

**This document has been prepared for
information purposes only – for the benefit of
The Climate Project Presenters**

Climate change scepticism in Australia: A toolkit

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- Useful links and a template press release

An Introduction

This toolkit has been purpose built for you – The Climate Project presenters who have been trained in Australia. Many of you have identified the need for quick and easy to relate answers to common sceptical questions.

The first section of this document is based on information sent to TCP from TCP Presenters in the field. The request from the team – was to supply an answer to these statements which are simple, short and in colloquial language.

The numbered questions/statements in this first section reflect a condensed list of queries or statements which have been asked at TCP presentations. In most cases, underneath the numbered statements in italics are quotes from people whose view contradicts the peer reviewed science. These statements are referenced so you can read some details about the person who made the statement.

We have tried to supply a simplified scientifically accurate answer while maintaining the scientific integrity of the sometimes complex answer. This is essential for the reputation and future of the Project. These answers to the statements/questions in the section 2 have been reviewed by Dr Graeme Pearman as has sections 3 and 4 - Scientific Processes and FAQs.

Many of you have the skills at your disposal to elaborate on these answers. The box under most of the answers contains a link for further reading.

Most of you work with audiences in Australia, but those who do not may not be fully serviced by this document as it is very focused on the sceptic case in Australia.

This document is not for publication, resale or further distribution by you. It has been prepared for your information and assistance purposes only.

We hope this helps with your important work.

The TCP Team.

Elevator Answers to Sceptical Statements

1)- Can you be sure it's carbon dioxide that's heating the atmosphere?

 *"There is no reasonable certainty that increases in atmospheric carbon dioxide from human activity cause significant global warming."*
- Alan Oxley¹

 *"Politically popular though it may be, the belief that atmospheric carbon dioxide is the primary driver of average planetary temperature is junk science"*
- Robert (Bob) Carter²



Experiments dating back to 1820s have established the relationship between the warming properties of carbon dioxide and the thermal properties of the atmosphere. In the last half century, the burning of fossil fuels has caused a sharp increase in greenhouse-gas concentrations, to a point where they are now higher than any time in at the last 650,000 years.

Further reading:

<http://www.csiro.au/resources/Humans-Changing-Climate.html>

2) - It is the Sun.

 *"The Sun is the primary driving force of climate"*
- Ian Plimer³



Research by the Royal Society of Mathematical, Physical & Engineering Sciences shows us that in the last 35 years of global warming, the sun has shown a slight cooling trend. Sun and climate have been going in opposite directions.

¹ Alan Oxley, "Unlike Kyoto, this climate deal suits us fine", *The Australian* (2 August, 2005), accessed at <http://www.onlineopinion.com.au/view.asp?article=3742> on 15 April, 2010. Alan Oxley studied Asian History and Politics at Monash University; is the Chairman of the Australian APEC Study Centre; and was an advisor to the Howard Government on foreign affairs.

² Robert Carter, "Nature will decide Earth's future", *The Daily Telegraph* (9 December, 2009), accessed at <http://www.dailytelegraph.com.au/news/nature-will-decide-earths-future/story-e6freuy9-1225808400388> on 18 April, 2010. Professor Carter is a research Fellow with the Marine Geophysical Laboratory at- James Cook University (Queensland); he has a Ph.D. in Palaeontology from the University of Cambridge; he was a founding member of the [Australian Environment Foundation](#) and is a Global Warming Expert for the Heartland Institute.

³ Ian Plimer, *Heaven + Earth: Global Warming: the Missing Science* (Ballan, Victoria: Connor Court Publishing, 2009), p. 100. Ian Plimer is a Professor of Mining Geology at the University of Adelaide; is a Global Warming Expert for US think-tank 'The Heartland Institute'; and is on the Board of Directors of three Australian mining companies (Ivanhoe Australia, CBH Resources, Kefi Minerals).

Further reading:

<http://rspa.royalsocietypublishing.org/content/464/2094/1387.abstract>

3) - The Earth is actually cooling. Isn't it true that it's actually been getting colder over the last 10 years?



“However, global mean surface temperature has not risen since 1998 and may have fallen since late 2001”

- Christopher Monckton⁴



Researchers from NOAA and NASA and empirical measurements published in the Journal of Geophysical Research documents that the Earth is still accumulating heat and global warming is still happening. Surface temperatures can show short term cooling when heat is exchanged between the atmosphere and the ocean, which has a much greater heat capacity than the air.

Further reading: <http://www.agu.org/pubs/crossref/2009/2009JD012105.shtml>

4) - The IPCC and scientists have an agenda.



“In other words, there was no consensus at all at the IPCC—other than the participants’ universal agreement that there was a problem with what they wanted to show. Mann is here telling us, in his own words, that there was an agenda to present a “consensus viewpoint”—that simply didn’t exist in reality because of the science.”

- John Costella⁵



“The IPCC is clearly an ascientific political organisation in which environmental activists and government representatives are setting the agenda for a variety of reasons including boosting trade, encouraging protectionism, adding costs to competitors and pushing their own sovereign barrow”

- Ian Plimer⁶

⁴ Christopher Monckton, “Climate Sensitivity Reconsidered”, *Forum on Physics and Society* (American Physical Society, July 2008), accessed at

<http://www.aps.org/units/fps/newsletters/200807/monckton.cfm> on 15 April, 2010. Christopher Monckton is the Third Viscount Monckton of Brenchley; he has a B.A in Classics, and a diploma in Journalism Studies; he was a policy advisor to British Prime Minister Margaret Thatcher; he is a Global Warming Expert for US think-tank ‘The Heartland Institute’.

⁵ John Costella, editor, *The Climategate Emails* (online publication: The Lavoisier Group, 2010), p. 16, accessed at <http://www.lavoisier.com.au/articles/greenhouse-science/climate-change/climategate-emails.pdf> on 15 April, 2010. John Costella has a PhD in physics and works as a Data Manager and Senior Research Scientist for The Portland House investment group.

Dr John Costella, Research Scientist with The Portland House investment group, Ph.D., University of Melbourne, Physics, 1994, B.E.(Elec)(Hons) , Electrical, Electronic and Computer Engineering , 1989.

⁶ Ian Plimer, *Heaven + Earth: Global Warming: the Missing Science* (Ballan, Victoria: Connor Court Publishing, 2009), p. 23.



The thousands of scientists who contribute to and review the UN's IPCC Reports have only one agenda - to make the most rigorous detailed study into the question at hand. The recent review into the IPCC is an example of that rigor.

Further reading:

<http://www.ipcc.ch/pdf/press/pr-1003210-UN.pdf>

http://www.ted.com/talks/lang/eng/rachel_pike_the_science_behind_a_climate_headline.html

5) - Carbon dioxide concentrations lag behind temperature increases, so climate change is not due to an accumulation of carbon dioxide in the atmosphere.



"The government needs to explain to the Australian people why global temperatures have remained steady over the last 10-15 years despite skyrocketing man made carbon emissions."

- Senator Steve Fielding⁷



The relationship between carbon dioxide and temperature is complex - it is called a coupled system. It is almost impossible to simplify this. In the past the oscillation of the Earth on it's axis, changing the amount of solar radiation reaching the Earth which caused a temperature change. Those changes were amplified by the Earth's natural processes, which responded by reducing the amount of greenhouse gases (carbon dioxide, nitrous oxide and methane) they released into the atmosphere. Both of these elements change the Earth temperature and cannot be separated.

Further reading:

http://www.atmos.washington.edu/2003Q4/211/articles_required/Lorius90_ice-core.pdf

6) - IPCC 'mistakes' and climate-gate is enough to prove the science is wrong and it is all a big conspiracy/sham.



"We're supposed to "trust" that guys who wish harm on their opponents, who are hell-bent on finding support for their personal favourite hypothesis, who fear and thwart any effort to audit them, we're supposed to believe these guys care about getting the research right?"

- Jo Nova⁸

⁷ Steve Fielding, "Climate Change" at www.stevefielding.com, accessed at http://www.stevefielding.com.au/climate_change/ on 2 April, 2010. Steve Fielding is a Federal Senator from Victoria and the leader of the Family First political party.

⁸ Joanne Nova, "Who needs a committee report to spot rank deception?", *ABC: The Drum Unleashed* (12 April, 2010), accessed at <http://www.abc.net.au/unleashed/stories/s2868937.htm?site=southcoast> on 15 April, 2010. Joanne (Jo) Nova is a popular science presenter and was host of the children's science show "Y?"; she is the



An independent inquiry into the emails hacked from the University of East Anglia's Climatic Research Unit has concluded that there had been no deliberate malpractice by the scientists and the UEA Climatic Research Unit. Nothing has called into question that there is scientific consensus that climate change is happening, faster than expected, that is human induced and that a great deal of the world's population will be strained if the Earth warms as predicted.

It is worth noting that many other well respected scientific academies around the world, including the Royal Society of London and by the US National Academy of Sciences, and major institutions such as the UK Meteorological Office, NASA and NOAA have assessed and drawn similar conclusions about the magnitude, cause and impacts of climate change.

Further reading:
http://www.sfgate.com/cgi-bin/blogs/gleick/detail/?blogid=104&entry_id=58962#ixzz0i09t6yAG
http://news.bbc.co.uk/2/hi/in_depth/629/629/6528979.stm

7) - Science not definite that CO2 and CH4 increases caused by human activity.



In March 2010 Australia's government body the CSIRO and the Bureau of Meteorology released a Snapshot of Australia's Climate which stated: "There is greater than 90% certainty that increases in greenhouse gas emissions have caused most of the global warming since the mid-20th century. International research shows that it is extremely unlikely that the observed warming could be explained by natural causes alone."

Further reading: <http://www.csiro.au/news/State-of-the-Climate.html>

8) - The climate is warming naturally – look at the trends over the last few million years.

 *"Climate is naturally variable and it poses serious hazards for humankind. To focus on the chimera of anthropological greenhouse warming while ignoring the threats posed by natural variability of the climate system is self-delusion on a grand scale."*

- William Kininmonth⁹

author of *The Skeptic's Handbook*; she has a B.Sc. (Microbiology), from the University of Western Australia; and in 2009 she spoke at the Heartland Institute's International Conference on Climate Change.

⁹ William Kininmonth, *Climate Change: A Natural Hazard* (Brentwood, Essex Multi-Science Publishing Company, 2004), p. 10. William Kininmonth is a retired meteorologist, formerly National Climate Centre head (1986 – 1998), M.Sc., Colorado State University, B.Sc., University of Western Australia; he writes for the Australian think-tank 'The Lavoisier Institute'; he is a Global Warming Expert for 'The Heartland Institute'; he is also a science advisor for the Science and Public Policy Institute.



Natural climate change in the past proves that climate is sensitive to an energy imbalance. If the planet accumulates heat, global temperatures will go up. Currently, carbon dioxide is imposing an energy imbalance due to the enhanced greenhouse effect and history shows us the Earth's atmosphere is sensitive to carbon dioxide.

Further reading:

<http://www.grist.org/article/current-global-warming-is-just-part-of-a-natural-cycle/>

<http://www.youtube.com/user/TheMetOffice#p/u/0/7KQ-cAqwtXs>

9) - How can we believe the climate predictions, when we can't believe the weather forecast? (*eg - last winter and the recent inland rain means we are now going back to a normal cycle, there's not a problem, the weather's fine!*)



There is a big difference between predicting/reading the weather and projecting our future climate. Weather is about day-to-day variations, while climate is more about long-term averages - based on decades of information.

Further reading: <http://www.csiro.au/science/living-atmosphere.html>

10) - I don't trust scientific modelling.



"As you well know there would be no Global Warming issue if it was not for the IPCC's computer modelling. It is the only foundation for the whole man-made global warming alarm-ism. Nothing else – zip – just what the IPCC computer modelling is predicting."

- Steve Truman¹⁰



"Climate change is a new, inexact and contestable science, and the computer modelling on which all of the more alarming claims depend are only ever as good as the data fed in."

- *The Australian*, 12 March 2010¹¹

¹⁰ Steve Truman, "International Study Shows Global Warming is Grossly Overstated", posted at the *Rooted* blog (18 November, 2008), accessed at <http://blogs.crikey.com.au/rooted/2008/11/18/international-study-shows-global-warming-modelling-is-grossly-overstated/> on 10 April, 2010. Steve Truman is the founder and editor of Agmates.com, a "rural & regional news & commentary blog site".

¹¹ *The Australian* editorial, 12 March 2010, accessed at http://www.theaustralian.com.au/news/opinion/open-issues-need-open-debate/story-e6frg71x-1225839757440_on_April_15, 2010. *The Australian* is Australia's top-selling national broadsheet newspaper. Its current editor is Chris Mitchell, who in 2008 received the 'JN Pierce Award for Media Excellence' for his coverage of climate change - bestowed by the Australian Petroleum Production and Exploration Association (http://www.appea.com.au/index.php?option=com_content&view=article&id=74&Itemid=70).



Scientists use climate models to make projections because we don't have another Earth atmosphere to pump billions of tonnes of greenhouse gases into and measure the impacts. Modelling has accurately simulated today's climatic conditions and replicated historical changes (volcanic eruptions, planetary tilting). Scientists have confidence that it is the best method for anticipating future change.

Further reading:

<http://www.bsyse.wsu.edu/Joan/teaching/bsyse556/W1/Refsgaar.pdf>

11) - Isn't it the case that an eruption of a single volcano produces more emissions than the whole planet in the last 5 years?



"Over the past 250 years, humans have added just one part of CO₂ in 10,000 to the atmosphere. One volcanic cough can do this in a day."

- Ian Plimer¹²



Volcanoes emit around 0.3 billion tonnes of carbon dioxide annually. This is about one percent of human carbon dioxide emissions - which sits around 29 billion tonnes per year.

Further Reading: <http://tamino.wordpress.com/2009/08/19/co2-and-the-volcanoes/>

12) - What about the Greenland warm period when they grew wheat and cattle on Greenland? (eg – It's been much warmer before and we've had much higher sea levels and higher CO₂ levels)



"The Mediaeval Warm Period, 800 AD to 1300 AD, (was) an era which was warm enough for Vikings to establish a colony in Greenland and which lasted for 300 years...there is now a great deal of evidence to show that the Mediaeval Warm Period was a global phenomenon."

- Ray Evans¹³



The Greenland ice sheet has existed for at least 400,000 years. There may have been regions of Greenland that were 'greener' than today but this was not a global phenomenon, according to prominent biologist and glaciologists.

¹² Ian Plimer, "Legislative Time bomb", *ABC: The Drum Unleashed* (13 August, 2009), accessed at <http://www.abc.net.au/unleashed/stories/s2655036.htm> on 15 April, 2010.

¹³ Ray Evans, "Nine Lies About Global Warming", *The Lavoisier Group* (February 2006), p. 4, accessed at <http://www.lavoisier.com.au/articles/greenhouse-science/climate-change/lav2006-forWeb.pdf> on 18 April, 2010. Ray Evans is the secretary of the Lavoisier Group and was a co-founder; he was also an Executive Officer at Western Mining Corporation from 1982 to 2001.

Further reading: <http://www.scientificamerican.com/article.cfm?id=proof-on-ice-southern-greenland-green-earth-warmer>

13) - How the recent temperature spike fits into geological history?



In the study of the climate (and not the weather) it is important to separate regional from global changes and that some temperature changes persist for years to decades, not decades to centuries. In that sense we need to look at temperature anomalies and trends and not spikes.

Further reading: [http://droyer.web.wesleyan.edu/PhanCO2\(GCA\).pdf](http://droyer.web.wesleyan.edu/PhanCO2(GCA).pdf)
http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf

ATTACKS ON MR GORE

14) - It's just so Mr Gore can make lots of money...



“Mr Gore, how much money do you make from global warming? What exactly are the profits of doom?”

- Andrew Bolt¹⁴



Finances. *Statements in quotation marks are directly from Mr Gore:*

“Virtually all that I have earned has come from companies in the media and information technology sector.”

“I support my personal staff, the majority of whom spend most or all of their time on global warming.”

Any money Mr Gore has earned from the publication of his books *An Inconvenient Truth* and *Our Choice*, as well as the release of the Academy Award winning documentary *An Inconvenient Truth* has been given to the not-for-profit *The Alliance for Climate Protection*.

Carbon emissions and travel:

Mr Gore does not own a private jet and flies commercially whenever it is possible. When he travels he buys carbon offsets, and he ensures that any trip is made more worthwhile via a full agenda of high value meetings relating to climate change mitigation. Mr Gore owns two Hybrid vehicles - a Prius and a Mercury Mariner.

Domestic energy consumption:

“My home is Gold LEED certificated (by the U.S. Green Building Council) powered with a geothermal system for heating and air conditioning and 33-solar photovoltaic panels. We purchase electricity from the Green Power programs offered by our utility (which obtains the “green” electricity from wind and solar sources rather than

¹⁴ Andrew Bolt, “Questions for Gassy Gore”, *The Herald Sun* (21 September, 2007), accessed at http://blogs.news.com.au/heraldsun/andrewbolt/index.php/heraldsun/comments/column_questions_for_gassy_gore/ on 15 April, 2010. Andrew Bolt is a columnist who writes for *The Herald Sun* and *The Sunday Mail*.

fossil fuels). We use the most energy efficient windows, appliances and other products for lighting and insulation. We also participate in a program to become carbon neutral.”

Further reading: http://en.wikipedia.org/wiki/Alliance_for_Climate_Protection

15) - Mr Gore is a politician not a scientist so why should we trust him?



Mr Gore is not a scientist, and no longer a politician. He is a private citizen, who chooses to communicate his thesis - that climate change is a danger to the Planet and we have a moral issue to act. He became aware of the climate change issue as a college student and has spent the last 30 years of his life reading, research and talking about the climate crisis.

Further reading: http://blog.ted.com/2007/10/gore_gets_it.php

16) - It has been proved that many scientific claims made in *An Inconvenient Truth* that are wrong.



“As many as 35 serious scientific errors or exaggerations, all pointing towards invention of a threat that does not exist at all, or exaggerations of phenomena that do exist, do not reflect credit on the presenter of the movie or on those who advised him. The movie is unsuitable for showing to children, and provides no basis for taking policy decisions”

- Christopher Monckton¹⁵



The validity of Mr Gore’s claims were tested very publicly in the British courts and High Court Judge Michael Burton who releases a 17 page finding which stated the film is "substantially founded upon scientific research and fact".

Further reading: <http://www.time.com/time/world/article/0,8599,1670882,00.html>

THE ECONOMY

17) - Solving this will hurt our economy/export jobs/shift our competitive advantage to the developing world/give advantage to my competitors.



If we don’t address this issue, experts say our economy; the global GDP and prosperity will suffer significantly. The first solar billionaire was NSW university graduate who had to move to China in order to prosper in his field. Australia is

¹⁵ Christopher Monckton, “35 Inconvenient Truths: the errors in Al Gore’s movie”, *Science and Public Policy Institute* (19 October 2007), accessed at <http://scienceandpublicpolicy.org/monckton/goreerrors.html> on 15 April, 2010.

loosing its advantage everyday we do not grasp the economic opportunities implicit in solving the climate crisis and developing a renewable energy industry.

Further reading: <http://www.garnautreview.org.au/chp11.htm#fn5>
<http://www.grist.org/article/ChinaRenew>
<http://www.cleanenergyjobs.com.au/>
http://www.acfonline.org.au/articles/news.asp?news_id=1963
http://www.acfonline.org.au/uploads/res/ACF_2010-11_Federal_Budget_Submission.pdf

18) - The CPRS is so corrupted and weakened it just pays polluters and won't have any impact on emissions anyway. (eg – it's just another tax)



“The world deserves a proper debate before we reverse our economies and standards of living and starve millions of third world people all for no climatic benefit.”

- Leon Ashby¹⁶



Australia needs to put a price on carbon. At the moment it is cheaper for industry to continue to pollute than it is for it to reduce greenhouse gas pollution. The Australian Government needs to legislate that function and in a way which facilitates prosperity by supporting a shift to the generation and uptake of renewable energy and other mitigation measures.

Further reading: http://www.acfonline.org.au/articles/news.asp?news_id=1950

19) - Europe has had an ETS for years and it hasn't worked - their emissions have not reduced.



We can learn from the European example and use that information to inform Australia's mandatory greenhouse gas emissions reduction standards and CPRS. What is important is that this process begins in Australia.

Further reading: <http://www.arb.ca.gov/cc/ab32/ab32.htm>

20) - We need the jobs. The climate will take care of itself.



“An ETS would decimate the national economy and devastate regional Australia. Kevin Rudd should not sacrifice Australia's economy to an uncertain and unlikely global agreement on carbon emissions reduction.”

- John Roskam¹⁷

¹⁶ Leon Ashby, “Explaining the protest against Al Gore: Leon Ashby”, (11 July, 2009), accessed at Jennifer Marohasy's blog, <http://jennifermarohasy.com/blog/2009/07/explaining-the-protest-against-al-gore-leon-ashby/#comments> on 19 April, 2010. Leon Ashby is the President, of the Australian Climate Sceptics Party.



Why not solve both issues at once? By setting an emissions reduction target Australia will generate up to one million jobs by 2030.

Further reading:

http://www.acfonline.org.au/uploads/res/Green_Gold_Rush_final.pdf

21) - If we don't mine and sell our minerals, including coal, someone else will. So why should we stop?



"Do I turn my head and allow another country to exploit my resource ... or do I position myself in such a way as I'm going to exploit it myself before they get there?"

– Barnaby Joyce¹⁸



Australia should diversify. We should move towards renewable energy and away from a reliance on burning fossil fuels because climate change will render Australia uninhabitable if it is not addressed. Coal is the most carbon intensive fuel.

Further reading:

[http://www.guypearse.com/docs/guypearse.com/Pearse%20Quarry%20Vision%20S
peech.pdf](http://www.guypearse.com/docs/guypearse.com/Pearse%20Quarry%20Vision%20Speech.pdf)

MORALITY

22) - It's God's will so why should we resist it?



Many congregations and senior church officials believe that it is the duty of their followers to act as stewards on behalf of their respective Gods to protect the Earth for this generation and those yet to be born. Such a sense of responsibility is also shared with many of those without religious affiliation.

Further reading: <http://www.arrcc.org.au/>

[http://www.vatican.va/roman_curia/secretariat_state/2008/documents/rc_seg-
st_20080212_climate-change_en.html](http://www.vatican.va/roman_curia/secretariat_state/2008/documents/rc_seg-st_20080212_climate-change_en.html)

¹⁷ John Roskam, quoted in "ETS should be scrapped, not delayed, says free market think tank", *Institute of Public Affairs Media Release* (4 May, 2009), accessed at http://www.ipa.org.au/library/publication/1241409911_document_scrap-not-delay-ets.pdf on 16 April, 2010. John Roskam is the Executive Director of the Institute of Public Affairs, and was a senior staffer in the Kennett and Howard governments.

¹⁸ Barnaby Joyce, "Barnaby Joyce urges Antarctic mining" on *The World Today* (1 May, 2006), accessed at <http://www.abc.net.au/worldtoday/content/2006/s1627937.htm> on 15 April, 2010. The quote refers to all Antarctic mining which includes oil and coal. Barnaby Joyce is a Federal Senator from Queensland and leader of the National Party in the Senate; he is currently Opposition spokesperson for Regional Development, Infrastructure and Water.

23) - China and India are the biggest problem so why should we bother doing anything anyway? (eg we can't make a difference/others are polluting worse)



China is increasing its energy use to catch up to standards of living that we enjoy. It is a leader in setting renewable energy targets. China is a leader in investing solar energy and in electric car production. Emissions do not observe national boundaries. We are all in this together, we need to work on this together.

Further reading: <http://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf>

Keywords: scientific processes explained

What is the scientific method, and why does it matter?

It is important as a TCP Presenter that you have a basic understanding of the scientific method, and that you are able to explain this clearly and simply to your audiences. That is the purpose of this document.

Peer Review

The peer review process is the cornerstone of modern science. It is a form of scientific quality control, where scientists open their research to other experts in the same field. These researchers will have sufficient expertise in the relevant disciplines to recognise if a piece of research is credible; they will be anonymous, to avoid favouritism; and they are unpaid.

Peer reviewers then look at a scientific paper and ask the following questions:.

- How was the data gathered?
- Does the data actually support the paper's conclusions?
- Are all the facts in the paper correct?
- Can the experiment be replicated using the information given?

The reviewers pass their comments back to the original researchers, who then have a chance to improve their research. However, if a scientific paper is fundamentally flawed then it will "fail" the peer review process, and no serious scientific journal will publish it. If a paper is deemed acceptable for publication, this does not guarantee that its conclusions are correct, but it does mean that its methods are credible.

Peer review is how we differentiate between sound science, and pseudoscience. Without peer review, non-scientists would not be able to maintain essential credibility.

It is important to note that peer review does not stifle innovation. Whether or not a paper's findings are in line with scientific orthodoxy, as long as they are based on coherent arguments, a replicable experiment, and sound data they should be accepted for publication.

Reputable scientific journals will only publish peer-reviewed science.

Certainty and Consensus

Science is never settled, and there is never unanimous certainty on scientific questions. Only purely mathematical concepts can be proven.

According to OECD calculations there were around six million science and engineering researchers in 2006. Any group of six million will hold a range of opinions on any issue. It important to note that virtually no area of science which has unanimous consensus.

This is because science is not really about proving hypotheses, but disproving them.

Scientists cannot *prove* that anthropogenic climate change is real, or that a dropped stone will always fall, or that the Earth will keep moving around the sun. They can only examine the evidence and conclude that, based on their observations and calculations, their scientific theory is the best possible explanation.

This is why the IPCC is only able to state that global warming is “very likely” caused by human activity. For the IPCC, “very likely” means “a greater than 90% chance”, which is about as certain as scientists can be.

Some useful facts when facing sceptics who take the “the science is not settled” line:

- 90% of scientists from all disciplines believe that humans are causing climate change.
- 99% of climate scientists believe that humans are causing climate change.
- Less than half-a-dozen of the thousands of published, peer-reviewed articles on climate change dispute that humans are the cause.

(Based on figures collected by Dr Maggie Zimmerman, under the supervision of University of Illinois Professor Peter Doran).

Modelling

A scientific model is a representation of a complex reality, which allows scientists to visualise what they already know, and to predict or simulate future events. We all use models every day, such as when we use a map to represent the reality of our neighbourhood streets.

Scientific modelling is nothing new: it dates back long before the era of computers and climate change. For centuries, astronomers created conceptual models of the solar system based on nothing but maths and their observations. These models could not be verified beyond all doubt, but they proved accurate enough that spacecraft launched in the twentieth century were able to intercept moving targets millions of kilometres away.

Models are used by scientists from all disciplines, but they are especially important to climate scientist because there is only one Planet Earth. Climatologists cannot perform direct experiments on the Earth’s atmosphere, so they construct models of the climate instead. These models plausibly explain past climate observations, and have been remarkably accurate at predicting the future. They have also been used to correctly predict the global impacts of large volcanic eruptions. However, the models only work if they take into account the warming impact of human produced greenhouse gases

It is true that models are not infallible, and can make mistakes. However, climate modelling is getting more sophisticated every year. Furthermore, in the vast majority of cases where climate models *have* been shown to be mistaken, it was because they *underestimated* the speed and severity of climate change.

Anomalies and Trends

A statistical *trend* is the long-term movement in a collection of data. It is a way of saying that, on average, something is increasing or decreasing over time. Trends allow scientists to see patterns in data that is otherwise difficult to interpret.

For example, glaciers grow in winter, when it is cold, and shrink in summer, when it is hot. So, at any given moment a glacier could be growing or shrinking. However, in recent years glaciers have shrunk a little more during summer, and grown a little less during winter. The *trend* is thus towards glaciers shrinking, but this can only be seen on a time-scale of several years.

An *anomaly* is a particular piece of data that goes against the trend of the data series as a whole. As winter turns to summer, the trend is for daily temperatures to get warmer. However, sometimes an unusually cool spring day might be colder than any other day in the preceding fortnight. This does not mean that summer is no longer coming of course, because it is an anomaly in the overall trend. Of course, the trend will be adjusted to take into account the anomaly, but one piece of data out of hundreds will not make much difference to the overall pattern.

Anomalies and trends play an important role in climate science. Because of global warming, the overall trend is for the planet to get hotter. However, some years are unusually hot, or unusually cold. These anomalies can be caused by cloud patterns, a volcano, the El Niño cycle, or just chance. By themselves, anomalies prove nothing.

However, climate sceptics seize on anomalies, and try to use them as proof that the planet is not getting hotter. They highlight that a few glaciers that are growing, while ignoring the fact that for each of these there are twenty glaciers in retreat.

Alternatively, sceptics can distort trends by focusing on relatively short periods of time, such as the period from 1998 to today.

The practice of selectively highlighting data that supports a hypothesis, while ignoring other data that contradicts it, is called *cherry-picking*. It is the basis for most of the 'scientific' arguments used by climate sceptics, which is one reason why their papers are not accepted by peer-reviewed journals.

Risk

The *risk* of an event is a calculation based on,

- how likely the event is to happen
- how damaging the impact of the event would be

Potential events can be risky in different ways. A meltdown at a nuclear power plant is very unlikely to happen, but it would be incredibly damaging if it did. In contrast, it is pretty likely that an over-utilised river will suffer algal blooms if the water level drops too low, but this would be relatively easy to manage and clean up. When considering the future, we have to analyse what kinds of risks we face.

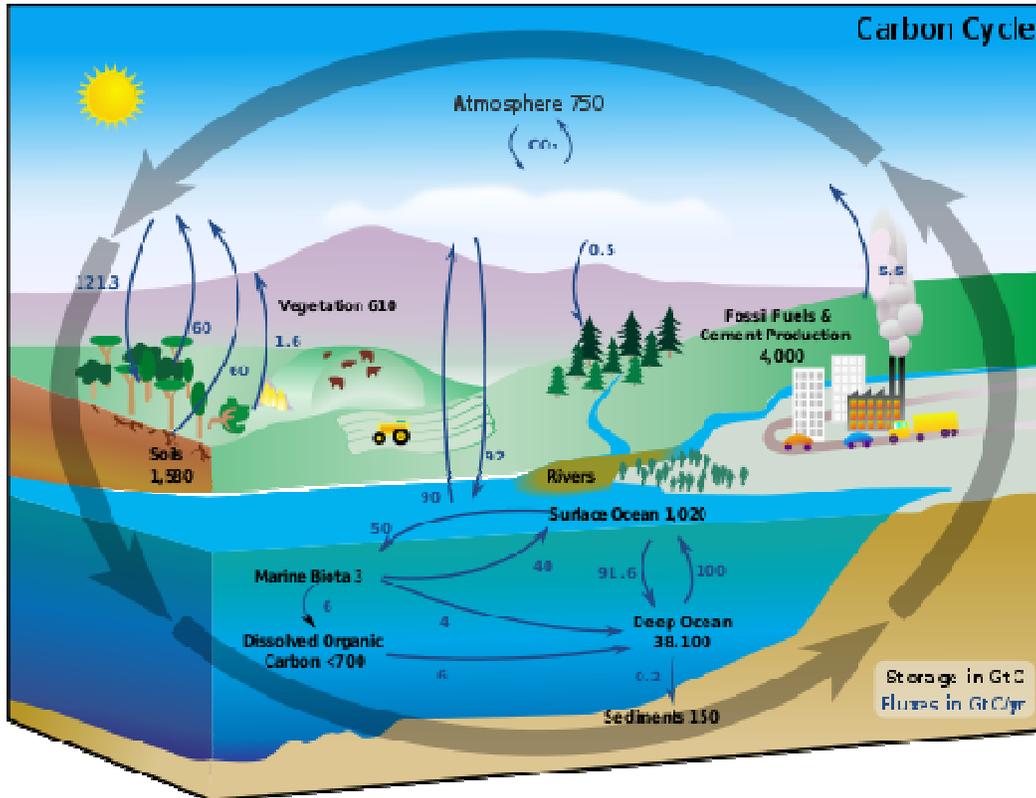
Environmental scientists use *risk analysis* to decide where our most urgent environmental problems are, and how much energy should be put towards fixing them.

But environmental scientists are not the only people who engage in risk analysis, everybody does. We think about risk when we buy insurance, or decide whether or not to place a bet. Humans have evolved to calculate everyday risks, and we are very good at it. However, numerous psychological studies have shown that when it comes to risks outside our everyday experiences, people find it a lot harder to respond logically. We overestimate the risk of dangers we can easily conceptualise, or that strike a particular fear. Other risks, especially of events that we have not experienced before, we underestimate.

The worst kinds of risks are those that are both highly likely, and highly impactful. Luckily, these kinds of risks are rare. Unluckily, climate change is one of them. Climate scientists across the world are saying that there is a very high probability that the Earth's average temperature will increase by over 2°C, and that this would be catastrophic if it happened.

Yet despite this, governments and individuals across the world advocate that we should take our chances on climate change. Governments spend billions on standing armies in case of an unlikely surprise attack from another state, but they will not spend a tenth of that on climate change mitigation. This is because we can easily conceptualise war, it has happened many times before. By contrast, climate change can seem diffuse, or far off, or hard to believe. We underestimate the risk.

The best way to mitigate risk is to buy insurance. We need to think about reducing our greenhouse gas emissions as insurance for our civilisation. By spending a moderate amount on insurance now, we can avoid losing a *lot* more money from the impacts of catastrophic climate change.



The black numbers indicate how much carbon is stored in various reservoirs, in billions of tons ("GtC" stands for GigaTons of Carbon and figures are circa 2004). The dark blue numbers indicate how much carbon moves between reservoirs each year. The sediments, as defined in this diagram, do not include the ~70 million GtC of carbonate rock and kerogen.

The **carbon cycle** is the biogeochemical cycle by which [carbon](#) is exchanged among the [biosphere](#), [pedosphere](#), [geosphere](#), [hydrosphere](#), and [atmosphere](#) of the Earth. It is one of the most important cycles of the earth and allows for the most abundant element to be recycled and reused throughout the biosphere and all of its organisms.

The carbon cycle is usually thought of as five major reservoirs of carbon interconnected by pathways of exchange. These reservoirs are:

- The atmosphere
- The terrestrial biosphere, which is usually defined to include fresh water systems and non-living organic material, such as soil carbon.
- The [oceans](#), including [dissolved inorganic carbon](#) and living and non-living marine biota,
- The [sediments](#) including [fossil fuels](#).
- The earth's interior, carbon from the earth's [mantle](#) and [crust](#) is released to the atmosphere and hydrosphere by volcanoes and geothermal systems.

Source: Wikipedia

FAQS: other relevant questions answered

Why should we believe the UNs International Panel on Climate Change?

The remit of the IPCC is to assess the current science, not to carry out new research itself. The IPCC scrutinises a wide range of peer-reviewed and internationally available literature. IPCC reports can include material from a wide range of sources - everything from government reports to industry journals. In each case the information must be critically assessed and reviewed.

Conclusions are drawn based on multiple sources of evidence. Once lead authors completed a draft report it is first given to independent experts from relevant fields of expertise, then to government reviewers. In principle, any scientific expert can join this process to add comments to the draft text. When comments are received, at least two review editors per chapter then ensure each is considered. Alternative views on each subject must be included in the final draft of the report to ensure all relevant arguments have been considered.

Once a report is finalised, a Summary for Policy Makers (SPM) is made to highlight key findings. These are then subject to a final line-by-line approval in a group conference, which all IPCC member countries are invited to join.

Is the science certain?

The facts about global warming are not a question of belief. Substantiated facts emerge from carefully considering all the evidence. The various assessment reports of IPCC provide a snapshot of that evidence at the time they are produced.

All areas of science progress through constant challenge and exploration of the boundaries of uncertainty — what is important is to be able to evaluate that uncertainty. Climate science is no different.

The overwhelming evidence for global warming remains intact and the last IPCC report (AR4), published in 2007, included the statement that “Warming is unequivocal and very likely (more than 90% probability) due to man’s activities.”

Any top-level statements like this need to be extremely robust. They are also, inevitably, very general. Since then this has been reinforced by further evidence of global warming affecting heat in the ocean, rising Antarctic temperatures and the shrinkage of Arctic summer sea-ice. Basic physics tells us that increasing greenhouse gases cause global warming – and we are likely to pay a heavy price if we keep emitting them at current rates.

Is global warming is part of a natural cycle of climate variability.

Natural variability will continue to bring warm and cool years but climate change means the warm years will be warmer and more frequent. Many factors contribute to climate change. Only when all the factors are considered can we explain the size and patterns of climate change over the last century. Much of the relatively small climate variability over the last 1,000 years, but before industrialisation, can be explained by changes in solar output and occasional cooling due to major volcanic eruptions. Since industrialisation, CO₂ has increased significantly. We now know that man-made CO₂ is the likely cause of most of the warming over the last fifty years.

Some people claim that the Sun and cosmic rays are responsible for climate change, measured solar activity shows no significant change in the last few decades, while global temperatures have increased significantly. Since the Industrial Revolution, additional

greenhouse gases have had about ten times the effect on climate as changes in the Sun's output.

Isn't the climate always changing?

Yes. There is natural variability in the Earth's climate but the current climate change is very unusual as it's not exclusively part of a natural cycle. Natural factors include volcanic eruptions, aerosols and phenomena such as El Niño and La Niña (which cause warming and cooling of the Pacific Ocean surface).

Natural climate variations can lead to periods with little or no warming, both globally and regionally, and other periods with very rapid warming. However, there is an underlying trend of warming that is almost certainly caused by man's activities.

Can't we just adapt? After all it is a small temperature change.

CO₂ concentrations in the atmosphere are rising. They have increased by about 38% since industrialisation began, from 280 ppm (parts per million) to 387 ppm. Two-thirds of that increase has occurred in the last 50 years. CO₂ levels are now 30% higher than at any time over at least the last 800,000 years.

When the Earth was in the last ice age it was only about 5°C cooler than today. At this time ice sheets 1,000s of metres thick covered Canada, Europe and northern Russia. As a result, sea levels around the world were about 80 metre lower than they are today. For example, Australia was connected to Papua New Guinea, and Tasmania was part of the mainland. So what may seem relatively small changes in global temperature can have a massive impact.

What about Methane? I have read somewhere that Methane is 20 times more potent than CO₂. Why is it more potent?

On a per unit mass basis, and integrating over a period of 100 years, methane (CH₄) is about 23 times more potent a greenhouse gas than carbon dioxide. This has to do with the relative molecular structures (the vibrations they can undergo) and the concentrations of these species (with so much carbon dioxide in the atmosphere, radiation in the spectral bands where carbon dioxide absorbs is more completely absorbed than is the case for methane). Much higher amounts of carbon dioxide are going into the atmosphere, however, and its lifetime is longer, so in that sense carbon dioxide is having the largest climatic influence. However, in that methane is really a fuel (i.e., natural gas) and its emission is a waste of energy, the economic incentive to capture and use it is strong. It's relative importance on a mass basis makes it a very attractive greenhouse gas to control.

Is it too late?

If we act today we may avoid the worst impacts of climate change. This will give our communities and natural environments more time to adapt to climate change and reduce the amount of damage it causes. However, we do need to act quickly. In 2006, UK Economist Sir Nicholas Stern suggested that we have at most ten years to put in place the policies and targets needed in order to give ourselves a good chance of avoiding the worst impacts of climate change. That's because the greenhouse-gas emissions we release today have an impact on our climate for well over a hundred years. We also need to be prepared to adapt to climate change regardless of how much we reduce emissions.

What is the connection between drought and climate change?

Scientists will not attribute this drought solely to climate change. Drought is a naturally occurring weather pattern in Australia. However, climate change increases the frequency, duration and severity of droughts. Global warming makes drought more likely and more severe. And it is a scientific fact that we are more vulnerable to disaster living in a warmer

world. However be aware that to make a definitive claim, the scientific community need to establish a 99 per cent certainty of fact. Given the magnitude of the impacts of the current drought, the community may not wait that much longer before making this statement. This is because when we manage risk, we weigh the magnitude of the impact of something happening against the probability of it happening. The drought we are seeing may or may not be a result of global warming, but it looks very similar to the prognosis for Australia over the next few decades in the context of climate change. We cannot rule out that what we are seeing is the beginning of these changes.

We can say that climate change is likely to have made this drought more severe and longer that it otherwise would have been. Moreover, unless we reduce greenhouse gas emissions, the CSIRO forecasts that droughts will cause water flows in the Murray-Darling Basin to decrease by up to 48 per cent.

If greenhouse gas emissions are reduced, how quickly would their concentrations reduce in the atmosphere?

The concentration of greenhouse gases in the atmosphere depends on the competition between the rate at which the gas is emitted into the atmosphere and the rate of the process needed to remove it from the atmosphere. As we know, carbon dioxide is removed from the atmosphere through photosynthesis and dissolution. On average it takes about 80 years for carbon dioxide emitted into the atmosphere to be transported semi-permanently into the deep ocean. If carbon dioxide emissions significantly reduced in the next two decades, we may be able to slowly reduce the concentration of greenhouse gases in the atmosphere in the decades that follow. This time delay makes early reductions in greenhouse gas emissions essential if we are to avoid the worst impacts of climate change.

Methane on the other hand is mainly lost via chemical reactions in the atmosphere whereby the average life of methane before it is converted to carbon dioxide is around ten years. Nitrous oxide and hydrofluorocarbons have a lifetime in the atmosphere that exceeds 100 years. For these greenhouse-gases with long lifetimes, the stabilisation of their concentrations requires large reductions of emissions.

Will our coal industry continue to survive?

Unless the coal industry can work out a way of creating zero greenhouse pollution through something like geosequestration also known as carbon capture and storage, technology, it is unlikely to survive the 21st century. It is also important to realise around 80-90 per cent of the coal produced in Australia is for export so the biggest impact on our coal industry will not be from the actions we take in Australia but the actions taken in other countries to reduce emissions.

How will Peak Oil and the lack of access to cheap conventional oil affect Australia's response to climate change?

Most observers believe we have or are close to having reached the end of the era of cheap oil extraction, ie, we have reached Peak Oil. For a country such as Australia which relies on imports of oil, this makes us somewhat vulnerable to oil price shocks. Exploiting unconventional oil supplies such as shale oil is not an option. It produces considerably more greenhouse pollution than conventional oil production. Australia therefore has an opportunity to explore a range of other climate friendly options such as supporting the uptake of more fuel efficient vehicles and hybrids as well as supporting better access to safe, reliable public transport. Given that the majority of the journeys we take in our private vehicles are within five kilometres of our home, redesigning our cities so we do not need to rely on our cars would also make a substantial contribution to reducing emissions.

I hear renewable energy isn't able to deal with base load capacity? Is this true?

No, power stations that run on organic fuels like sugar-cane waste – biomass plants – are considered base load stations. Wind power, if deployed at scale and across a wide area, can also supply dispatchable power in modern power systems. New renewable energy technologies (such as geothermal power which captures the heat in the earth to run turbines) and large scale concentrated solar thermal stations which can capture and store energy are also expected to be base load stations.

However, in some respects however this is wrong question. A better question is can a combination of renewable energy, smart use of energy and lower emission fossil fuel plants supply power when we need it and at the same time reduce greenhouse emissions. Simply put the answer is yes and numerous Australian and international studies and experiences have demonstrated this.

We have heard a lot about clean coal and carbon capture (geosequestration) isn't this a way to reduce Australia's increasing emissions?

Clean coal is a term used to describe a variety of technologies that reduce the amount of greenhouse gas created in the process of burning coal to generate electricity. Some of those technologies seek to make coal-fired power stations more efficient, such as the mechanical drying of brown coal. These technologies make coal cleaner, rather than clean and are currently unproven operationally or economically, or at early stages of development.

Other technologies seek to capture and bury carbon dioxide underground, in a process called 'carbon capture and storage' or 'geosequestration'. Geosequestration is currently unproven at the scale required. If proven in the future, it may play a role in some areas. In general, it is safer to reduce the amount of waste created rather than store it indefinitely.

We should direct our attention to developing clean, safe, proven technologies such as renewables and energy efficiency and think about how we shift away from the global reliance on greenhouse polluting energy like coal and oil in order to reduce emissions from these fuels. Australia does need to stop building new coal fired power stations that use the old, polluting technology. New capacity in the immediate future should be met by renewable methods of generating energy or gas.

Why isn't nuclear power an acceptable "technical fix" to climate change?

A senior analyst from the International Atomic Energy Agency Alan McDonald, said in 2004: "Saying that nuclear power can solve global warming by itself is way over the top."¹⁹

Nuclear power still poses nuclear weapon proliferation and security risks, it is not clean, it is not cheap and there is no solution to the intractable problem of nuclear waste.

Because of these problems the potential for nuclear power to help reduce emissions by replacing fossil fuels is limited. Few predict a doubling of nuclear power output by 2050, but even if that did eventuate it would still only reduce greenhouse emissions by about 5 per cent - less than one tenth of the reductions required to stabilise atmospheric concentrations of greenhouse gases.

In addition to this, if you did double the nuclear capacity you would need to manage the production of 200,000 kg/yr of plutonium this is approximately twice the plutonium in all U.S. weapons. It is worth remembering that a nuclear weapon big enough to destroy a city only requires 10 kg of plutonium.

¹⁹ Alan McDonald, 2004, quoted in The Independent (UK), 28 June

The International Energy Agency has said expanding nuclear power is the least effective means of reducing emissions.²⁰

²⁰ The IEA say it's the least effective means of reducing emissions, SOURCE: "World Energy Outlook 2006" by International Energy Agency (IEA), Quote in: "Summary and Conclusions" p.42 in: "Alternative Energy Scenario". To elaborate:
Reference: "*World Energy Outlook 2006*" by International Energy Agency (IEA),

Resources

Climate Change Information

Blogs/sites

[RealClimate](#): Is a commentary site on climate science ‘by working climate scientists for the public and journalists’.

[Stoat](#): (William Connolley) Is an ex-climate modeller who specialised in Antarctica.

[Skeptical Science](#): ‘Getting skeptical about global warming skepticism’ aims to explain what peer reviewed science has to say, and is now also an iphone app!

[James’s Empty Blog](#): (James Annan) A scientist involved in climate prediction, living in Japan.

[Open Mind](#): (“Tamino”) Is a bit more technical with lots of stats.

[More Grumbine Science](#): (Robert Grumbine) Aims ‘to be inclusive of students...as well as teachers and parents’.

[Deltoid](#): (Tim Lambert) A computer scientist living in Australia, blogs about ‘areas of science with political implications such as global warming’ -amongst other things.

[Rabett Run](#): (Eli Rabett) ‘is a not quite failed professorial techno-bunny...’

[Only in it for the Gold](#): (Michael Tobias) Is a Research Scientist Associate at the University of Texas Institute for Geophysics, Austin.

[Climate Science Watch](#): Is a ‘not-for-profit public interest education and advocacy project dedicated to holding public officials accountable for the integrity and effectiveness with which they use climate science and related research in government policymaking’.

[Denial Depot](#): Who are not afraid to be called climate deniers

[Skeptical Science](#): this site is good for Australians. It is administered and compiled by a scientist in Queensland

Videos

<http://www.heatisonline.org/video.cfm> “The Heat is Online”
http://sciencepolicy.colorado.edu/about_us/meet_us/max_boykoff/

http://www.ted.com/talks/lang/eng/rachel_pike_the_science_behind_a_climate_headline.html - the scale of the effort which goes into science prior to releasing them

Australian Sites/Organisations that are Sceptical about Anthropogenic Climate Change

[Agmates](#): “Agmates’ AgNews allows farmers & people living in rural & regional areas to have their say.”

[Andrew Bolt’s Blog](#): Australia's most-read political blog.

[The Australian APEC Study Centre](#): A free-market NGO which believes that attempts to mitigate climate change will stifle economic growth.

[Australian Climate Madness](#): “ACM exists to communicate an alternative viewpoint to the one-sided presentation of climate change issues provided by the Australian government and mainstream media.”

[The Australian Environment Foundation](#): An environmental NGO founded by members of the Institute of Public Affairs, it takes “an evidence-based, solution focused approach to environmental issues.”

[Citizens Electoral Council of Australia](#): A political party following the beliefs of American economist Lyndon LaRouche.

[The Climate Sceptics Party](#): “The world’s first political party representing scepticism and objectivity in climate policy.”

[The Heartland Institute](#): American think-tank that employs several high-profile Australians as Global Warming Experts.

[The Institute for Public Affairs](#): “The Institute of Public Affairs is an independent, non-profit public policy think tank, dedicated to preserving and strengthening the foundations of economic and political freedom”

[Kids Against Anthropogenic Global Warming](#): A 15 year old girl from Queensland attempts to “send out an alternate source to the point of view that most of the media has today”.

[The Lavoisier Group](#): Founded “to promote vigorous debate within Australia on the science of global warming and climate change, and of the economic consequences of both unilateral or multilateral decarbonisation.”

Template release



For immediate publication

Add Date

Local TCP Presenter delivers the latest facts on climate change

Local (*add area, name*) will speak to (*add audience*) and explain the most up to date scientific consensus which says climate change is happening, faster than expected.

(*Add name, add occupation*) is also a volunteer presenter for The Climate Project (TCP), the Australian branch of Al Gore's climate change leadership program, is a non-profit organization. TCP's mission is to educate the public about the harmful effects of climate change and to work toward solutions at a grassroots level worldwide.

Part of (*add name's*) role as a TCP presenter is to help the public understand what is meant by the scientific consensus that climate change is happening and dangerous.

"A report titled *State of The Climate*, prepared by our two leading science agencies CSIRO and the Bureau of Meteorology – explains clearly what has changed in Australia," said (*name*).

Findings, based on a current snapshot of Australia's climate, include:

- Australia will be hotter in coming decades: average temperatures are projected to rise by 0.6 to 1.5 °C by 2030
- Much of Australia will be drier in coming decades
- Observations clearly demonstrate that climate change is real

(*Name*) will deliver (*his/her*) version of Al Gore's slideshow on climate change (*add where, when*).

Eminent climate scientist Dr Graeme Pearman explains that that academics and scientific experts internationally agree that clearly understanding the issue and consequences of climate change is urgent and important.

"It is safe to say, a warmer world is a more dangerous world. And the scientific community agrees - beyond reasonable doubt - that the Earth is warming." Dr Pearman said.

For more information contact (*name*) on (*email/phone #*) or TCP Australia at climateproject@acfonline.org.au