community groups, plus government and industry. Greenhouse/climate change tackled by an inter-sectoral group that made significant recommendations, later watered down by federal bureaucracy.

Industry concerns about economic 'cost' of climate change mitigation action enter public discourse; coal industry moves to forefront and 'debate' is initiated.

Federal and state energy portfolio ministers in the Australian Minerals and Energy Council release report, and initiate studies and action to lessen emissions from that sector; significant because it shows early understanding by this portfolio.

October: Federal government releases 'interim planning target' to stabilise CO₂ emissions at 1988 levels by 2000, and reduce them by 20 per cent from there by 2005.

Late 1990 and 1991	Treasurer Paul Keating (elected prime minister in 1991) commissions both ESD greenhouse working group and Industry Commission to investigate cost and benefit of taking action; he receives widely divergent responses; Industry Commission 'frame' focusing on economic cost becomes a pivotal turning point in the national discussion.
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1991	Change of federal leadership in Australia, Keating replaces Hawke.
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1990s overall	Characterised by increasing influence and then dominance of neo-liberal/free market economic policies, shunning regulation, and shifting from public to privatised energy infrastructure based on coal, gas and hydro-electricity. This period cements investments with 40+ year time span in conventional energy infrastructure and production (e.g., coal-fired electricity plants). Deregulation and competition in energy and other markets switches emphasis from lowering consumer and industrial demand to mitigate emissions, to an emphasis on profit via greater consumption and more supply.
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1992	UN Conference on Environment and Development (Rio Earth Summit); Australia still argues for binding emission targets, rejected by the United States under President George H.W. Bush.
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1992	<p>UN Framework Convention on Climate Change (FCCC) unveiled at Rio Summit; Australia is a signatory (ratified by federal parliament in December 1992), making it the eighth of 192 parties to have signed by 1994. The convention sets some goals like 2000 as the year for returning emissions to 1990 levels, and obligating signatories to adopt national policies to limit emissions.</p> <p>National Greenhouse Response Strategy (NGRS) established; reflecting influence of dominant market ideology, NGRS rejects regulation for greenhouse response strategies at federal and state levels. Focus turns to business concerns and priorities, and voluntary industry action, but there is now a reduced focus on alternative energy supply–efficiency measures and renewable technologies at the state level, and international participation at the Commonwealth level.</p>
1994	<p>‘Greenhouse ‘94’ organised by CSIRO and New Zealand scientists, organised to review science in lead-up to first conference of the parties to the FCCC. Thereafter, Australian academies of science, engineering and social science report jointly in 1995.</p>
Mid-1990s	<p>Scientists gain better understanding of possibilities and mechanisms of rapid climate change; international scientific reports and warnings of risk continue from, inter alia, UK Meteorological Office, the US National Aeronautic and Space Administration (NASA), US National Academy of Sciences, NOAA, and other international institutions.</p>
1995	<p>Second IPCC assessment reports on science, impacts and responses to anthropogenic climate change; confirm and continue the risk analysis set out in 1990 reports; however, language changes to a more cautious/academic modality.</p> <p>Australian National Greenhouse Response Strategy (NGRS) published but scarcely implemented.</p> <p>First conference of the parties to the FCCC, held in Berlin, Germany; leads to Berlin Mandate, which calls for agreement, by the end of 1997, on greenhouse gas emission reduction targets. The Kyoto Protocol of 1997 is to establish specifics of targets and methods for each country.</p> <p>A key frame shift is evident at Berlin; Australia changes its position in international negotiations from ethical-based to an economic-based position, arguing the ‘special needs’ of its fossil fuel-specialised economy.</p>

1996	<p>Change of federal leadership in Australia to Coalition and John Howard.</p> <p>Second conference of the parties to the FCCC held in Geneva, Switzerland. Australia's policy frame continues to shift and Australia establishes itself as a 'climate change laggard' (McDonald 2005: 225).**</p> <p>** 'Immediately before the conference the government questioned the science of climate change and opposed the idea of the IPCC's new conclusions on climate change impacts providing the basis for negotiations ... These would "hurt Australia"' (McDonald 2005: 225). Australia was joined by the OPEC states and the Russian Federation. The United States and Europe supported binding emission targets at the time, with the United States under President Bill Clinton who was elected in 1993.</p>
1996–2001	<p>Transition to complete neo-liberal, economic rationalist dominance (hegemony) of public policies and discourses. International stance now about economic 'national interest' and Australia's special case. Cuts or dismantling of research programs focused on energy efficiency, and renewable and alternative sources. Strong ties to neo-liberal think tanks. Attacks on, and marginalisation of, environmentalists. Reports that climate science communication is discouraged from government-funded institutions during this period and later.</p>
1997	<p>Australian Greenhouse Office established. National Greenhouse Advisory Panel (established under Hawke) of scientists, industry, unions, consumers, and government representatives effectively disbanded (not asked to meet after this year). National Greenhouse Response Strategy reviewed; outcome critiqued as weak and ineffective due to lack of leadership, inability to separate public interest from narrow commercial interests, and lack of informed public discourse.</p> <p>Australian media reports exhibit strong shift in emphasis from science story to political economic story in the lead-up to the Kyoto Protocol, and document considerable industry resistance to action.</p> <p>November: Kyoto Protocol to the FCCC agrees nations to reduce emissions by 2012; signed by 163 countries including Australia (which eventually declined to ratify until a change of government at the end of 2007).</p>
1999	<p>New National Greenhouse Strategy developed with emphasis on voluntary action.</p>

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- 2001 March: Newly inaugurated US President George W. Bush renounces Kyoto Protocol on national emission reduction targets, soon to be joined by Australia; a new stage of political scepticism and denial ramps up in both countries.
- IPCC Third Assessment report; echoes risks outlined in first two assessments in greater regional detail, using language of scientific probability and uncertainty.
- By December 2006 a report by the Australian Greenhouse Office regarding domestic emissions 'predicted greenhouse emissions generated by rising demand for coal-fired electricity would increase by 62 per cent over the next four years, and by 127 per cent by 2020' (Beeby 2006).
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- 2009 Level of CO₂ in atmosphere has risen to 390 ppm. Combined with methane and nitrous oxides (CO₂-e) the level is 450 ppm.
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- 2014 Level of CO₂ in atmosphere measuring above 400 ppm, and scientists voice concern that, without immediate and significant measures to lower global emissions, warming will not be stopped at 2 °C, which is still considered manageable for human societies. Sea level rise of 1–3 metres guaranteed with scientific reports that West Antarctic Ice Sheet has begun irreversible melt. News reports that coastal cities like Miami, United States, already experiencing sea water incursions. In Miami's state of Florida, leading politicians continue to deny the reality of climate change and its effects.
- Australia becomes first country to legislate to undo a national price on carbon pollution and a link to an emissions trading scheme. The carbon price was credited with lower emission measurements after two years in place before it was axed. Australian Government backpedals on successful renewable energy sector.
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Sources: Bouma, Pearman & Manning (1996); Diesendorf (2007); Flannery (2005); Hamilton (2001); IPCC (1990, 1995, 2001); Weart (2003); Australian Government documents; industry documents; media reports.

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