Climate Myths and How to Respond to Them

by

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Characteristics of climate denial

Climate denial has five main characteristics: the use of fake experts, faulty logic, impossible expectations, cherry picking and conspiracy theories.

Fake experts

Fake experts are pseudo-scientists who are used by climate deniers to give the impression that there is no scientific consensus about climate change. These people appear to be highly qualified, but actually have no qualifications in the field. There are also a handful of legitimate experts who, until recently, have not accepted the climate consensus. These people have also been trotted out to give the public the impression there is no consensus.

Logical fallacies

These are logically false arguments that lead to an invalid conclusion. An example would be the idea that CO_2 is a colourless, odourless gas, which constitutes only the tiniest proportion of the atmosphere, so how can it possibly cause global warming? Logical fallacies include misrepresenting the science, making faulty links (i.e. jumping to conclusions that don't actually follow) and presenting false dichotomies (presenting only two choices when other options are available).

Impossible expectations

This involves demanding unrealistic standards of proof before acting on the science. The tobacco industry pioneered this. Every time new evidence came out, the industry would demand a new, higher standard of proof. Climate deniers require higher levels of proof for claims that conflict with their beliefs than for ones that conform to those beliefs. In other words, they create impossible expectations.

Cherry picking

Cherry picking involves using only evidence that fits the desired conclusion, and excluding evidence that does not. This is a very common method used by climate deniers. A good example is the claim that because Louisville Kentucky has not experienced any increase in temperature over the past century, there cannot be any global warming. As we shall see later, the first part of this statement is correct, but the second part is absolutely false.

Conspiracy theories

Conspiracy theories are often the last vestige of climate deniers, when no other explanation is available. The main such theory regarding climate change is that all the world's experts, scientific institutions and journalists are conspiring to fake or exaggerate the evidence about the Earth's temperature.

Categories of climate denial

The arguments put by climate deniers are various, fallacious and often contradictory. They can be put into five broad categories:

- Climate change is not real. The Earth's temperature has not significantly changed over the past 40 years.
- Climate change is not caused by greenhouse gas emissions.
- Climate change is not a problem. It may even be good for us.
- Climate change is too expensive to stop. We would be better off just adapting to it.
- Climate change is too far advanced to stop, so we're all doomed.

You can think of these arguments in simple terms as follows: not happening, not our fault, not a problem, not affordable and not stoppable.

We shall examine each in detail, looking at 121 different myths and how to respond to them.

Category 1: Climate change is not real

This first type of myth relates to the very existence of climate change. Those who push this view are hardcore climate deniers – so hardcore that they refuse to even accept the temperature data. Many also refuse to accept that sea levels are rising, or that Antarctica, the Arctic and a majority of the world's glaciers are experiencing a loss of ice.

Myth 1: Temperature measurements are inaccurate, because we don't have good enough technology to measure the Earth's surface, the oceans, the stratosphere and the troposphere.

Fact: Temperature measurements are not perfect, but provide a very good picture of temperature trends. These all show warming. Interestingly, climate deniers were happy to use temperature measurements when they thought they showed a *fall* in temperatures or a temperature pause (as was the case between 1998 and 2005). Since 2005, however, they have shown increasing hostility to the very notion of being able to accurately measure global temperature.

It's the same with climate models. Deniers use them when they confirm their own views, but reject them when they don't.

Myth 2: The Earth *was* heating up until the late 1990s, but this has now stopped. Temperatures actually *fell* in the 1950s and '60s. So, global warming isn't an issue.

Fact: The slight fall in global temperatures that occurred in the 1950s and 60s was due to increased particulate matter (sulfate aerosols) in the atmosphere, due to unregulated industrialisation. This particulate matter reflected some of the sun's rays, causing a small amount of cooling. When, for health reasons, nations introduced laws in the 1970s mandating a reduction in industrial pollution, the quantity of particulate matter decreased significantly, and global warming resumed as predicted. [It should be noted that increased particulate matter resulting from greater volcanic activity after 1257 AD is believed to have

been the main factor triggering the so-called 'Little Ice Age' (1450-1850 AD), which caused a noticeable drop in temperatures in the Northern Hemisphere. The drop in *global* temperatures, however, was nowhere near as significant – somewhere between 0.2°C and 0.6°C from the peak of the Medieval Warm Period (900-1150 AD).]

It is true that global temperatures reached a peak in 1998 – a record that was not broken until 2005. This temperature pause seemed to call into question the predictions of climate scientists, and prompted some commentators (like Australia's Andrew Bolt) to claim that the Earth was actually *cooling*. Three factors explain the pause. Firstly, and most importantly, much of the Earth's increased heat was going into the oceans (partly due to the La Nina effect), rather than the atmosphere. Secondly, industrial pollution from Asia increased the level of albedo (reflection of the sun's rays), just as European and North American pollution did in the 1950s and '60s. And thirdly, and solar activity briefly declined during these years.

Surface temperatures have continued to rise since 2005, albeit not as fast as in the decades prior to 1998. The temperature record was next broken in 2010. Every year since 2013 has been hotter than 2010. Global temperatures rose by an average of 0.07°C each decade after 1880. The most recent decade (2010-19), however, saw a increase of 0.39°C – five and a half times the historical average. The warming trend is clear, and *very* worrying.

Myth 3: Climate science was invented by leftists as a way of destroying capitalism.

Fact: This conspiracy theory is so ludicrous as to barely warrant refutation. In fact, climate science has been around for almost 200 years.

The French physicist Joseph Fourier, who developed the Law of Heat Conduction, first postulated the idea of a greenhouse effect in 1824, as a way of explaining why the Earth was not a ball of ice. Something in the atmosphere was trapping infrared radiation, but he did not know what.

Another French physicist, Claude Pouillet, demonstrated that some infrared radiation was not returning to space. In 1838 he speculated that this might be because it was being trapped by CO_2 and water vapour.

Then, in 1856 the American scientist Eunice Foote demonstrated that CO_2 was responsible for trapping heat in the atmosphere. Six years later, the Irish physicist John Tyndall reached the same conclusion, adding that methane was also a greenhouse gas.

In 1896, the Swedish physical chemist Svante Arrhenius concluded that human activity was heating up the planet. Ten years later he calculated that a doubling of CO_2 would result in a 4°C increase in global surface temperatures – a figure that is very close to modern day predictions. [Arrhenius won the Nobel Prize for Chemistry in 1903.]

Finally, in the 1930s the English meteorologist Guy Stewart Callendar gathered global CO_2 and temperature measurements from around the world over a 50 year period and demonstrated that both were rising, and that the likely cause of the latter was the increase in the former. His experiments suggested that at least half of the temperature rise to that point was attributable to human activity. This was the first time anyone had suggested that humans were causing global warming. Callendar calculated that a further temperature increase of 2°C might act as a 'tipping point' for increases that would be irreversible. [It was another 40 years before scientists had the instruments needed to prove Callendar right.]

Hence, climate science is *not* a recent development. It has been a part of modern science for as long as Darwin's theory of evolution and longer than Einstein's theory of relativity.

Myth 4: Governments and research institutions are conspiring to fake temperature measurements.

Fact: This claim is also completely ludicrous, as it implies that the US government has been a part of this conspiracy, even when President Trump was declaring global warming to be a hoax. If it really *is* easy for a government to cover up the truth, you would expect the US government to have planted weapons of mass destruction in Iraq, to justify the 2003 invasion. Instead, it sent 1,500 weapons inspectors to scour the country for WMD, then admitted that no such weapons existed. Conspiracy theories are almost never true, particularly in countries where the government is held accountable by voters and the media. [In authoritarian regimes it is a different matter, as the government controls all the levers of power. Even so, the truth has a way of getting out over time.]

Myth 5: Scientists came up with the term 'climate change' to cover for the fact that the world stopped warming in 1998.

Fact: Climate deniers have this completely the wrong way around. The term 'climate change' is actually much older than 'global warming' in the scientific literature. It dates back to the 1850s, and refers to "changes in a particular climate variable over a given area." 'Global warming', by contrast, refers to changes in the Earth's overall temperature. It is just one of various types of climate change. The term was first used in the 1960s, but was popularised by Wally Broecker in a 1975 article in the journal *Science*.

Myth 6: If global warming is real, why are there still record cold days? Surely there would be no record cold days in a warming climate.

Fact: Global warming doesn't mean there are no very cold days, just *fewer* of them. Weather reports in the US and Australia over the last 60 years show that the number of hot and cold records were about equal during the 1950s, 60s and 70s. Then the number of heat records started to increase and the number of cold records started to fall. There are now almost twice as many hot records as cold ones. As an example, in August 2020 Baghdad hit a new temperature record of 51.78°C. Similarly, in June of that same year, a monitoring station in Verkhoyansk in Siberia registered a record high of 38°C. Such temperature records are being set all over the world at the moment. This is certain evidence that global warming is real.

Myth 7: If global warming is real, why are some glaciers increasing in size?

Fact: A few glaciers *are* advancing, but the vast majority of the world's 200,000 glaciers are shrinking. The reason a few are expanding is that in a few places, warmer winter air can lead to more snowfall (as warmer air holds more moisture), thereby increasing the mass balance of glaciers. [The mass balance is the difference between the total gains and losses of ice over a year.] In most glaciers, the extra snowfall does not add to the glacier's mass, as it melts quickly. Only in a few places does it get incorporated into the glacier. If global warming continues, however, this process will cease completely, and *all* glaciers will shrink. Non-polar

glaciers are currently losing about 150 billion tonnes of ice each year. [This is more than the entire weight of Mount Everest.] To put that in perspective, it takes approximately 360 billion tonnes of ice to produce one millimetre of global sea-level rise. Frighteningly, in 2019 the Greenland ice sheet lost about 500 billion tonnes of ice. Loss of Greenland's ice is the major cause of global sea level rise at present. If the entire ice sheet were to melt, sea levels would rise by 7.3 metres. Of course, it would take thousands of years for this to happen.]

Myth 8: If climate change is real, why was the amount of Antarctic sea ice *in*creasing rather than decreasing over a period of decades?

Fact: It is true that Antarctic sea ice did increase by about 3.5 percent between 1979 and 2014, but it began shrinking again in 2015, and has now reached the lowest level ever recorded. [We don't have figures for before 1979, as this was when satellite monitoring began.]

One reason for the rise in sea ice levels up until 2014 is that the winds that blow off the continent increased, carrying more cold air out to sea, where ice forms. Another reason is that increasing meltwater from the Antarctic ice sheets led to an increase in ice formation, as fresh water freezes at a higher temperature (0°C) than salt water (-2°C). Finally, higher temperatures increased the amount of snowfall over both the continent and the surrounding oceans, thereby increasing sea ice cover. [This is because warmer air holds more moisture.] So, even when sea ice levels were rising, it was not evidence for an absence of global warming. It was just evidence of the complexity and unpredictability of that phenomenon.

The problem, however, is not the loss of sea ice in Antarctica but the loss of *land* ice. Between 2002 and 2020, that loss averaged 135 billion tonnes a year – all of which contributes to sea level rise. The science suggests that this is going to continue as long as global temperatures continue to rise. [It takes approximately 360 billion tonnes of ice to produce one millimetre of global sea-level rise.]

Myth 9: On January 8th 2024, Arctic sea ice reached its highest level in 21 years. How can global warming be real if this is so?

Fact: It's true that Arctic sea ice did briefly reach a 21 year high on that date, but unfortunately this was an anomaly, not a trend. Over the past 45 years sea ice cover has actually been in steady decline. In February 2024, it covered 14.61 million square kilometres of the Arctic – 4.6 percent less than the 1981-2010 average of 15.30 million square kilometres.

Of course, the real problem is not the level of sea ice in winter, but the level in summer. Studies suggest that even if greenhouse gas emissions are sharply reduced, the Arctic will be ice-free during September in just a few decades' time. If they are *not* reduced, this could happen as early as the 2030s. This will be disastrous for the animals that make the region their home.

So no, Arctic ice cover is *not* on the rise. Claims to the contrary are just cherry picking.

Myth 10: How can a colourless, odourless gas like CO_2 that only makes up 0.04 percent of the atmosphere (or 418 parts per million, as of 2022) have an effect on the climate?

Fact: This argument sounds plausible, however is it completely fallacious, as the quantity of a substance is not the only factor determining its impact. For example, Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs) make up just 1,190 parts per *trillion* of the atmosphere (or just over one part per billion), yet threatened to destroy the ozone layer (with extremely deleterious repercussions for life on Earth). Similarly, just 35 parts per billion of arsenic in drinking water is hazardous to health, and 800 parts per million of alcohol in the bloodstream is enough to render a person intoxicated. Finally, the painkiller ibuprofen works at just 3 parts per million. So of course CO_2 can have an impact at just 422 parts per million.

Myth 11: How can there be global warming when some places, like Louisville Kentucky, have had no temperature increase at all?

Fact: It's true that some places, like Louisville Kentucky, *haven't* experienced a rise in temperature. Others, however, have had very *large* increases. The temperature in Sao Paulo, for example, has risen by about 2°C since the beginning of the 20th century – almost *double* the global average. Cherry picking data from individual locations doesn't give us the big picture. We have to look at the global average.

Myth 12: If climate change is real, why aren't sea levels rising by much, and why aren't those rises happening evenly across the globe?

Fact: Sea levels are not even across the globe. Factors like winds, currents, river discharges, and variations in temperature and gravity make sea levels different in different parts of the world. It's the same with sea level rises. For example, Sydney harbour has only risen by about 10 cm in the last century – about half the global average of 20 cm between 1901 and 2018 – but in other places, like Micronesia, the sea level has risen by more the global average.

Worryingly, sea levels are rising at an increasing rate. For the first seven decades of the 20th century, they rose at an average of 1.3 millimetres per year. However, between 2006 and 2018, they rose at 3.7 millimetres per year – an increase of 185 percent.

In fact, we are only in the early stages of sea level rise. Around 400,000 years ago, when global temperatures were about 2°C warmer than the average for the past 10,000 years, sea levels were 6-9 metres higher. At current rates of warming, we are headed for a rise of up to one metre by the end of the century. Some scientists believe the eventual rise will be as much as 3 metres. [It should be noted that tides are not uniform across the globe either. In some places, at certain times, there is barely any difference between high tide and low tide. In other places, such as the Bay of Fundy in Canada, the difference is as much as 16 metres!]

One city that is particularly threatened by sea level rise is New York, where levels have risen by 22 millimetres since 1950. The problem is being exacerbated by the fact that the city is also sinking – at the rate of 1-2 millimetres a year, with some parts sinking at twice this rate. This is due to some of its skyscrapers having been built on sand and clay rather than solid rock. As a result, the city has faced two recent inundations – one in 2012 and the other in 2021 – when hurricanes caused whole areas to be flooded. These 'once in a century' events are now happening with alarming frequency. Other cities facing the threat of inundation include Miami, New Orleans, Shanghai, Jakarta, Bangkok, Lagos and Alexandria.

Myth 13: In 2010 there was a small fall in global sea levels. How could this have happened if global warming were real?

Fact: The reason sea levels fell in 2010 was that there was very heavy rain over Australia and South America, which transferred a significant amount of water from the oceans to these two land masses. It took two years for that water to fully drain back into the sea, and once that had happened, sea levels rose again.

Myth 14: How can global warming be real when the eastern United States had a record cold snap in 2012-13?

Fact: Temperature increases in the Arctic are causing movements in the jet stream – the band of strong winds near the top of the troposphere, about 10 km above the Earth's surface. The jet stream acts like a barrier to the southward movement of frigid arctic air. In 2012, the jet stream moved south in a wave-like formation (known as the Wavy Jet Stream), taking cold Arctic weather with it. This is what caused the cold snap in the eastern US. At the same time, the western US experienced a terrible drought.

Myth 15: Climate activists claim that 97 percent of climate scientists accept that global warming is real and is caused by fossil fuel emissions. This so-called 'consensus' is just an invention of the media, and has no basis in reality.

Fact: The figure of 97 percent was always correct, and has now reached 99.9 percent! Climate 'scepticism' is quite literally dead – in the scientific community at least.

Two decades ago, a number of major studies generated the 97 percent figure. Two of the best known were done by academics at Princeton University and the University of Illinois. Peer-reviewed articles in respected climate science journals were reviewed to see if the authors supported the notion of anthropomorphic (human-induced) climate change. Those authors were also given the opportunity to reject the conclusions reached by the reviewers. The figure each of these studies came up with was 97 percent. By contrast, *no* studies were done suggesting anything different. In addition, it should be pointed out that not all of the 3 percent of scientists who indicated that they did not accept the consensus were deniers of anthropomorphic climate change. Many simply had not reached a conclusion.

Since the Princeton and Illinois studies were done, a lot has changed. All eight of the famous climate 'sceptical' scientists have now accepted the reality of climate change, after decades of claiming the opposite, and four of them have also accepted the role of CO_2 and methane in causing the observed temperature increase. The others do not know what is causing it. So, the scientific consensus is much higher than 97 percent now. A 2021 study by Cornell University looked at 88,125 scientific papers published on the topic of climate change since 2012 and found that only 0.1 percent were sceptical of the notion that humans were causing global warming. In other words, the scientific consensus is now 99.9 percent! It is only *non*-scientists who are still sceptical about climate change.

Myth 16: In 2008, the Oregon Institute of Science and Medicine (OISM) released a list of 31,000 people with science degrees who had signed a petition rejecting the theory of human-caused global warming. This proves that the so-called 'scientific consensus' is actually no such thing.

Fact: 2006, *Scientific American* published a study which found that that list contained flaws so glaring as to render it all but meaningless. [See "Scepticism about Sceptics," *Scientific American*, 23/8/2006]

In the first place, no verification was done by OISM to check that the names on the list were real, or that the people really had science degrees. [In fact, pranksters managed to get Charles Darwin, members of the Spice Girls and characters from Star Wars on the list!]

Secondly, the journal contacted people on the list, and found that a majority either no longer supported the petition, couldn't remember signing it, or were dead.

Thirdly, while 31,000 sounds like a lot of people, it is actually only about 0.3 percent of the total number in the US who gained a science degree over the previous 40 years.

Finally, and most importantly, only 39 of the 31,000 people on the list were actually working in climate science. The rest were working in fields unrelated to climate, and could therefore be expected to have little real knowledge on the subject.

It should also be noted that the petition did not just declare climate change to be a myth, but also that "there is substantial scientific evidence that increases in atmospheric carbon dioxide produce many beneficial effects upon the natural plant and animal environments of the Earth." In other words, it actively encouraged the use of fossil fuels.

Myth 17: Even if almost all climate scientists agree that global warming is real, doesn't the fact that a few don't agree suggest that there is still some doubt?

Fact: The fact that 99.9 percent of climate scientists accept the reality of climate change and the role of greenhouse gas emissions in causing it suggests that the scientific debate is now over. [See Myth 14.] As for the 0.1 percent who still do not accept the scientific consensus, that is not uncommon in science. For example, after Copernicus, Darwin and Einstein published their theories, there was a lot of scientific resistance. More recently, there are still researchers who don't accept the link between smoking and cancer (many of them working for tobacco companies, it should be noted). But that does not mean we should abandon efforts to discourage smoking. Think of it in terms of aviation. If 99 engineers declared that a plane was unsafe to fly, and one said the opposite, how many people would still make the flight? Probably none. Another analogy relates to insurance. Statistics show that the chance of a house burning down in a particular year is about 1 in 3,000 – i.e. extremely small. Yet most people still insist on having home insurance, even though it is far from cheap. The reason is that they are unwilling to put their major asset at risk, however small that risk might be. Yet some of the very same people will take enormous risks when it comes to the security of their celestial home – planet Earth. It doesn't make sense.

Myth 18: If global warming really *is* a major problem, surely governments would be taking it more seriously.

Fact: This myth is based on the idea that governments always act rationally and in the best interests of society. Were that the case, the Second World War would never have happened, as the British and French governments would have recognised Hitler as a threat and put an end to his ambitions before they got out of hand. Instead, they believed what they wanted to believe, which was that the Hitler had only limited objectives and was not a threat to world peace. This was strange, given that he had never made a secret of his intentions. [They were published in *Mein Kampf* in 1925, fourteen years before the start of the war.]

Another problem is that politicians often *do* realise that action is needed, but would rather postpone it until a later time – preferably when they are not in office. A good analogy would be with smokers. Most know that cigarettes are bad for them, and that it would be better if they quit, but they cannot bring themselves to do it just yet. The benefits they gain now by continuing their habit are greater than any danger they may face in the future. Besides, they tell themselves, that danger may never eventuate. After all, doesn't everyone know someone of advanced age who spent a lifetime smoking? And isn't a cure for cancer just around the corner?

Finally, it should be pointed out that in recent years, governments *have* been taking climate change more seriously, and have begun introducing policies to combat it. This is particularly so in Europe, the United States and China.

Myth 19: Climate scientists are just making money and becoming famous by propagating the myth of global warming.

Fact: This myth is simply ridiculous. If anyone could prove definitively that global warming was *not* happening or was *not* a problem, he or she would become the most famous, wealthy and decorated scientist since Einstein. Scientists become famous by *overturning* paradigms, not by reinforcing them. Besides, if you want to make a lot of money, you don't go into science as a profession; you go into business.

Myth 20: Climate models used by scientists are at best imperfect, and cannot be used to predict future warming?

Fact: Climate models *are* imperfect, as is our knowledge of the solar system, of cancer, of economics, and of many other things. No models of the real world are ever perfect, but that shouldn't stop us from using them. Global climate models are *very* useful tools. As early as 1906, Svante Arrhenius was able to predict that a doubling of CO_2 in the atmosphere would result in significant global warming, and he was relying on simple observations plus a pen and paper! Climate models have improved dramatically since then, and have proven remarkably accurate in their predictions. [See below.]

Myth 21: So-called 'experts' have made 'doomsday' predictions in the past, and these have not come to pass. Examples include the likelihood that overpopulation would lead to mass starvation, the notion that the 'millennium bug' would disable computers, and the fear that the nuclear arms race would lead to nuclear holocaust. Predictions about climate change will prove no different.

Fact: This is faulty logic. The fact that one threat doesn't come true doesn't mean that others won't. The coronavirus pandemic is an excellent example. Many prominent climate

deniers also denied the seriousness of the pandemic when it first emerged. Some of those people *still* don't take it seriously.

Climate models have been amazingly accurate over the years. In 1906, Swedish physicist Svante Arrhenius estimated that a doubling of carbon dioxide in the atmosphere would result in global surface warming of about 4°C. That is amazingly close to modern day predictions – and Arrhenius had only rudimentary laboratory equipment and a slide rule to do his calculations.

Modern climate models have predicted global warming since the 1960s, and have been proven remarkably accurate. In 1967, Syukuro Manabe and Richard Wetherald calculated that a doubling of CO_2 would cause about 2.4°C of warming. [Manabe shared the 2021 Nobel Prize for Physics for his work in this area.] In 1981, James Hansen projected that between 1981 and 2015 the planet would warm by 0.6°, which is just 0.1° more than actual observations.

In the 1970s, Manabe and Wetherald also predicted that CO_2 emissions would cause the lower atmosphere to warm and the upper atmosphere to cool. Another of their predictions was that the Arctic would warm faster than the rest of the planet, in part because of decreased reflectivity due to melting ice. Both these predictions have been confirmed by scientific observation.

In 1989, Roland Stouffer, Syukuro Manabe and Kirk Brian predicted that CO_2 emissions would cause the land surface to warm faster than the ocean surface – something which has subsequently proved to be true.

Even in the 1970s, when the climate had not warmed much for two decades, climate scientists were still predicting future warming, due to the physics of CO_2. Time would prove them right. The climate pause of the 1950s and '60s was found to be due to increased particulate matter in the atmosphere. Once this was reduced by legislative action, global warming resumed.

Myth 22: Didn't scientists in the 1970s predict that the Earth was going to cool, and that we faced the imminent threat of an ice age? Global cooling did not occur, so how can we take scientific predictions about global warming seriously?

Fact: Scientists did *not* predict an imminent ice age. What happened was that researchers at NASA calculated what would happen if there were a quadrupling of particulate matter in the atmosphere. They predicted that this would block enough sunlight to reduce global temperatures by 3.5°C and trigger another ice age. Of course, this scenario did *not* occur, as governments introduced legislation in the 1970s to clean up polluting industries. The reason the public became aware of the story was that *Time* and *Newsweek* magazines published articles at the time about the possibility of an imminent ice age. Scientists were not wrong in their predictions, as they never *made* such predictions. This was just a media 'beat-up'.

Myth 23: Scientists can't explain everything about the climate, so we should wait until they *can* before taking any action.

Fact: Again, this argument is ridiculous. It's like saying, "Scientists don't know everything about cancer, so we shouldn't tell people to stop smoking until they do," or "We don't know everything about space, so we shouldn't launch spaceships until we do."

Myth 24: Since computers can't predict the weather two weeks ahead with any certainty, how can they be relied on to predict what the Earth's climate will be decades from now?

Fact: This myth makes a false analogy between weather and climate, which are two different things. Weather is the state of the atmosphere at a given point in time. It covers temperature, cloud cover, air pressure, wind direction, wind speed, rain and snow. Climate, by contrast, is the average weather over a long period of time. It's true that we can't predict the weather more than a week in advance, but we *can* predict what average temperatures will likely be decades into the future, given the basic laws of physics.

Myth 25: The emails that were hacked in 2009 completely discredited climate science.

Fact: The hacked emails didn't discredit anything. Climate deniers totally misrepresented what the scientists were discussing in those emails. They were talking about the so-called 'divergence problem', which was a minor issue in climate science. [It referred to the relationship between temperature and the width of tree rings in Arctic regions. Since 1960, that relationship has changed, and at the time the emails were written scientists did not fully understand the reason.] In one of the hacked emails, Professor Phil Jones (Director of the Climatic Research Unit at the University of East Anglia) said that he had come up with a "trick" to reconcile an aspect of the divergence problem. Climate deniers used this as evidence that Professor Jones and his fellow correspondent (Professor Michael Mann) were perpetrating fraud. Nothing could be further from the truth. In science, a 'trick' is jargon for a solution, not a falsehood. Professor Jones was proposing a solution to an aspect of the divergence problem. His words were taken completely out of context.

Myth 26: The Intergovernmental Panel on Climate Change (IPCC) is exaggerating the dangers posed by climate change.

Fact: This is simply not true. If anything, the IPCC is *under*estimating the impacts of global warming. For example, its reports have downplayed the importance of Arctic sea ice loss in driving global warming (via reduced albedo), have discounted the impact of meltwater from Greenland's glaciers in raising sea levels, and have largely ignored the impact of methane released by melting permafrost in the Arctic. By contrast, scientific papers in respected journals actually paint a far *bleaker* picture of the Earth's prospects than do the IPCC reports. The main reason for this is that the IPCC is very conservative, and does not wish to present scientific speculation as fact. [The IPCC has, on occasion, *over*estimated certain impacts of global warming, but such examples are isolated, and are always corrected when new evidence and data come to hand. This is in stark contrast to the pronouncements of climate deniers.]

Myth 27: The IPCC's own figures show that the Earth has warmed far less than 1.1°C.

Fact: This view has arisen due to the fact that the IPCC's temperature figures are averages and contain a significant margin of error. That margin of error is estimated to be 0.2°C above or below the stated figure of 1.2°C. While this does indeed mean that the Earth's temperature could have risen by only 1.0°C since the second half of the 19th century, it also means it could have risen by as much as 1.4°C. In other words, it's possible the situation is not quite as dire as we fear (albeit still dire!); but it's also possible that it's *worse*. Climate deniers are happy to assume that the official figure is an *over*estimation, but shirk from the possibility that it is actually an *under*estimation. The most reliable figure we have is the one officially used by the IPCC – the global average.

Myth 28: Didn't Professor Tim Flannery say in 2005 that drought conditions would become permanent in eastern Australia and that "the rain that comes won't fill our dams"? Neither of these things have happened, so how can anything climate scientists say be taken seriously?

Fact: It's true that Tim Flannery did say those things, and they have not proved to be correct – thus far, at least. The fact is, Tim Flannery is not a climate scientist; he's a palaeontologist. So his words do not discredit climate science, any more than would the words of a psychologist or a dermatologist on the same subject. It is unfortunate that he later became the head of the Climate Commission, so was seen as the public face of the climate movement in Australia. While he has been a tireless advocate for climate action in this country, he did not do the movement any favours by saying what he did.

Even so, there is good reason to be concerned about the availability and distribution of water in Australia. It's now becoming clear that climate change is resulting in more droughts and greater flooding. The problem is, it's proving hard to predict where each of these will occur. What we *do* know is that neither will be good for the environment or the economy.

Myth 29: The Earth's atmosphere is becoming 'carbon-saturated', meaning that as the level of CO_2 increases, its impact on global temperature will decrease. (In mathematics, this is known as the 'logarithmic effect'.) As a result, we can happily go on emitting CO_2 without causing significant increases in temperature.

Fact: This view has been propounded by Professors William van Wijngaarden and William Happer. They claim that a doubling of CO_2 levels from 400 ppm to 800 ppm will only increase global temperatures by 1°C. [We are currently at 421 ppm, up from 270 ppm prior to the industrial revolution.] To get an additional 1°C warming, CO_2 would have to increase to 1,600 ppm, according to Wijngaarden and Happer.

It would be nice to believe that the Earth has a built-in stabiliser to save us from catastrophic climate change. However, the science doesn't bear that out. Although it is true that the warming impact of CO_2 decreases as its prevalence in the atmosphere increases, this effect is nowhere near as strong as Wijngaarden and Happer claim. The scientific consensus is that other factors will overwhelm the 'logarithmic effect' and ensure global warming continues unabated. The most important of these factors is the exponential rate at which CO_2 emissions will increase if no serious action is taken by governments. Secondly, the ability of the Earth's carbon sinks (forests and oceans, primarily) to absorb CO_2 is decreasing, meaning that more of our emissions will likely finish up in the atmosphere. And finally, there will be feedback effects that increase global temperature. These include a reduction in snow and ice

cover (which will reduce albedo) and the melting of permafrost (which will increase CO_2 and methane emissions).

So no, 'carbon saturation' will not save us from ourselves.

It should be noted that prominent climate 'sceptics' have now largely stopped denying the reality of global warming. Those 'sceptics' include all the famous names: Patrick Michaels, Robert Balling, John Christy, Steven Koonin, Richard Lindzen, Roy Spencer, William Happer and William van Wijngaarden. Instead of challenging the temperature record, they are now claiming that greenhouse gases are either not primarily responsible for the observed warming or that the warming itself will be benign. Steven Koonin, for example, claims that it is impossible to determine the respective contribution of CO_2 emissions and other factors (like solar activity) due to "the deficiencies of climate data"; hence we would be better off adapting to climate change rather than trying to stop it. Roy Spencer is blaming the observed warming on "natural factors" like the Pacific Decadal Oscillation, although he provides no evidence for this assertion. John Christy, by contrast, *does* attribute most of our current warming to CO_2, but does not believe the impact of future temperature rises will be catastrophic. Patrick Michaels agrees, even though he estimates those future rises to be up to 3°C by 2100. Finally, William Happer believes that increased CO_2 levels will be good for the world. In 2014, he said that the "demonization of carbon dioxide is just like the demonization of the poor Jews under Hitler".

Hence, the nature of climate denial has changed over the past decade. We now need to look at claims that observed temperature increases are unrelated to human activity.

Category 2: Human activity is not responsible for climate change

This second type of myth is espoused by people who accept the reality of climate change, but refuse to acknowledge that humans are responsible for it. As we shall see, this is a hard argument to make, as greenhouse gas emissions are the only viable explanation for our current level of warming.

Myth 30: Temperature changes are natural. They happen in cycles, and this is no different. The Earth has passed though countless ice ages and thaws. More recently we have seen the Medieval Warm Period (900-1150 AD) and the Little Ice Age (1450-1850 AD), both of which occurred without any significant CO_2 emissions by humans.

Fact: Large temperature changes *are* natural over many millennia (ice ages and thaws), as are small changes over many centuries. We know what causes these changes, and those factors do not apply at the moment.

The current level of warming is absolutely unprecedented – 1°C in a century. During thaws from ice ages it takes between 1,000 and 2,000 years for the atmosphere to warm by this amount.

The Medieval Warm Period and the Little Ice Age involved significant temperature changes in northern Europe and the Atlantic, but not in other parts of the planet. Scientists estimate that the average global temperature changed by between 0.2°C and 0.6°C from the height of the Medieval Warm Period to the nadir of the Little Ice Age. During the latter period, winters

in Europe were colder than today, but summers were not significantly so. There is little evidence of a widespread breakdown of food production.

It should be noted that the Little Ice Age was not actually an ice age, or anything like it. Many climate deniers are obsessed with it simply because of its name. They seem to think that because it has been dubbed an 'ice age', it actually was one.

Myth 31: The Medieval Warm Period (MWP) was warmer than today, as evidenced by the fact that the Vikings were able to cross the north Atlantic and settle in Iceland and Greenland due to the reduced ice cover. This is proof that global temperature changes are natural, and that current warming is nothing to worry about.

Fact: The MWP (900-1150 AD) was *not* warmer than today, although in northern Europe and the North Atlantic temperatures were similar to today's, and may have even been warmer. In some parts of the world, however, temperatures actually got *colder* during the MWP. Scientists estimate that on average, global temperatures were similar to those in the mid-20th century. Interestingly, sea levels then were nowhere near as high as they are today. (They rose by 24 cm over a period of 400 years, but never got to 20th century levels.)

If we only look at the natural factors that generated the MWP (changes in solar and volcanic activity, changes in oceanic currents, and small changes in the Earth's orbit), there should have been global cooling over the past 50 years, not warming. Yet we are experiencing the opposite.

The current warming trend is unprecedented – 1°C in a century. We have not seen such rapid warming in the past two million years, and maybe not for 55 million years. During thaws from ice ages it took between 1,000 and 2,000 years for the atmosphere to warm by 1°C.

It should also be noted that while the MWP improved living conditions in places like Greenland, it devastated regions like the southwest of the United States, which experienced severe and prolonged droughts. Communities in the latter regions were forced to move, while the Vikings were forced to abandon Greenland when the MWP ended. [Had the Vikings discarded their European farming practices and adopted the Inuit lifestyle, however, they would not have had to leave Greenland.]

A final point of interest is that Iceland was settled *before* the Medieval Warm period began – evidence that reduced ice cover was *not* the reason the Vikings were able to cross the north Atlantic.

Myth 32: How can anyone know what temperatures were like centuries ago, let alone millions of years ago? For all we know, temperatures were much hotter during the Medieval Warm Period (900-1150 AD) than they are now.

Fact: Scientists use 'proxies' to calculate past temperatures. These include tree rings, ice cores, coral sediments and sea levels. [The study of past climates is called paleoclimatology.] The data produced by these proxies is not perfectly accurate, but does provide a good picture of the past. That data suggests that the Medieval Warm Period was *not* warmer than today, although temperatures *may* have been this warm in parts of the northern hemisphere. [Interestingly, climate deniers are happy to use evidence from proxies when

they *confirm* their views, but not when they contradict them.] For more detail on the Medieval Warm Period, see the previous myth.

Myth 33: Recent temperature increases have been caused by solar activity, not by increases in CO_2.

Fact: Solar radiation reaching the Earth (known as insolation) can only result in *minor* temperature changes. The sun's energy fluctuates on an 11 year cycle. It only changes by about 0.1 percent each cycle, so its impact is very small.

Scientists estimate that solar activity has contributed about 0.1°C to temperature increases since 1870. For the last three decades solar activity has actually been decreasing, yet the planet *isn't* cooling. If CO_2 levels had no impact on global temperatures, as climate deniers claim, then you would expect this not to be the case. What is actually happening is that the impact of CO_2 emissions is overwhelming any cooling effect from decreased insolation. Of course, when solar activity starts to *increase* again, it will exacerbate the impact of greenhouse gas emissions.

Another important factor is that if solar activity *were* causing recent temperature increases, the atmosphere would warm uniformly. In fact, the upper atmosphere (above 20 kms) is cooling, while the lower atmosphere is warming. This is not consistent with solar activity. It *is* consistent with increases in CO_2, however. In addition, if solar activity *were* the cause of recent warming, summers would be warming more than winters, and days more than nights. In actuality, neither of these things is happening.

Hence, all the evidence suggests that CO_2 is the main cause of the warming we are currently experiencing.

Myth 34: Current temperature increases are just part of the same process that ended the Little Ice Age (1450-1850 AD).

Fact: An increase in solar activity *did* help trigger an end to the Little Ice Age. However, the warming that has occurred since the middle of the 20^{th} century cannot be explained by solar activity. For the past three decades solar activity has been *decreasing*, yet there has been no concomitant cooling of the atmosphere.

Myth 35: Temperature changes are caused by Milankovitch cycles and other changes in the Earth's orbit, not by CO_2.

Fact: A Milankovitch Cycle is the movement of the Earth's climate from an ice age to a thaw or vice versa. Such cycles are caused by small changes in the Earth's orbit, its tilt and the rotation of its axis (all of which are affected by the gravitational pull of the larger planets). Over a period of about 100,000 years, the orbit, tilt and rotation line up in such a way as to significantly change the amount of solar radiation reaching different parts of the planet. This in turn sets off a feedback loop that induces an ice age or a thaw. This process occurs very slowly (over millennia rather than decades). The Earth emerged from the last ice age around 12,000 years ago, and is not due to enter another for about 70,000 years. Milankovitch Cycles are *not* the cause of our current global warming.

Myth 65: Global warming is the result of volcanic activity, not the burning of fossil fuels.

Fact: Volcanoes *have* caused global warming in the past, when they erupted en masse and emitted vast quantities of CO_2, but this has not happened for many millions of years. The level of CO_2 emanating from volcanoes each year now is about 1 percent of that emitted by humans – not enough to have any impact on temperatures. Moreover, present day carbon emissions are low in the isotope Carbon-13, indicating an origin in plants rather than volcanoes. [Plants preferentially select Carbon-12 during photosynthesis.] In fact, volcanic activity in modern times has a *cooling* effect, not a warming one, as it increases the particulate matter in the atmosphere, thereby increasing albedo (the reflection of the sun's rays). Major eruptions can reduce the Earth's temperature by up to half a degree for a period of several years, but these effects are temporary. The last major eruption that had an impact on global temperatures was that of Mount Pinatubo in 1991.

Myth 37: Scientists can't prove that emissions of CO2 and methane are the cause of global warming. Until they can, we should not take action.

Fact: It's true that scientists can't prove the link between greenhouse gas emissions and temperature changes. But that is true for many areas of science. The theories of gravity, relativity and evolution cannot be proven. Nor can the link between smoking and cancer. That doesn't mean we shouldn't accept these theories as true. We accept them because they provide a convincing, testable explanation of observed phenomena. We believe in the theory of gravity, for example, because there is no other way to explain why objects fall to the ground when dropped. Even so, it is still theoretically possible that something else is responsible. For example, angels could be sitting on the objects, pushing them down. That's what people believed in medieval times. But no modern scientist would accept that view now; it simply doesn't fit the facts.

Hence, while we cannot *prove* that greenhouse gases are the cause of global warming, we can trust the scientific community when it says that they are. This is because they provide the only explanation that fits with observed reality. As such, it is incumbent upon governments to take urgent action to address the problem of climate change.

Myth 38: Studies show that changes in the level of CO_2 *follow* changes in temperature, rather than precede them, so they can't be the cause of global warming.

Fact: Changes in temperature *do* trigger changes in the level of carbon dioxide, mainly by causing the oceans to emit more or less CO_2. This in turn changes the Earth's temperature, by increasing or decreasing the absorption of heat in the atmosphere (which in turn changes the level of water vapour – a major greenhouse gas). In other words, global temperature and CO_2 levels lead and follow each other, in mutually reinforcing cycles. It is this process, over a period of millennia, that results in ice ages and thaws.

Myth 38: The amount of CO_2 released each year by humans is only about 4 percent of all global emissions. The other 96 percent occurs as a result of natural forces. So, our impact is very small.

Fact: This statement is logically flawed because over the years the build-up of CO_2 in the atmosphere becomes very significant. In fact, it has increased by 50 percent since the 19th century – from 280 parts per million in the 1880s to 418 parts per million today. Nature has actually been *resisting* that increase, by absorbing up to 60 percent of what we've been releasing – mainly into the oceans. This process is keeping atmospheric CO_2 levels below where they would otherwise be, but it is increasing ocean acidification significantly. Acidification is having its own detrimental effects on the biosphere, threatening fish species and contributing to coral bleaching.

Myth 40: The main greenhouse gas isn't CO_2, it's water vapour. *It* is responsible for about half of all global warming. So why aren't we concerned about water vapour? It's because we have no control over it. As such, there is nothing we can do about most of the warming that is taking place.

Fact: Water vapour *is* an important greenhouse gas, but its level is determined by atmospheric and sea surface temperatures. Studies show that for every 1°C of warming, there is a 7 percent increase in water vapour. This creates a powerful feedback effect that further heats the atmosphere and the oceans. In other words, we *do* have control over water vapour, but *indirectly*, via our emissions of CO_2. The only way to stop water vapour from increasing is to stop emitting CO_2 and other greenhouse gases.

Myth 41: How do we know that CO_2 in the atmosphere has been emitted by human activity? The vast majority of it could just be natural.

Fact: A molecule of CO_2 from burning fossil fuels does not contain the isotope Carbon-14, as this decays over time (indicating that the carbon has been in the ground for millennia). CO_2 from fossil fuels contains only Carbon-12 and Carbon-13. It is therefore not difficult to determine what proportion of the CO_2 in the atmosphere is a consequence of human activity. [Interestingly, the existence of C-14 allows us to date plant material up to 60,000 years old, since C-14 has a half-life of about 5,700 years. This process is known as 'radiocarbon dating'. It is regularly used in archaeology.]

Myth 42: If CO_2 is the cause of global warming, how do you explain the temperature decrease that occurred in the 1940s and 50s?

Fact: This is explained by the increase in aerosols (particulate matter in the atmosphere from industrial activity). This reflected away some of the sun's rays, causing some cooling. When we acted to reduce industrial pollution (for health reasons), aerosols decreased and warming resumed.

Myth 43: Temperature increases over the past century are explained by the Urban Heat Island Effect – that is, by urbanisation – in that cities are 'darker' and therefore reflect less heat than rural areas.

Fact: There is a little bit of truth to this, but the impact of the Urban Heat Island Effect on global temperatures is minuscule compared to that of CO_2 emissions.

Overall, climate deniers don't have an alternative paradigm to explain what is happening to global temperatures. This is why many are reluctant to admit that warming is a reality. [Even those who deny the theory of evolution have an alternative paradigm (the biblical story of creation), dubious as this paradigm might be.]

Category 3: Global warming is real, but is not a serious problem

This third type of myth is espoused by people who accept the reality of climate change, and who may also accept that humans are causing it, but who deny that it's a problem. A warmer climate will be good for us, they say, or at the very least will be benign. This is often a fallback position, after they have given up on the first two sets of myths but still don't want to do take any action.

Myth 44: We are heading into another ice age, so won't global warming help avert this?

Fact: The next ice age is not due for another 70,000 years, so we do not need to be concerned about it at the moment. [In fact, given the level of warming that is already locked in, some scientists believe the next ice age may not actually be due for another 100,000 years.]

Myth 45: Heat is good for people. It's cold that's a killer.

Fact: It's true that cold kills more people each year than heat stress, but that is not an argument against preventing global warming, as the latter is a threat to the biosphere, not individuals. It will affect people by impacting food supplies and ecosystems.

In addition, most people who die of cold do so because they are living on the streets or are too poor to pay for heating. You don't solve this problem by heating up the world. You solve it by raising people's incomes and living conditions. [Interestingly, many of the same people who claim that cold is a bigger threat than heat are indifferent to the suffering of those who cannot afford proper heating.]

High temperatures and high humidity are a deadly combination. Medical investigations have revealed that large areas of the tropics will become uninhabitable if these warm, humid areas increase in temperature by just a few degrees.

Myth 46: 3°C of warming is nothing. The difference between summer and winter is far greater than that, so there is nothing to worry about.

Fact: 3°C of warming is *very* significant at a global level. In fact, the difference between an ice age and the current warm period is only about 5°C. [The oceans were about 3.5°C cooler during the last ice age.] The planet has not seen such high temperatures for 400,000 years, and certainly not when it had 8 billion people to feed.

Myth 47: CO_2 is good for plants, so increased levels of CO_2 will "green the planet" and increase agricultural production. Plants also need less water in a higher CO_2 environment, so decreased rainfall won't be a problem.

Fact: Plants *do* grow better with more CO_2, and this does mean some need less water. The problem is that plants do *not* do well in higher temperatures, and you can't have more CO_2 without more warming. Wheat is particularly susceptible to heat. [Climate deniers often counter this by claiming that the rise in CO_2 is *not* being accompanied by increased warming, since the two are not linked. However, this line of argument cannot be used to explain why higher temperatures would be good for the planet.]

Recent scientific research has shown that as CO_2 levels increase, the nutritional content of crops decreases, due to a reduction in vital trace elements like zinc and iron. The incidence of crop diseases like wheat leaf rust and corn rust is also greater, as is the prevalence of weeds. In addition, some pests (like the Colorado potato beetle and the European grapevine moth) also thrive in higher temperatures.

Finally, a warmer world will *not* be a world with more ground water, so crop yields will not increase. [The reason why ground water will decrease is outlined in the next myth.]

Myth 48: Warmer temperatures will lead to more evaporation and therefore more rain, so global warming will not lead to a drier world.

Fact: Warmer temperatures will indeed lead to more evaporation. In fact, for every 1°C of warming, there is a 7 percent increase in water vapour, meaning more of the planet's finite supply of fresh water winds up being trapped in the atmosphere. Even if rainfall increases, the Earth will still be dryer.

An analogy might be a bath which, instead of letting water drain away, pumps it straight back into the bath. The system is primed so that the amount of water leaving via the drain is exactly matched by the amount being put back in via the tap. This closed system is in equilibrium – like the Earth's hydrological system at any point in time. Now, if we elongate the pipe, allowing it to hold more water, the amount in the bath goes down. Let us also speed up the rate at which the pump pulls water from the bath and spits it back out of the tap. The system moves to a new equilibrium, with more water being pumped *into* the bath (i.e. more rain) but less actually *in* it (i.e. a dryer Earth).

Myth 49: As the planet heats up, there will be an increase in water vapour. This, in turn, will cause more clouds to form, and these will reflect away more of the sun's rays, thereby reducing some of the heating effect of CO_2 emissions. In other words, clouds will act as automatic stabilisers, saving us from the worst impacts of global warming. There is therefore nothing to worry about.

Fact: This argument was put forward by Richard Lindzen and Roy Spencer in 2011. The science of cloud formation is complex and not well understood. Low-level clouds (like cumulus) *do* increase albedo (reflection), and therefore have a cooling effect on the planet. High-level clouds (like cirrus) absorb heat (given that they are composed of water vapour), and warm the planet. The overall impact depends on which type of clouds will form. The current view is that the overall effect will be slightly on the warming side. But even if that were not true, and only low level clouds were formed, this would have a marginal impact on the climate.

The flaw in Lindzen's and Spencer's argument should be obvious even to a layperson. If clouds really did negate the effects of temperature changes, how could we have had temperature changes in the past? In other words, how could the Little Ice Age or the Medieval Warm Period have occurred – let alone *actual* ice ages and thaws? Surely changes in cloud cover would have prevented these changes from happening. No, clouds are not our saviours.

Finally, it should be noted that Lindzen and Spencer are not devotees of all forms of science. Spencer rejects the theory of evolution, while Lindzen rejects the notion that second-hand cigarette smoke is dangerous to health. Hence, climate is not the only field of study in which they are outside the scientific consensus.

Myth 50: We've had higher levels of CO_2 in the past, so why worry now?

Fact: It's true that CO_2 levels were much higher hundreds of millions of years ago, but the amount of solar energy reaching the Earth back then was also significantly less (possibly only 70 percent of what it is now). This is because stars like our sun get hotter as they age, and emit more radiation. Another reason is because at that time the continents were joined together near the equator, and were reflecting more solar energy back into space. These two factors cancelled out much of the impact of higher levels of CO_2. If CO_2 were to return to the level of the distant past, the result would be catastrophic, as so much more solar energy is reaching the planet now.

It should also be noted that the last time CO_2 levels were as high as they are now (418 parts per million) was during the Pliocene period, around about 3 million years ago. At that time, sea levels were about 10 metres higher than now. Humans had not yet evolved, and we certainly didn't need to feed 8 billion people.

Myth 51: Species can adapt to climate change. They survived the various ice ages we've had in the past, so they'll survive the current warming.

Fact: Yes, species can and do adapt, but not quickly. When the ice ages hit and receded, species had thousands of years to adapt and/or move. This time they will only have decades or, at best, a few centuries. For many, that will not be enough time.

There have been five mass extinctions in the past, with each resulting in the loss of over 75 percent of all species. Scientists believe that four of these events were triggered by climate change, mostly resulting from volcanic activity, which first froze the planet (due to increased albedo from additional particulate matter) then heated it (due to increased CO_2). [The other mass extinction, 65 million years ago, was triggered by an asteroid striking the Earth. It resulted in the passing of the dinosaurs.] Some scientists believe we are headed for a sixth mass extinction, as a consequence of global warming. They suggest that we could lose up to 40 percent of all species by the end of the century. If such an extinction occurs, it will take millions of years for the planet to recover.

Myth 52: Polar bear numbers have increased from 5,000 to 30,000 over the last 50 years, so they are not under threat from global warming.

Fact: Polar bear numbers have indeed increased, but only because hunting was banned in the 1960s and 70s. However, about 70 percent of Arctic sea ice has disappeared over the past 35 years, threatening the bears' habitat. In some regions the bears are still doing well, but in others they are under threat. If global warming continues, they will largely be extinct in the wild by 2100.

Myth 53: There are fewer hurricanes now than decades ago, so they are not a threat.

Fact: There is some truth to this statement, as hotter temperatures are increasing wind shear, which can break up hurricanes before they reach land. However, hotter temperatures are also increasing evaporation, which puts more latent heat (i.e. energy) into the upper atmosphere. This has made hurricanes more powerful and destructive. So there are fewer hurricanes now, but they are more damaging. Overall, this is a bad outcome.

Myth 54: Deaths from climate-related natural disasters like fires, droughts, storms and floods have dropped by 98 percent over the past century, mainly because of improved warning systems and better evacuation plans. This means it would be far better to simply adapt to climate change than to try to stop it.

Fact: It's true that deaths from natural disasters have fallen by 98 percent over the past century, due to improvements in technology. But those improvements were made at a time when the Earth's climate was stable. This will not be the case in the future, as global warming starts to disrupt the Jet Stream, the Gulf Stream, deep ocean circulation and other key elements of the climate system. And even if we can limit human casualties through improved warning systems and better evacuation plans, we cannot do the same for the animal world. In the end, we are dependent on a properly functioning ecosystem, and this will not be the case if temperatures continue to rise. It's also worth remembering that all of human history has been based on a stable climate. To believe that new technology can compensate for us interfering with this is to gamble with our future.

Myth 55: We've had bushfires in Australia in the past that were so bad they make our recent fires look like a backyard burn. The 1974-75 fires burnt 117,000,000 hectares, which is six times as much as the fires of 2019-20.

Fact: The fires of 1974-75 were mostly of grassland in the Northern Territory and Queensland. We didn't even know they had occurred till after the fact. The 2019-20 fires were in forested areas, and were four times more damaging than the previous worst such conflagration.

Myth 56: There are actually fewer bushfires globally now than 20 years ago. In fact, the incidence of fire has declined by 15 percent over the past two decades.

Fact: It's true that there are fewer bushfires today than 20 years ago, but this figure is misleading. Two thirds of all bushfires are in Africa, and these have declined over the past two decades. But this is not because climate change is not a problem, but because of increased farming, which has reduced the areas where fires take place. It is also because the changing climate has increased precipitation in tropical Africa, thereby reducing the

incidence of fire. In temperate and boreal forest in Europe, Australia and North America, by contrast, fires have become more frequent and more intense.

Myth 57: Heatwaves in the United States were much higher in the 1930s than they are now, so the notion that climate change is making things worse is simply wrong.

Fact: Once again, this myth contains an element of truth. The worst heat waves the United States has experienced were in 1930, 1931,1934 and 1936, but there were specific reasons why these years were so bad. This was the era of the 'dust bowl', when extreme drought, exacerbated by poor land management, resulted in an environmental disaster in America's west. Outside of those four years, the frequency and extent of heatwaves in the US over the last two decades is greater than at any other time since 1895.

Myth 58: If sea levels 3 million years ago were 10 metres higher than they are now, when CO_2 levels were roughly the same as now, why aren't they 10 metres higher now? This is proof that sea levels are unrelated to CO_2.

Fact: Sea levels have a long lag time, following temperature increases. It may take hundreds of years before they reach their peak, but the evidence suggests that this is the direction they are headed. At current rates of temperature increase, scientists expect a rise of up to one metre by the end of the century, with more coming after that.

Myth 59: The land mass of some islands has *in*creased over the past six decades, not decreased, so talk about islands being inundated by sea level rise is rubbish.

Fact: The land mass of some atolls has indeed increased over the past half century, but this is *not* evidence against the threat of climate change. The reason for the increase is the production of sediment from the coral reefs that surround these islands. That's how the islands were formed in the first place. Unfortunately, with reefs increasingly suffering from coral bleaching due to global warming, and with sea levels expected to rise by a metre this century if we don't cut our carbon emissions, sediment-based land expansion will be overwhelmed and coral atolls will indeed start to disappear. Other low-lying islands are already losing land.

Myth 60: Can't we use carbon dioxide 'fans' to suck CO_2 out of the atmosphere and sequester it safely underground?

Fact: Certainly, this can be done but it is prohibitively expensive. Given the technology available to us today, it costs about US$100 a tonne to scrub CO_2 from the atmosphere. This means that in order to remove all the CO_2 emitted by humans in a year, we would need to spend US$5.5 trillion, or more than Japan's entire GDP. It would be much cheaper to simply stop the emissions in the first place.

Myth 61: Can't we counter the warming impact of greenhouse gas emissions by firing particulate matter into the stratosphere, to reflect some of the sun's rays back into space?

Fact: This idea, known as 'solar geoengineering', seeks to emulate the impact of large volcanic eruptions like that of Mount Pinatubo in 1991, which cooled the atmosphere by 0.6°C for about 15 months. The scheme has the advantage of being cheap and feasible, but the disadvantage of being potentially very dangerous.

Unfortunately, putting sulfate aerosols into the stratosphere will not precisely offset our CO2 emissions, as the two processes impact the Earth in different ways. The former blocks the entry of heat, while the latter blocks its escape. This means that while the Earth's temperature would indeed cool if we bombarded the stratosphere with aerosols, that cooling would not be spread evenly across the globe. It is entirely possible that the polar regions would become hotter rather than cooler, and that the polar ice caps would melt at a faster rate rather than a slower one. This, in turn, would reduce the level of albedo on the planet, increasing solar radiation rather than reducing it. The simple fact is, we don't know what the overall effect would be if we started experimenting with the planet this way.

Another problem is that eventually, all of the particulate matter sent into the stratosphere would return to Earth, creating acid rain. This problem was deemed so severe in the 1970s that laws were passed to stop industries from polluting this way. Acid rain is dangerous to lakes, rivers and people's health. It is also damaging to the ozone layer.

Then there is the problem of politics. Who decides how much particulate matter is put into the stratosphere, and what happens if a rogue state decides to 'go it alone'? It is difficult to get agreement among nations on any issue, let alone one as important and difficult as this.

Finally, there is the question of what to do if we make a mistake. If, for example, we were to put too much particulate matter into the stratosphere, there is simply no way to get it down until it comes down of its own accord – and we don't know how long that would be. In the meantime, the impact on the climate could be catastrophic.

Myth 62: Can't we put gigantic reflectors into space, to stop some of the sun's rays reaching us?

Fact: This idea is another example of 'solar geoengineering'. It has the advantage of being less dangerous than putting sulfate aerosols into the stratosphere. However, it would be prohibitively expensive, as it can cost up to US$400 million to put a large satellite into space. No one knows how many of these reflectors we would need to cool the atmosphere. Whatever the cost, it would be much cheaper to simply stop emitting greenhouse gases.

Myth 63: Can't we seed the oceans with iron dust to generate phytoplankton blooms, which would absorb the CO_2 we are currently emitting?

Fact: This idea, known as 'ocean iron fertilisation', works in principle, in that phytoplankton do require iron in order to grow, and seeding the oceans does produce phytoplankton blooms. Unfortunately, studies have shown that most of the CO_2 absorbed by the blooms is released back into the atmosphere when the phytoplankton die, rather than sinking to the bottom of the ocean as proponents of the idea had hoped. This means 'ocean iron fertilisation' is not a viable solution to the problem of global warming. Not surprisingly, its advocates have gone quiet of late.

Myth 64: What about reforestation? Can't we just plant enough trees to absorb all our CO_2 emissions?

Fact: Sadly, the answer to that is 'no. Even if we planted trees on every available hectare of land on the planet, those trees would only be able to absorb about half the CO_2 emissions from a single year of human activity. In reality, of course, there are economic and political reasons why we would not be able to plant anywhere near that number of trees. Hence, reforestation on its own is not the solution to global warming. It is an important *part* of the solution, but not a replacement for the cuts we need in greenhouse gases.

Myth 65: Some places like Greenland and northern Canada will benefit from global warming, while others will lose. In the end, the benefits will cancel out the losses.

Fact: It is not true that the benefits will cancel out the losses. But even if it *were* true, climate change would still cause inestimable damage, as the regions benefiting from this change would not compensate those losing. So, for example, if life were to improve in Greenland, the country would be inundated with refugees seeking to escape their own damaged homelands. Powerful nations suffering from global warming would almost certainly step in, ensuring that *their* people gained the benefits, not the people of Greenland. Thus, the latter would be robbed of their culture and independence.

You need to look no further than the war in Syria to see the political consequences of climate change. In the years before the Arab Spring in 2011, 60 percent of the nation's farms were ruined by a prolonged drought. A million and a half people were forced off the land, and ended up as refugees in Syria's cities (adding to a similar number of refugees who were already there as a result of the conflagration in Iraq). The Syrian government did nothing to help these people, and when the Arab Spring broke out, many joined the protests sweeping the country. The result was the most brutal war of this century, with 500,000 dead, millions of refugees and much of the nation's infrastructure in ruins.

Category 4: Stopping climate change is not affordable

A fourth type of myth is espoused by people who may or may not accept the reality of climate change, but believe that fixing the problem would be prohibitively expensive.

Myth 66: China is mostly responsible for global warming, and is doing nothing about it. If *we* take action, we'll only bankrupt ourselves and still not solve the problem.

Fact: While it is true that China is currently the world's largest emitter of CO_2, and is responsible for 32 percent of the world's annual total, when population is taken into account, the average Chinese citizen is responsible for only half of the annual emissions of the average American, and only one ninth of the cumulative emissions. For India, the respective figures are one tenth and one thirty-fifth. So, it is quite disingenuous to single out China as the main culprit when it comes to global warming.

Secondly, it is *not* true that China is doing nothing about climate change. In September 2020, President Xi Jinping announced that the country would reach peak emissions by 2030 and net zero emissions by 2060. In fact, the country is way ahead of schedule, with peak

emissions reached in March 2024 and total emissions falling by 1.6 percent during that year. If this trend continues, China will reach net zero by 2054 – well ahead of many other nations.

The reason for this is not surprising. In 2022, the nation added 125 gigawatts of renewable energy to its grid. In 2023, the figure rose to 278GW, then to 357GW in 2024 and to 430GW in 2025. This has brought the total to 1,190GW over the last four years. To put this in context, the US managed to install just 45GW in 2024 and 30GW last year. China also had 215 gigawatt hours of battery storage in 2025 – two and a half times that of the United states – with this figure expected to rise to 720GWh by the end of 2027. Australia currently had 6GWh of battery storage.

All this means that China's grid is now 40 percent renewable – the same as Australia's – and the electrification trend shows no signs of slowing down. By the end of 2025, the nation had now electrified 76 percent of its rail network, 98 percent of its buses, 99 percent of its two-wheelers and 12 percent of its passenger vehicle fleet. 58 percent of all cars purchased were EVs (up from 4.8 percent in 2019). Indeed, EV sales are expected to reach almost 100 percent in the next few years. In addition, 28 percent of all heavy-duty trucks sold were fully-electric in 2025 – up from just 9 percent the previous year – and the number is likely to reach 60 percent by the end of 2026! The nation has 9,000 public charging stations dedicated to heavy-duty electric trucks.

China is also taking other steps to reduce its emissions. In June 2021, it introduced an emissions trading scheme (ETS) to punish companies emitting CO2, and to encourage a shift to renewables. This priced emissions at US$6.30 a tonne, and rose to US$10 in 2025. [By contrast, California's ETS prices emissions at US$17 a tonne, while the EU's scheme does so at US$98 a tonne (up from US$5.50 in 2017). Julia Gillard's carbon tax, which Tony Abbott said would destroy the Australian economy, was US$20 (A$24) a tonne.] The Chinese ETS is already the biggest in the world, but they will need to ramp it up considerably if they hope to reach zero net emissions by the middle of the century. At least they've made a start.

Despite all of these initiatives, it is true that China is still building coal-fired power stations, but these are likely only be used as backups, to avoid a repetition of the power shortages that occurred in 2021-22. (These were the result of a severe drought that reduced the nation's hydroelectric output.) Those coming on line now also represent decisions that were made between four and six years ago, before China fully committed itself to renewables. In fact, coal is in steep decline in China, falling at a rate of 2 percentage points a year. In the first half of 2025, its use fell by 3.4 percent. That year it was responsible for only 55 percent of the nation's electricity generation, and China's coal-fired power stations were operating at only 44.8 percent capacity. Hence the reason why coal use is going down, even though new plants are coming online. With gas representing 3 percent of the nation's electrical generation use, renewables now make up 42 percent – and growing rapidly! In the first five months of 2025, China added 13.5GW of renewables for every gigawatt of coal it added to its grid.

Besides doing its bit to stop climate change, China has other important reasons for reducing its carbon emissions. Foremost among these is the fact that its cities have been among the most polluted in the world, and the only way to reduce this pollution is to stop burning coal and oil. In addition, many of its coastal cities are very low-lying and face inundation, even with relatively modest rises in sea levels. Similarly, its river systems are fed by glaciers that are threatened by warmer temperatures. Their loss would devastate the nation's agriculture. The Chinese government is well aware of these problems.

Another reason to decarbonise is that China cannot aspire to superpower status while being dependent on fossil fuel imports, and it lacks sufficient domestic supplies to pursue a policy

of fossil fuel autarchy. Were a war to come, the country would be vulnerable to a cut-off of oil, coal and gas supplies, and it lacks the military might and political will to defend far-off sea lanes. Decarbonisation is the only way it can achieve energy self-sufficiency.

As far as Australia is concerned, we too need to make the shift to renewables or suffer the consequences of rising fossil fuel prices. The Albanese government knows this, and has commenced the transition process. As stated earlier, Tony Abbott insisted that the introduction of the Carbon Tax would destroy the economy, but in practice it had no impact whatever on GDP. He also said that its removal would reduce electricity prices, but this also failed to occur.

Finally, at a moral level, the argument put by climate deniers is similar to that espoused by slave traders in the 18th century: if England were to withdraw from the slave trade, they declared, other countries would simply fill the vacuum; no fewer slaves would be traded, and England would deny itself an important source of income. William Wilberforce, by contrast, argued that Britain had a moral obligation to act, irrespective of the cost. As it turned out, Britain's decision to ban the slave trade shamed other nations into taking similar action. Within a dozen years of that decision, trade in human cargo was at an end. Slavery itself was abolished over subsequent decades.

Former British Prime Minister Boris Johnson put the moral argument about climate change very succinctly in 2020, when he said that it was incumbent on the countries that had put most of the CO_2 into the atmosphere to act first to take it out. Under Johnson, Britain is committed to zero net carbon emissions by 2050.

Myth 67: It will cost too much to eliminate carbon emissions.

Fact: This is simply not true. Ross Garnaut, one of Australia's leading economists, estimates that a move to zero emissions would cost the country between 0.67 and 1 percentage point of GDP growth per year, if we put a price on carbon. That's *not* 1 percent of GDP, but of GDP *growth*. In the long run, the move will actually *save* us money, as it will spawn a raft of new industries, with new sets of skills and export potential. More importantly, it will generate jobs that have a long-term future, because they will not be threatened by declining resources, changing international demand or government action to reduce pollution.

And even if the move to renewables *did* cost a lot, it would be far less than what we spent on dealing with the coronavirus. During WWII, Britain devoted 52 percent of its GDP to the military without destroying the economy. The US was devoting 37 percent of its GDP in 1945, and Australia 40 percent in that same year. Germany devoted a massive 70 percent to the military in the later stages of the war. It was not this spending that destroyed the German economy; it was bombing by the Allies.

Finally, there is an important comparison to be made with the cost of home insurance. Although home insurance is not cheap, the vast majority of people still choose to take it out, even though the chance of their home burning down is about one in 3,000 – i.e. 0.03 percent per year. The chance of dangerous climate change occurring is much greater than this, and the cost of dealing with it is significantly less. In fact, offsetting your lifestyle against climate emissions costs about 10 percent as much as insuring your home. And it should be remembered that as the impacts of climate change increasingly manifest themselves, it will become prohibitively expensive to insure against them – especially in regions prone to fires, floods and storms.

Myth 68: What about the Net Zero Australia Report? That says it will cost $9 trillion to reach net zero emissions.

Fact: The figure of $9 trillion has been taken completely out of context. It actually refers to the total amount of investment that will be needed by 2025, not the amount that will be needed to reach net zero. In fact, $8.7 trillion of that investment will have to be spent anyway, even if we were to stick with fossil fuels. This is because large numbers of private appliances and industrial machines, and almost all our road transport fleet, will need to be replaced over the next 25 years. If in the process we ensure that all the replacements are powered by electricity, we will cut our emissions and upgrade our technology at no extra cost. We may actually *save* money, as electrical equipment is, in general, cheaper to buy and to run than fossil fuel equivalents.

Hence, the actual cost of getting to net zero is not $9 trillion, but $300 billion – a figure that amounts to $12 billion a year. This is less than half of what is spent on alcohol each year and only a third of what is spent on gambling!

Myth 69: Renewables are more expensive than fossil fuels and can't provide baseload power.

Fact: Again, this is simply not true. In most parts of the world, solar and wind are cheaper than coal, and only a third the cost of nuclear power. Batteries and stored hydro can provide most of the backup we need to keep the lights on 'when the wind don't blow and the sun don't shine', as climate sceptics love to say. In fact, Britain's National [Electricity] Grid has set itself the target of being able to operate completely fossil fuel free by 2025. [Climate sceptics sometimes suggest that Britain will only be able to achieve this because of an excessive reliance on nuclear energy. This is not true either. Britain currently gets only 16.8 percent of its electricity from this source, and has no plans to increase such capacity.] Scotland is even more advanced. It currently gets 97 percent of its electricity from renewables (mostly from wind). The other 3 percent comes from gas. And closer to home, South Australia is now getting 75 percent of its electricity from renewables, and is on track to reach 100 percent by 2027.

As for the costs involved in eliminating fossil fuels from the grid, it is estimated that we will need to spend an additional $180 billion in wind and solar generation, plus about $20 billion in various forms of storage. This represents about $800 a year per person, over a ten-year period – or about $2.20 a day. Such an amount will hardly bankrupt the country.

Myth 70: The elimination of coal will cost jobs and income.

Fact: This is true, but so did the elimination of the car industry in Australia, along with the footwear, clothing and textile industries, and much of the steel industry. That didn't stop the government from supporting or initiating these changes. Nor did it affect the Australian economy in the long-run. In fact, these changes have benefitted us economically. There can be no economic development without some dislocation. The key is to provide alternative employment for those affected by the transition.

In addition, we have no control over the future of our coal industry, as 77 percent of our coal is exported. Britain reduced its reliance on coal for electricity generation from 75 percent in 1970 to just 2 percent today. Very soon, coal will disappear completely from its grid.

Myth 71: Ending our fossil fuel exports would cost us billions of dollars of foreign income, and cause our exchange rate to collapse.

Fact: It's true that the elimination of fossil fuel exports on its own would have very negative impacts on the economy, as about 7 percent of our GDP is derived from this source. However, the Commonwealth Treasury estimates that revenue from such exports is set to nosedive over the next two decades – from A$198 billion in 2025 to A$106 billion in 2030 and A$46 billion in 2050. By contrast, exports of products related to clean energy – like ammonia, iron, steel, bauxite, alumina, aluminium, copper, lithium, nickel and cobalt are expected to rise from about A$46 billion in 2025 to A$120 billion in 2035 and A$270 billion in 2050. In fact, they are set to bring in far more income and foreign exchange than fossil fuels do today.

In addition, the switch to EVs will save us from importing $40 billion a year of petroleum and crude oil to run our vehicle fleet. An added advantage is that we will no longer have to worry about having our energy supplies cut off in the event of a regional conflict – say, over Taiwan. And, of course, there is always the awkward fact that our fossil fuel exports are going to decline and ultimately collapse anyway, since our trading partners are all committed to net zero emissions and energy self-sufficiency.

Myth 72: If the world shifts to renewables, we will sentence developing countries to perpetual (or a longer period of) poverty.

Fact: This argument is completely disingenuous, as many climate deniers are unconcerned about poverty in their own countries, let alone in developing ones. In fact, many developing nations have discovered that renewables are already cheaper than fossil fuels, and are adopting them at a faster rate than we are. The cost of renewables is actually much less for developing countries, as they don't need to scrap existing fossil fuel plants. They can go straight to renewables as they develop.

Even so, it will be necessary to provide some funding to the poorest nations, to kickstart the transition. This was agreed to in Paris in 2015 and at COP27 in Egypt in 2022.

Myth 73: You'll never replace fossil fuels in many of our key industries, like steel, cement, alumina, aluminium and aviation.

Fact: Replacement technologies will be available in all these areas over the next two decades. Low emission steel is already viable, and zero-emission steel is being developed. It's the same with cement and aluminium. Producing commercially-viable zero-emission alumina and aviation fuel is a harder proposition, but work is already well under way. The Germans, for example, are developing the latter fuel, although it will be more expensive and won't be available until at least 2025.

Myth 74: The manufacture of lithium batteries produces more greenhouse gases than the batteries save during their lifetime. Hence the move to renewables is futile.

Fact: A recent study by the Massachusetts Institute of Technology (MIT) showed that the greenhouse gas emissions resulting from the manufacture of lithium batteries are offset after 6 to 18 months of battery use. Given that such batteries currently have a lifespan of about fifteen years, this represents a huge saving in emissions.

Myth 75: It has been predicted that demand for lithium will increase 42-fold if we make the shift to electric vehicles. There simply isn't enough lithium in the world to make this transition possible.

Fact: It is true that the world's known sources of lithium would run out by mid-century, if we were restricted to using lithium just once in batteries, or if no other technologies became available. Neither of those caveats is true, however. In the first place, lithium can be recycled. To quote a 2021 report by BloombergNEF, "With universal battery recycling, not only does primary lithium demand remain below known reserves, but there is also the prospect of a fully circular battery industry, with supply of recycled lithium exceeding total annual demand by mid-century." [See James Fernyhough, "EV-to-grid could supply three times peak electricity demand: BNEF," *Renew Economy*, 9/6/21.] In fact, the commercial recycling of lithium is already a reality. Hydrovolt owns the biggest EV battery recycling plant in Europe. Based in Norway, it is capable of recycling 12,000 tonnes of battery packs each year. 95 percent of the battery packs can be recycled.

Secondly, a number of new technologies have been developed which either do not require lithium at all, or use it in far smaller quantities than is the case now. These technologies include zinc-ion batteries, zinc-air flow batteries and iron air batteries. Iron air batteries offer the prospect of storing energy at one-tenth the cost of traditional lithium-ion systems. So, the supply of lithium is not going to be a problem.

Myth 76: Lithium mining has a devastating effect on the environment, so will cause widespread damage if we have to rely on it for our energy storage needs.

Fact: It's true that lithium production can be environmentally damaging, particularly in ecologically sensitive regions like the Atacama salt flat in Chile. For this reason, strict regulations will be needed to ensure that mining is carried out as responsibly as possible.

Of course, the bulk of lithium mining no longer takes place in sensitive regions like Atacama salt flat. Australia now produces 52 percent of the world's lithium, and does not use the brine extraction technique used in Chile. Instead, it uses the much less damaging hard rock extraction technique.

In addition, new technologies like Direct Lithium Extraction (DLE) are on the horizon. These promise dramatic improvements in the environmental impact of lithium mining.

Finally, it is not yet certain that lithium batteries will underpin our long-term shift to electric vehicles, although it does seem likely. Hydrogen fuel cells are still an option, although the consensus is that they are not as efficient as lithium batteries. [One advantage is that they

are environmentally friendly, as they work by fusing hydrogen with oxygen to make water. Electricity is a byproduct of that process.]

Myth 77: Electric vehicles are barely any less polluting than their fossil fuel counterparts, so it's a waste of time promoting them.

Fact: Electric vehicles are way less polluting than vehicles powered by internal combustion engines. Even if they are powered entirely by 'dirty' electricity from the grid, they still produce 70 percent fewer emissions than cars powered by fossil fuels. If their energy is sourced purely from renewables, then their emissions are next to zero. And, of course, if the electricity is sourced from rooftop solar, then the cost to the owner is negligible.

Myth 78: EV batteries are made with nickel, which is highly polluting to produce.

Fact: This myth was given voice in an episode of *Spotlight* on Australian television in April 2025. The program alleged that nickel produced in Indonesia is highly damaging to the local environment, and that this nickel is used in Chinese-made EVs. The implication was that EV are no less damaging to the environment than internal combustion engine vehicles.

Nothing could actually be further from the truth. While it's true that Indonesian nickel mining is environmentally unfriendly, it is not used in EV batteries; it's the wrong grade. The countries that produce the correct grade are Canada, Russia and Australia, where the mining process is far less harmful to local ecosystems.

But this is largely irrelevant, as 60 percent of all EVs use Lithium Iron Phosphate (LFP) batteries, which contain no nickel at all. [Nor do they contain any cobalt.] The figure for Chinese EVs is 70 percent, a fact that was ignored in the *Spotlight* episode.

In fact, 70 percent of all nickel mined globally is used to produce stainless steel. This is where Indonesia's nickel goes. So yes, campaign against Indonesian mining practices, but not against EVs. They are not the culprit in this story.

Myth 79: Big batteries, home batteries and EV batteries all use cobalt, which is mined under appalling conditions in the Congo. Those who promote these technologies are as responsible for these conditions as the mining companies themselves.

Fact: Most modern batteries no longer use nickel manganese cobalt (NMC) technology. Instead, they use lithium iron phosphate (LFP) technology, which does not contain cobalt. In Australia, all of the big batteries being installed around the country use LFP, as do all the major brands of home batteries.

As far as EV batteries are concerned, 60 percent of all those manufactured globally use LFP technology rather than NMC. The figure is 70 percent for vehicles made in China.

The devices that *do* all use cobalt are mobile phones, laptops, tablets and power tools. Every single one in them contains it. So if people are concerned about cobalt mining in the Congo, they should be protesting against the use of these devices, not batteries. Interestingly, it is also used in oil refineries to remove sulphur from crude oil, to produce cleaner fuel. So, the fossil fuel industry is also dependent on it.

Myth 80: Even though electric vehicles do not produce any emissions when they are driven, they still produce emissions when they are manufactured and when they are powered from the grid. One study has shown that a Tesla Model 3 has to be driven for 126,650 km before it reaches its emissions 'break-even' point. At the average daily commute of 34.5 kilometres in Australia, it would have to be driven for 17 years before it became carbon neutral. So, EVs cannot significantly cut emissions.

Fact: The 17-year figure quoted in this study is indeed correct, but it assumes that the Tesla Model 3 is charged using 100 percent coal-fired power. If that same Tesla is powered from the grid in the United States, it reaches its break-even point after just 21,726 km. This means if you drive it for 34.5 kilometres per day (the average distance driven by an Australian commuter), then you reach the break-even point after 20 months. And if you charge it entirely with renewable energy, the break-even point is just 13,500 km, meaning it reaches carbon neutrality after just one year. Of course, once EVs are made with renewable energy, they will have next to no carbon footprint at all. General Motors, which will *only* make EVs after 2035, is already committed to becoming carbon neutral in its production processes by 2040. The other car manufacturers have commitments of between 2045 and 2050. More impressively, the new Tesla factory in Texas, which is one of the largest vehicle factories in the world, will be powered by 70,000 solar panels on the roof, plus a huge battery complex nearby.

So, it is not true that EVs are environmentally unfriendly. They will help us get to net zero emissions as long as they are powered by renewable energy. And even if they are not, they are still better than non-electric vehicles,which will *never* reach break-even point.

Myth 81: What about hybrid vehicles? Aren't they much better than internal combustion engine (ICE) vehicles, as far as emissions are concerned?

Fact: Hybrids are significantly better than ICE vehicles, when it comes to emissions. They emit about two thirds as much carbon over their lifetimes as their petrol-driven counterparts. (Plug-in hybrids emit slightly less than this.) EVs, by contrast, emit only a third as much CO2 as ICE vehicles, and only a quarter as much if powered by renewables. If they are also *produced* using renewables, like cars at Tesla's gigafactory in Texas, then their carbon impact is just 4 percent that of legacy vehicles.

Myth 82: EV batteries only have a life span of 10 to 12 years, so producing them is very wasteful.

Fact: EV batteries have a lifespan of between 10 and 20 years. Manufacturers like Tesla, Audi, Mercedes-Benz, BMW and Nissan give an eight-year/160,000-kilometre warranty for their vehicles. At the average distance driven each day by passenger vehicles in Australia (34.5 km), this equates to a 12-year warranty. Tesla batteries are even more impressive, degrading by 10 percent after 250,000 kilometres of driving. This means an average driver could expect the battery to last 19 years!

But that is not the end of the story. When a lithium battery *does* reach the end of its life in an EV, it can be used for another 10 to 12 years in a different form – as a home battery or as

part of the electricity grid. In Japan, recycled car batteries are being used to power street lights. And when the battery finally degrades to the point where it is no longer usable in any form, its critical materials can be 100 percent recycled.

Myth 83: EVs are not appropriate for Australia, as the distances between our cities are too great.

Fact: Most Australians only drive between 30 and 40 kilometres a day, so EVs are very appropriate for use in our cities. In addition, the federal government is committed to having a fast-charging station every 70 to 100 kilometres around the country, so distance will no longer be a problem for those owning EVs. These fast-chargers can put hundreds of kilometres worth of power into a car in just 8 minutes. True, this is not as fast as filling up at a petrol station, but the cost advantage is likely to make the wait worthwhile. Besides, many EVs on the market today have sufficient range to get you from Sydney to Canberra and back with just one charge. This is comparable to that of petrol-driven cars.

Myth 84: Electric vehicle batteries are prone to catch fire, and those fires are very difficult to put out.

Fact: The reality is the exact opposite of this myth, when it comes to the frequency of EVs catching fire. The Australian firm EV FireSafe keeps track of passenger EV battery fires worldwide. Between 2010 and June 2023, only 393 such fires occurred globally – and this, despite some 30 million EVs on the road. Only four of these fires were in Australia.

The American insurance company AutoInsuranceEZ has looked at the number of fires occurring in three different categories of vehicle in the US. Per 100,000 vehicles, the respective figures are 25 fires for EVs, 1,530 for internal combustion engine (ICE) vehicles, and 3,475 for hybrid vehicles. In other words, you are 60 times more likely to experience a fire in an ICE vehicle than in an EV, and 139 times more likely in a hybrid.

That said, it is true that fires in EVs are harder to put out than in ICE vehicles, but that is a problem for firefighters, not for drivers. In fact, it is far easier to escape an EV fire than an ICE fire, as the EV fire takes much longer to take hold.

Myth 85: Electric vehicles are dangerous if they get caught in a flood. They could easily explode.

Fact: The battery pack in an EV is designed to be safe in water, even if fully submerged. So, in the unlikely event that the car gets caught in a flood, it will be perfectly safe.

Myth 65: Electric vehicles are much heavier than ICE vehicles, so may cause car parks to collapse if adopted in large numbers.

Fact: This myth emerged in the wake of the collapse of a second-floor parking garage in New York City in April 2023. Initial reports suggested that the cause was an excess of cars that had been parked there – something that was not actually true. Then fears started to circulate

there would be more such collapses if EVs became the dominant type of vehicles in America, as they are heavier than ICE vehicles.

In fact, there is no evidence that car parks will collapse if they are populated with EVs. It's true that EVs are up to 50 percent heavier than ECE vehicles, but most being sold are smaller models, which weigh no more than the SUVs that make up the bulk of sales in Australia. Private car parks, of course, don't have this problem as they are mostly on the ground floor of apartment buildings, where there is no danger of a collapse.

Myth 87: Because electric vehicles are heavier than their ICE equivalents, their tyres wear our much faster, making them more expensive to run.

Fact: It's true that an EV is about 30 percent heavier than an ICE vehicle, and that its tyres can wear out up to 20 percent faster. But weight is not the only factor affecting the life of a set of tyres. Others include acceleration rates, frequency of braking, and how fast the car takes bends and corners. A careful driver will have tyres that last a lot longer than an incautious one.

That said, we can calculate how much extra an EV owner would have to pay if his tyres wore out at the maximum rate (20 percent). A set of tyres in Australia lasts on average five years, and a standard set for an EV costs $540 (at 2024 prices). If those tyres lasted four years instead of five (i.e. 20 percent less), then the extra cost would be $33.75 a year. This is a pittance compared with the savings to be made with an EV via lower fuel and maintenance costs.

So this myth is just that – a complete furphy.

Myth 88: Electric vehicle batteries don't work properly in the cold, so they are unsuitable for many countries and regions.

Fact: It is true that EV batteries can work less efficiently in extremely cold conditions (-20°C), but this is not a serious problem if drivers know how to deal with it.

The first problem is that in extreme cold an EV battery has to be warmed before it can be charged. This process can take up to half an hour. If a driver has not already done this before arriving at a charge station, the charging process can take up to half an hour longer. Warming the battery does not use much power, so the range of the EV is only reduced by a few kilometres.

Range can also be affected by extreme cold. Normally, the loss of range is no more than 10 percent, but it can be up to 36 percent in extraordinarily cold conditions. Of course, such conditions are extremely rare, and when they occur driving any sort of car can be dangerous and should be avoided.

Interestingly, the nation with the highest uptake of EVs in the world is Norway, where extreme cold is normal in winter. People understand how to properly run their EVs, so neither of the above-mentioned problems is a concern. And they certainly aren't a concern in Australia, where such conditions are unheard of.

Myth 89: If you have an EV made in China, the Chinese government will be able to use it for espionage purposes and may even be able to disable it, so it can't be driven.

Fact: There is no evidence whatever that Chinese-made EVs can used for espionage purposes, let alone be disabled remotely. The sim card inside an EV connects it to the internet, just like a mobile phone or a tablet. But unlike the latter two devices, the sim inside the car can be removed easily, rendering the car completely autonomous. The only things that will stop working are the navigation system and the entertainment system, and these can be replaced by the driver plugging his/her mobile phone into one of the car's charge points.

So, if someone seriously believes their Chinese-made EV is acting as a mobile espionage device, they can fix the problem very easily. The other answer, of course, is to buy an EV made somewhere other than China.

Myth 90: Doesn't Australia have a lot of untapped oil? Surely we'd be better off using this than electrifying our road transport.

Fact: Australia has about 1.8 billion barrels of oil remaining in its existing oil fields – enough to supply the country's needs for 4 years without imports. There are also believed to be between 13 and 18 billion barrels of shale oil in Queensland and another 5 billion barrels of conventional oil beneath the Great Australian Bight.

Let's start with the shale oil. This type of oil is expensive to produce and would cost motorists as much as double what they were paying for petrol before the war with Iran broke out. It would also take between 5 and 10 years to set up a shale oil industry, and double that time to scale it up to the level needed to provide for Australia's needs. Without massive government subsidies, the private sector would not be prepared to invest in this industry.

As for the oil in the Great Australian Bight, unfortunately it's about 400 kilometres offshore, where the ocean floor is between 1,000 and 2,200 metres deep. Bass Strait's oilfields, by contrast, are at depths of between 50 and 400 metres, so have been relatively cheap and easy to exploit. The oil in the Bight would be significantly more expensive, meaning it cost a great deal more at the bowser. This is why the three companies that had exploration rights to this oil abandoned plans to tap it a decade ago.

Of course, those who are pushing to 'drill, baby, drill', will argue that with the price of oil being much higher following the war in the Persian Gulf, Australia's untapped sources will be far more economic. That might have been true once, but today there are cheaper alternatives than oil for transportation – namely, EVs – so if the price stays high, more people will go down this path, reducing the demand for oil. It's a no-win situation for potential investors in the oil industry in Australia. Whether the price goes up or down, there is no incentive to exploit our untapped oil reserves.

Myth 91: Lego has failed to produce emissions-free building blocks, despite a five-year effort to do so. If we can't decarbonise something as simple as children's toys, how can we do so for the entire economy?

Fact: This is another example of a logical fallacy. It's true that Lego have, thus far, failed to produce blocks using biopolymers (plant-based plastics), but plastics are nowhere near as

damaging to the environment as burning oil in cars. In fact, they are only responsible for 4.5 percent of global emissions, as opposed to transport, which accounts for 21 percent. This is because most of the carbon used in making plastics is stored in the finished product and not released into the atmosphere during the manufacturing process. As long as those products are properly disposed of at the end of their useful life, the carbon they contain will not contribute to global warming.

Biopolymers, by contrast, can actually help reduce emissions, as they are made from the carbon sequestered by plants – that is, carbon that has been sucked out of the atmosphere via photosynthesis. If we could make as many of our plastic products from biopolymers instead of from oil, these products would have a positive impact on climate change, by acting as carbon sinks. Even if we could make half of all plastics from biopolymers, this would amount to 10 percent of all the annual carbon sequestration required to reach net zero emissions.

Finally, it should be remembered that net zero does not mean absolute zero. There are some things which we simply will not be able to make without fossil fuels. They are the ones we'll have to compensate for by sequestering carbon. Who knows – perhaps Lego bricks will be among their number. Or just perhaps the company will solve the problem somewhere down the track and produce a zero-carbon Lego brick. After all, it wasn't so very long ago when people thought getting to the moon was impossible.

Myth 92: You're asking us to move to new technologies that haven't even been invented yet. How does that make sense?

Fact: Well, actually, most of the technologies we need to deal with climate change *have* already been developed. But even for those that happened, this should not be a problem. Back in 1961, when President Kennedy pledged to put a man on the moon by the end of the decade, scientists had no idea how to do it. In fact, America had only just launched a man into space the previous year. What Kennedy was doing was giving his scientists and engineers a goal, and in response they developed the technology to achieve it. It was the same when President Roosevelt approved the development of the atomic bomb. More recently, scientists were tasked with developing a vaccine for COVID-19. Just because we don't currently have a technology does not mean we should not be trying to develop it.

Myth 93: What about nuclear power? Isn't that the best solution to global warming?

Fact: Nuclear power is a possible solution to global warming, and may be viable in countries that do not have plentiful sources of renewable energy, but it is definitely not viable in Australia.

The fact is that wind and solar are significantly cheaper than nuclear, so no companies are likely to build reactors unless heavily subsidised by the government. As of 2020, the price of nuclear power was 16 cents a kilowatt hour. By contrast, the price of solar was 3.7 cents a kilowatt hour, and wind 3.4 cents. Largely for this reason, the world commissioned 192GW of new renewable power in 2020, but only 8GW of new nuclear power. At the same time, 5GW of nuclear power was decommissioned, meaning the total planned addition to the world's nuclear capacity for 2020 was 3GW.

Politically, nuclear power is also problematic. Although modern reactors are far safer than their predecessors, the experience of Three Mile Island, Chernobyl and Fukushima has soured the public on nuclear technology. It is next to impossible to find a community willing to host a nuclear reactor, let alone one that will store nuclear waste. As such, it is futile to push nuclear power as a solution.

Another problem is that nuclear waste must be stored securely for many thousands of years before its radioactivity drops to safe levels. The cost of doing so, and the impact on the environment at the storage site, are often not fully taken into account.

A final difficulty is that constructing a nuclear power plant is very energy intensive, and unless this energy were produced by solar, wind or other renewable sources it would result in a large increase in CO2 emissions. These would eventually be offset by the lack of emissions from the nuclear plant, but not for many years. We would be so much better off using renewable energy than nuclear power.

Myth 94: Can't nuclear power provide the backup we need for a grid that is mostly powered by renewables?

Fact: The problem with this line of argument is that nuclear reactors must operate at near full capacity in order to amortise their high capital costs. This means they cannot ramp up their output if there is a sudden dearth of wind and/or sun. And even if they were to operate at a loss, at say 60 percent capacity, they cannot increase their output anywhere near quickly enough to deal with a failure elsewhere in the grid.

Battery and hydro storage and peaking gas are far better forms of backup for renewable energy. They can be brought into play almost instantly, preventing blackouts while the power outage is rectified.

Myth 95: China is going all-out for nuclear power, so why shouldn't we?

Fact: China is indeed building more nuclear power plants than any other nation, but nuclear's contribution to its energy grid is very small. At the beginning of 2024, it had 54 gigawatts (GW) of operable nuclear power, with another 31GW under construction, 45GW in the planning stage and 98GW being proposed. In 2024, it increased its nuclear capacity by 3.9GW. That compares with an increase of 357GW in its renewable energy capacity! In other words, China added 91 times more renewable capacity in 2024 than it did nuclear capacity. So yes, China it *is* building nuclear reactors, but these are *not* central to the nation's energy plans.

Myth 96: What about small modular reactors? Aren't they a solution to the climate crisis?

Fact: Small modular reactors (SMRs) are mini-nuclear power plants, similar to the units used in American aircraft carriers and nuclear submarines. They have been touted as viable sources of zero-emissions energy, but actually suffer from the same problems as their full-scale counterparts. At the moment, there is only one SMR operating in the world – Russia's 70 megawatt floating nuclear power plant, which is used to provide electricity to isolated settlements on the Arctic coast. This reactor cost 37 billion roubles (A$688 million)

to build, and produces power at five times the cost of renewable energy in Australia. China's demonstration 210 MW high-temperature gas-cooled reactor (HTGR) is proving slightly less expensive to run, but is nowhere near competitive with renewable energy sources or with large-scale nuclear plants. The only way the costs of SMRs could be reduced to a competitive level would be to mass produce them, but there is no sign of this happening.

The Coalition has mooted the idea of replacing Australia's ageing coal fired power stations with SMRs. To do so would require 71 such reactors, but these could not be built until most of our coal-fired plants had already closed down – leaving us with significant power shortages. In addition, the Department of Energy estimates that the cost of building 71 SMRs would be $387 billion, or $18,167 a kilowatt, compared with $1,058 for large-scale solar projects and $1,989 for onshore wind. Even if the ultimate cost of SMRs proves to be much less, they will still be uncompetitive, short of massive taxpayer subsidies.

Myth 97: What about nuclear fusion? Hasn't that been demonstrated to be feasible now, in which case why don't we wait for it to provide emissions-free energy?

Fact: Nuclear fusion has been demonstrated to be feasible, but will not be commercially available for decades. If we are to avoid catastrophic climate change, we must act immediately and reach net zero before nuclear fusion becomes available. This makes renewables our only viable option (although a small amount of nuclear power will likely be in the global energy mix).

Myth 98: Solar panels don't work in cold countries because snow covers the panels and prevents them from working properly.

Fact: Solar panels work perfectly well in colder climes, as they are installed with sufficient tilt to prevent snow from accumulating on them. A study in Canada revealed that snow only reduces the output of solar panels by 3 percent – an insignificant amount.

Myth 99: Clearing trees to build solar farms negates the impact of those solar farms on emissions. You'd be better off not cutting the trees down at all.

Fact: Felling trees does have a negative impact on emissions, but that impact is completely overwhelmed by the emissions that are saved though the installation of new solar panels. In fact, the ratio is over 200 to one, meaning that for every tonne of carbon you emit by felling the trees, you save 200 tonnes by increasing solar capacity. Hence, the myth is a total furphy.

Myth 100: Wind turbines are a danger to human health, as they cause dizzy spells and sleep deprivation on the part of those who live nearby.

Fact: Wind turbines produce what is known as infrasound. Infrasound is defined as any sound below 20Hz, meaning it is usually inaudible. It occurs naturally, but can also be man-made. Numerous studies have been done on the infrasound produced by wind turbines, and none have shown there to be any adverse physiological or psychological effects. In fact, infrasound levels from wind turbines are usually lower, and certainly no higher, than those we are already exposed to in nature. A recent study conducted by Sydney University's Woolcock Institute of Medical Research looked at the impact of infrasound from

wind turbines on sleep patterns, and found there to be none at all. To quote the study's lead author, Associate Professor Nathaniel Marshall, "We've been able to show conclusively that the infrasound generated by wind turbines doesn't make you dizzy or nauseous, doesn't impact heart health or mental health, or impact on sleep."

Myth 101: Wind turbines have a very high carbon 'footprint' – meaning the manufacturing process emits a lot of CO_2. So it's a waste of time thinking they can significantly reduce emissions.

Fact: This claim is simply rubbish! CO_2 emissions do result from the manufacture of wind turbines, but these are dwarfed by the CO_2 saved over the life of those turbines. Recent studies have concluded that wind power has a carbon footprint that is 99 percent less than coal-fired power, 98 percent less than natural gas, and 75% less than solar power. Other studies have shown that the 'energy-payback' time for wind turbines (that is, the time it takes for a system to generate more energy than it took to make it) is just 4 to 6 months. When the turbines are produced using renewable energy, as will be the case in the not-too-distant future, their carbon footprint will be next to zero. So, there is no truth whatever to this myth.

Myth 102: Wind turbine blades only last between 3 and 7 years, rendering wind power expensive and ineffective in fighting climate change.

Fact: Studies show that wind turbines last between 17 and 25 years on average. The industry standard is 20 years. The world's oldest wind turbine, in the town of Tvind in Denmark, has been generating electricity continuously since 1978! At 53 metres high and with a wing diameter of 54 metres, it produces enough electricity to power 1,000 homes. [To put this in context, a modern offshore turbine is five times as tall, has twice the wing diameter and can power 16,000 homes.]

Myth 103: Offshore wind turbines are an eyesore.

Fact: While onshore wind farms do have a visual impact on the landscape, the same cannot be said for their offshore counterparts. Most offshore wind turbines are so far out to sea that they cannot be seen with the naked eye from the coastline, even when the viewing platform has some elevation. This is certainly the case with the wind farm proposed for the Illawarra region in New South Wales. It is 20 kilometres offshore, which is four times the distance to the horizon. From that far out, the turbines would be completely hidden from view. Even from the top of the Illawarra escarpment they would be difficult to spot.

The wind turbines proposed for the Hunter region in NSW and Gippsland in Victoria will also be difficult or impossible to see, as they will be located between 10 and 35 kilometres out to sea.

So, if people really are concerned about the visual impact of wind turbines, they should be supporting the offshore variety, as these are largely hidden by the curve of the Earth.

Myth 104: Offshore wind turbines cause disruption to shipping.

Fact: The safety zone around a turbine is about 50 meters, so shipping is barely disrupted at all by the presence of an offshore wind farm.

Of course, there *have* been a few instances where ships have collided with wind turbines – the most famous being when the bulk carrier *Julietta D* did so off the Dutch coast in 2022 and when the cargo ship *Petra L* struck one in the North Sea in 2023 – but no one died in those collisions. The same cannot be said for the times when ships have hit offshore oil and gas rigs. Those platforms are highly flammable, and the resultant explosions have caused dozens of deaths. In 2005, for example, a ship hit an oil rig off the coast of India, and the resultant inferno killed 22 people. Wind turbines are positively safe by comparison.

Myth 105: Wind turbines off Australia's shores won't stand up to the massive swells and winds generated by our east coast lows and by tropical cyclones.

Fact: The waters off Australia's southern coast are indeed susceptible to strong winds, as are those in the far north, but those areas are not where wind farms are to be located. Instead, the farms will be set in the waters off the Hunter and the Illawarra in NSW, and off Gippsland in Victoria, where the winds are perfectly manageable.

Of course, offshore wind turbines do occasionally get damaged by extreme weather events, but the real damage from such weather is to onshore transmission lines, not platforms out at sea.

And while on this subject, we should not forget the estimated $60 billion cost of dismantling the offshore oil platforms that dot Australia's coasts. This amount dwarfs any costs we might face when dismantling offshore wind farms.

Myth 106: Offshore wind turbines are too expensive to dismantle, so will just be left to rot once they reach their use-by dates.

Fact: Offshore wind turbines, like their counterparts on land, have a lifespan of 20 to 25 years. After that they can either be upgraded, repurposed, dismantled or left where they stand. A combination of all four options may be deemed appropriate for a wind farm.

Upgrading involves replacing the old blades and electronics, so the turbine has a new lease of life. Repurposing involves turning the base into a haven for wildlife (a breeding ground for seabirds, for example). Dismantling is not a technically difficult task and will soon be undertaken in Europe on a massive scale. The cheapest option, of course, is to dismantle the blades and the electronics, but leave the base where it stands. This is what was done with the offshore defences Britain built along its south coast during the Second World War. Many of these are still there today, slowly rotting away.

Whatever option we choose, it's not a problem we'll have to face till the second half of the century.

Myth 107: Offshore wind turbines are harmful to whales, disrupting their migration routes and causing them to strand. In addition, sonar mapping of the seabed in preparation for the construction of wind turbines can be distressing to whales.

Fact: Every major study that has examined this issue has concluded that offshore wind turbines do not harm whales. They do not cause them to strand, nor is there evidence that they disrupt their migration routes. Even Greenpeace, which has been campaigning for fifty years to protect the creatures, agrees with this assessment.

As for sonar mapping, it is true that it may have some impact on whales that pass by, but that impact is minuscule compared with the impact of sonic blasting, which is used to search for offshore oil and gas.

The real threats to whales include entanglement in fishing nets and ropes, collisions with ships, whaling (still practised by Japan, Norway and Iceland), plastic pollution, overfishing and climate change (which threatens the food chain upon which whales depend). Claims about offshore wind turbines emanate almost entirely from think tanks funded by the fossil fuel industry, which has a vested interest in stopping the rollout of renewable energy.

Myth 108: Wind turbines are a threat to birds.

Fact: While wind turbines do kill birds, the number killed pales when compared with other threats to the creatures. In the United States, cats kill an average of 2.4 billion birds every year, and collisions with building glass kill another 599 million. Wind turbines, by contrast, kill just 234,000. In addition, fossil fuels cause 5.2 bird fatalities per gigawatt hour of energy produced, while wind turbines cause an average of only 0.35.

There are also ways to reduce avian fatalities from wind turbines. These include painting the towers or the blades black and using artificial intelligence to slow the blades down when flocks of birds are approaching. Painting the towers can reduce fatalities by almost 50 percent, while doing the same with one of the blades can reduce them by 70 percent.

Myth 109: There isn't enough land to power the world with renewable energy.

Fact: This is nonsense. A number of studies have been done to determine how much land would be required to power the United States using only renewable energy. One done at MIT estimated that all of America's energy needs in 2050 could be satisfied with solar technology using 33,000 square kilometres of land. This represents 0.5 percent of the land mass of the United States. If those solar panels were restricted to the sunniest parts of the country, only 12,000 square kilometres would be required.

This might seem like a great deal of land, but it actually isn't all that much when you consider that golf courses take currently take up about 10,000 square kilometres in the United States and major roadways take up another 49,000 square kilometres. In addition, the US has 20,000 square kilometres of rooftop space, so there is no shortage of places where solar panels could be located.

In Australia, the Clean Energy Council has estimated that just 0.06 per cent of rural land would be required in order to provide all the solar power NSW will need by 2050. Much of that land, of course, is not be suitable for agriculture, so the loss of production would be minimal.

In reality, of course, much of our renewable energy will be produced by wind turbines, which can be placed on agricultural land without decreasing its productivity. Solar panels can also be used this way, but not in all circumstances and not without some reduction in

productivity. Wind turbines can also be placed offshore, while solar panels can be placed over canals or floated on lakes. They can also be placed on land that is unsuitable for other purposes, like deserts, abandoned mines and former waste dumps.

In the United States, the Biden administration is placing big batteries in disused coal fired power stations. It is also turning dams into hydroelectric power stations, converting oil and gas wells into geothermal energy plants, and transforming abandoned coal mines into solar farms. This is bringing income and employment to back to areas that have experienced economic decline.

Hence, there is plenty of land available for the renewable energy revolution.

Myth 110: Business is opposed to climate action, and because business is the backbone of the economy, any attempt at climate action would be bad for jobs and economic activity.

Fact: Business *was* opposed to climate change not so many years ago, but this has changed of late. An increasing number of the leading corporations are now divesting from fossil fuels and/or supporting a move to net zero emissions by 2050. By August 2020, 139 global financial institutions had announced plans to exit from coal. These include Mizuho (the world's largest private financier of coal), Deka Investments and Union Investment (two of Germany's largest asset managers), Citibank, Allianz, Goldman Sachs, JP Morgan and the Norwegian Government Pension Fund (the world's largest sovereign wealth fund). Even fossil fuel companies like Shell, BP and Total are now calling for carbon neutrality by 2050. Locally, the Business Council of Australia and the National Farmers Federation are also calling for this, and support the Albanese government's 43 percent emissions reduction target.

Myth 111: Actions to mitigate climate change are antithetical to a market economy. They would involve a move to socialism.

Fact: There is no truth to this statement. Climate deniers tend to make it because they believe that all climate activists are closet Marxists. In fact, market mechanisms are by far the best way to drive the economy towards carbon neutrality. By introducing a carbon tax or an emissions trading scheme (ETS), businesses would be given a market signal that would push them to reduce CO2 emissions without significant input by government. Such mechanisms are no different in the way they operate than tariffs and excise duties (such as taxes on tobacco and petrol). They skew market signals so as to produce the government's desired outcome. The carbon tax that operated in Australia from 2012 to 2014 was extremely effective in reducing CO2 emissions, without in any way impeding economic growth. Interestingly, the so-called 'direct action' policy that replaced it saw only a marginal fall in emissions. [By one estimate, if the rate of reduction under the Coalition government were to have continued, Australia would not have reached net zero emissions until 2167!]

Hence, there is no need for excessive government intervention in order to move to a carbon neutral economy. What *is* needed is a clear set of price signals to encourage businesses and consumers to stop using fossil fuels and invest in renewables. [Interestingly, it is the fossil fuel industry in Australia that has been, and still is, the main beneficiary of government intervention – in the form of an $11 billion a year subsidy. Strangely, few climate sceptics claim this to be a form of socialism.]

What is also needed is a significant boost in government spending, to make up for nine years of climate inaction under the federal Coalition. This does not mean government ownership of industry, or any other form of socialism. But it *does* mean greater government intervention in areas that are roadblocks to further progress on renewables. The nation's energy infrastructure is at the top of this list.

Myth 112: Even sustainability festivals and renewable energy expos are powered by fossil fuels, so what hope is there of us ever getting to net zero?

Fact: This argument is ridiculous. It's like saying that we shouldn't produce solar panels if they're made using 'dirty' sources of electricity. The whole purpose of making them is to replace those dirty sources, and when there are no clean alternatives available, they can't be made any other way.

Another favourite line of attack by climate sceptics is to accuse climate activists of being hypocrites by flying to conferences about global warming. Yes, those flights are causing emissions, but those emissions are minor compared with the benefits to be had by staging the conferences. Most climate activists also offset their emissions via organisations like Greenfleet, which plant trees to soak up offending carbon. Others use less polluting forms of transport, like rail and EVs. Greta Thunberg famously returned to Europe by sailboat after attending a UN climate conference in New York. She did this to avoid being branded a hypocrite.

Myth 113: Won't the disposal of solar panels and batteries make them an uneconomic and dangerous proposition?

Fact: There *will* be health considerations when disposing of solar panels and batteries, but these problems are no worse than with many other types of electronic equipment. Most of what goes into a solar panel or battery can be recycled, and the rest can be disposed of safely. All it requires is proper government legislation. As for the economics of disposal, it is estimated that recyclable materials from solar PV panels will be worth more than $US2.7 billion a year by 2030, and a staggering $US80 billion by 2050. Hence, disposal will not be a significant issue.

Myth 114: More than 60 percent of a power bill is made up of transmission costs. These will increase significantly if we opt for 100 percent renewable energy, as we will need to build thousands of kilometres of new power lines to bring electricity from solar and wind farms to the cities.

Fact: Transmission involves moving electricity from its source (power stations, wind farms, solar farms, etc.) to substations in urban and rural areas. It represents only 8 percent of a power bill, not 60 percent as the myth claims. Even if we add distribution costs, which are not affected by the cost of high voltage power lines, we only get to 42 percent of a power bill.

In addition, the Australian Energy Market Operator (AEMO) estimates the cost of building new transmission lines to be $16.4 billion, if we are to completely decarbonise the electricity grid. It also estimates that this amount will not only be fully recouped, but also deliver an

additional $17 billion in net benefits to the economy. In other words, consumers and businesses will be better off with a shift to renewables.

Myth 115: Hasn't Australia been meeting its commitments under the Paris Climate Agreement of 2015? Why should we do more than other nations?

Fact: The Morrison government was only able to claim that we were meeting our Paris climate commitments because those commitments amounted to very little. In fact, we have done a lot less than other, comparable nations. What we agreed to in Paris was to reduce our 2005 level of emissions by 26-28 percent by 2030. However, we also claimed the right to achieve this by using 'carryover credits' from the time of the Kyoto Protocol, when we were allowed to include changes in land use (a drop in deforestation) in the calculation of our emissions. The fact that we did manage to reduce our emissions during that period (largely due to Labor's carbon tax) has meant that the current government can now slacken off in its own efforts and still achieve its 2030 target. To our shame, we were the only country in the world that was planning to use this subterfuge, even though others had also earned the right to do so. As the IPCC pointed out in 2019, doing this would "reduce what Australia needs to do to meet its 2030 target by more than half." And even using these carryover credits, we were still not on target to meet our Paris commitments! [As an aside, it is worth noting that our two biggest mining companies, BHP and Rio Tinto, opposed the use of carryover credits. Both believed we should make real emissions reductions, and not just paper ones.]

According to government figures, the nation's emissions fell by 19 percent between 2005 and 2020. About two thirds of that occurred prior to the abolition of the carbon tax, 3 percent as a result of the COVID economic downturn, and 4 percent from initiatives by the Coalition government. At this rate, it was likely that our emissions would only fall by 8-11 percent below 1990 levels by 2030. [It should be noted that all other nations used 1990 as a benchmark for emissions reductions. We used 2005 because our emissions were a lot higher in that year than in 1990.]

The Albanese government has committed Australia to a 43 percent reduction in emissions by 2030 and a 62 to 70 percent reduction by 2035. These are significant improvement on the previous government's target, but still inadequate to meet the ambitions of the Paris Climate Agreement. That said, it will take a great deal of effort to achieve them, given how little was done under the Coalition.

Category 5: Global warming might be a problem, but it's too late to take meaningful action

A final type of myth asserts that it is too late to do anything about climate change. The horse has already bolted; temperature increases are now locked in.

Myth 116: There's nothing we can do about climate change; it's too big a problem and it's too late to act. If we're already heading for 2°C warming, we're doomed anyway.

Fact: In all likelihood it is indeed too late to keep global warming to 1.5°C. Even 2°C will be difficult. But both those temperatures are manageable ecologically, and we have all the

technology and all the economic levers we need to stop further increases. The problem is getting politicians to act. That's why public pressure is so important.

Myth 117: Even if we stopped all greenhouse gas emissions, the CO_2 and methane we have already released would stay in the atmosphere forever, so the planet is still doomed.

Fact: This is not true. The oceans and land absorb about 60 percent of the CO_2 we emit each year, so if we reduced our emissions to zero, the oceans would become giant CO2 sponges. Scientists estimate that it would take about 50 years for our cumulative CO_2 emissions in the atmosphere to fall by 60 percent, and 200 years for them to fall by 80 percent. [Unfortunately, it would take thousands of years for them to fall back to pre-industrial levels.]

Methane would be even easier to eliminate, as methane molecules only stay in the atmosphere for 12 years, by which time it is largely converted to CO_2. Methane levels would start falling very quickly if we reduced our emissions to zero (or to somewhere thereabouts).

The news is even better when it comes to global temperature. Climate scientists estimate that this will stabilise with three to five years after we reach net zero.

Myth 118: Methane clathrates have already been irreversibly destabilised by the current level of global warming, meaning that catastrophic temperature increases can't be stopped. There is therefore no point in cutting CO_2 emissions.

Fact: Methane clathrates are ice-like substances that trap methane gas in a cage of water molecules. They form below the seabed and in permafrost. If just a fraction of one percent of the methane trapped in these clathrates were released into the atmosphere, it would indeed add significantly to global warming. However, there is *no* evidence that this is about to happen, so we are *not* facing such a doomsday scenario. The planet's methane clathrates are still locked away safely beneath the oceans and in the Arctic permafrost.

Myth 119: Global warming is an international problem and needs an international solution. We can't act alone.

Fact: We already have an international solution: the Paris Climate Agreement. Many nations are taking it seriously, and even with the return of Donald Trump, US emissions are still going down, albeit not as rapidly as they were under Joe Biden. China is also taking serious action, with the nation already six years ahead of schedule in its quest to net zero by 2060. Given that China is responsible for almost a third of global emissions, its actions will have a greater impact than those of any other nation.

Myth 120: India and China are going to overwhelm any action the rest of the world might take, so it's a waste of time Australia doing anything about climate change.

Fact: India and China are not doing nothing, and are nowhere near as responsible for the problem as we are. Most of the CO_2 in the atmosphere was put there by the nations of Europe and North America, so it is incumbent on them to take the lead when it comes to

solving the problem. Australia, with the second-largest greenhouse gas emissions per capita among the OECD nations, is also responsible for a disproportionately high level of CO_2. We have a moral responsibility to rectify this.

It's also worth noting that if we really *are* concerned about China's and India's emissions, we should stop selling them the coal and gas that are causing those emissions.

Myth 121: Overpopulation is the reason why global warming is taking place. Unless we can drastically reduce the world's population, we cannot do anything about climate change.

Fact: Overpopulation *is* a serious problem in parts of the world, and is putting great stress on the planet's resources. However, it is *not* the main factor driving climate change. A person's environmental footprint is calculated by the following formula: Impact = Population x Affluence x Technology (I = PAT). The fact is, while population might be great in many poor countries, affluence and technology are not. Most of our greenhouse gas emissions are a result of these latter two factors, and originate in the wealthy nations, not the developing ones. [China is the main exception to this, although it should be noted that most of its CO_2 emissions are generated by its upper and middle classes, not those still toiling on the land. This will change, of course, as the country continues to develop.] The solution is to be found by changing the technology we use to generate wealth. By using renewable energy, we can go on living comfortable lives without altering the Earth's climate. [Of course, continued economic growth does have other, negative environmental consequences, but this is a separate issue to the one being discussed here.]

This document was prepared by **Ken Enderby**, of Climate Action Burwood-Canada Bay.

If you would like more information on any of the topics discussed here, or help in preparing a presentation on climate change, feel free to contact Ken at ken.enderby@hotmail.com.

About the author

Ken Enderby was born in 1955, and has degrees in history and economics. After brief stints as a high school teacher then as a scriptwriter, he became a peace and human rights activist in the 1980s. It was a role that took him to parts of the world where conflict and oppression were rife. He travelled to East Germany and Czechoslovakia to meet with critics of the Soviet-backed regimes, trekked upcountry in El Salvador and the Philippines to interview Marxist guerrillas, ventured into the Guatemalan highlands to investigate the government's campaign of genocide, and visited Israel and the Occupied Territories to talk with moderates and extremists on both sides. Ken was with Solidarity in Poland during martial law, in Nicaragua during the war with the Contras, and in Western Europe during the anti-missile protests. He gave talks and interviews in more than thirty countries, took part in demonstrations and letter-writing campaigns, raised money for aid projects, and contributed to journals and newspapers in Australia and overseas.

Throughout this period, Ken financed his activities by working as a casual teacher in TAFE and at Sydney University. Then, in 1989, he accepted a full-time job at Bankstown TAFE, where he taught history, economics and politics for the next thirty years.

Despite settling down to a relatively quiet life, Ken maintained his interest in economic development and human rights. He raised money for aid projects in different parts of the

world, helped the resistance movement in East Timor and worked to secure the release of Mamdouh Habib from Guantanamo Bay. More recently, he has undertaken study trips to North Korea, East Timor and the Philippines, and has returned to the Middle East on several occasions to assess the situation in the Occupied Territories. In 2019, he travelled across Russia, talking to people from all walks of life about Putin, Putin's regime and the conflict in Donbas.

Since retiring at the end of 2018, Ken has focused his attention on climate change, something that has interested him for decades, and is currently president of Climate Action Burwood/Canada Bay in Sydney's inner west. He is also a trainer with Al Gore's Climate Reality Project and a facilitator with Climate for Change. In 2020, he completed a course on climate science at Queensland University, and now concentrates on debunking myths perpetrated by climate deniers. His letters are published regularly in *The Australian*, the *Financial Review*, the *Sydney Morning Herald* and the *Daily Telegraph.*

Ken is also the author of a major study on American foreign policy, and co-author of the novel *Trail of Deceit*, published in 2011. That same year he featured on ABC Radio's *Conversations* with Richard Fidler. He has written for both radio and television, and recently scripted and acted in the comedy series *The Adventures of Sgt Grit Grinder's Suicide Squad*, available on YouTube and Spotify.

Ken speaks French, Spanish, German, Italian, Russian and some Indonesian. He is married, with two adult children, and lives in Concord, Sydney.