



Pathway 2022

An Emissions Reduction Profile





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This document supersedes Pathway 2021. The report has been expanded to cover Australia and updated following the COP26 meeting in Glasgow and issuing of further IPCC reports.



1 Background

This Report provides a pathway for emissions reduction based on what has been published through scientific investigation, including the causes of and trends in greenhouse gas emissions, the consequent warming of the climate system and the impacts of this warming. It is a companion report to the NSW Community Plan (2022) which sets out how this can be practically achieved through actions by both individuals and the community. This report aims to provide an emissions reduction pathway consistent with achievement of the internationally recognized Paris Agreement goal of 1.5 °C.

The changes to our climate are driven by human emissions of greenhouse gases. The amount of eventual warming depends on the total amount of additional greenhouse gases we emit.

The Intergovernmental Panel on Climate Change Report (IPCC AR6 WGI): *The Physical Science Basis*¹ finds:

“It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred.

unless there are immediate, rapid and large-scale reductions in greenhouse gas emissions, limiting warming to close to 1.5°C or even 2°C will be beyond reach”

Any emissions reduction profile over time must be consistent with meeting the goals of the Paris Agreement (referred to above).

The Paris goals are to keep the rise in temperature well below 2 °C and as close as possible to 1.5 °C. The last seven years average more than 1.2 °C above the 1850-1900 average. Most of the rise has occurred since 1970 against all scientific advice.

¹ Reference: Intergovernmental Panel on Climate Change, 6th Assessment Report, first part contribution of Working Group I (7 Aug 2021): *The Physical Science Basis* (IPCC AR6 WGI).

Emissions Budget

Time is critical. The eventual temperature trajectory will depend on the total sum of all emissions. This can be understood as a 'budget' of emissions. If we exceed the budget, the eventual temperature rise will be higher.

This total budget amount includes historical additions of greenhouse gas emissions from before the beginning of the industrial revolution through to today and also what we expect to emit before we get to the zero emissions economy.

Therefore, calculations can be made to determine an allowable *remaining* budget that provides a particular chance of staying below a particular global temperature rise. For every year of delay, the remaining budget is reduced by the amount emitted in that year.

This means that the rate of the cuts required to control climate change to 1.5°C goes up every year as we are consuming our remaining available emissions budget.

1.1 The urgency of the response

A review of recent reports shows that the science clearly requires urgent and rapid reductions in all greenhouse gas emissions (report list given in the References below)

The most recent relevant reports are from the Intergovernmental Panel on Climate Change. The first part of the **6th Assessment Report: *The Physical Science Basis*** (IPCC AR6 WGI) provides a thorough review of the current science looking at more than 14,000 scientific papers.

Not only does it confirm that humans have triggered global warming, but it states that unless immediate action is undertaken now, by everyone, to stop emissions, we will not be able to keep warming to 1.5°C and may struggle to achieve the 2°C limit.

As the follow-up IPCC reports show, the resulting changes to the climate system would be catastrophic for people everywhere (6th Assessment Report: *Impacts, Adaptation and Vulnerability* (WGII), and *Mitigation of Climate Change* (WGIII)).

The changes we already face are causing loss of life and property and destroying lives. The human and economic impacts of climate change that are already happening will escalate rapidly this decade.

We are also at risk of passing tipping points that would create rapid changes that could not be reversed.

The more the temperature increases, the greater the economic cost and burden on human health and welfare. It is far cheaper to act now with urgency and speed to reduce emissions than to delay for even a single year. If we fail to act with sufficient urgency, we will destroy the economic and personal future of all of us and leave a mess for the survivors that will be impossible to repair.

The decisions we make each day can lead to a significant reduction in the emissions that are warming our planet. Every tonne of greenhouse gas that we save will make a difference.

The reduction profile presented in this Pathway Report aims to turn emissions around by providing a reduction curve for setting of targets for every year this decade and for the years beyond.

1.2 Technical background for the pathway and targets selected

The Paris Agreement was approved by the world's governments in 2016. It represents the aims of all people to control the rise in the world's temperature to limit the damage we are doing to our environment and hence to ourselves.

The **Intergovernmental Panel on Climate Change Special Report on Global Warming of 1.5 °C** (IPCC SR15) describes the likely increased damage of a temperature rise of 2 °C as opposed to 1.5 °C and provides pathways for emissions reduction to achieve the goals of the Paris Agreement. The pathway that provides a chance of achieving the Paris goals is initially steep with a longer tail and includes negative emissions.

The **IPCC AR6 Reports** confirm the situation and provide new scenario pathways based on the latest science. These are similar to the IPCC SR15 report with a steep initial cut leading to negative emissions.

We must be aware that the situation will become a lot worse as we pass tipping points that would trigger massive, unexpected changes to our climate.

The **United Nations Environment Program, Emissions Gap Report 2021 (EGR21)** details the progress of nations towards achieving the Paris goals, identifies gaps and quantifies the additional cuts required to meet those goals. The 2021 report clearly shows that the current commitments of all the world's nations, including those presented at the recent 26th Conference of Parties Meeting in Glasgow (COP26) are not nearly enough to achieve the Paris goals.

The Climate Council, an independent technical advisory body in Australia, has called for Australia to aim for a cut of 75% below 2005 emissions levels by 2030 (see **Climate Council report: Aim High, Go Fast**).

In 2014, the **Australian Climate Change Authority Final Report on Australia's Emissions Reduction Targets** (CCA 2014) recommended a target for Australia of 40%

to 60% reductions below 2000 levels by 2030. Since then, Australia has reduced its emissions (below 2005 levels) mostly as a result of forestry and land use changes. Unfortunately, the global emissions level has continued to rise, eating into the emissions budget and making it imperative that we increase our ambitions even more than recommended in the CCA 2014 report.

Although the preferred emission cuts would be to stop immediately, no-one can expect this to be a practical option. However, if we don't act urgently this decade, we may be forced to take sudden action across the globe to prevent disaster with all the resulting consequences for people and the economy.

The targets in this Plan are based on the need to limit ourselves to a carbon budget as identified by the scientific community in the above reviewed reports. A broad range of documents have been consulted besides the ones mentioned above (see list in References below).

Relevant pathway information is given in the **IPCC SR15, Summary for Policy Makers**, Figure 3a that shows emissions projections over time. Figure ES.5 of the **UNEP Gap Report 2020** also illustrates the emissions reduction pathways; in this case, those required to give a 67% chance of meeting the 1.5 °C aspiration.

The profile given in this report is generally consistent with the references given above. It is also consistent with the 75% target by 2030 proposed by the Climate Council.

This 75% target was proposed as below 2005 levels and falls linearly while the one in this report falls in a curve that is steeper at first and is below 2019 levels (considered to be the current levels).

This difference also reflects the drop of approx. 15% in Australian emissions between 2005 and 2019 (624 MtCO₂e reduced to 529 MtCO₂e, including LULUCF).

A temporary sharp drop in global emissions due to the COVID19 pandemic has passed with emissions now back to very near the pre-pandemic levels.

The pathway in this report has been revised given the failure of the 26th conference of the parties (COP26) in Glasgow to generate sufficient international ambition.

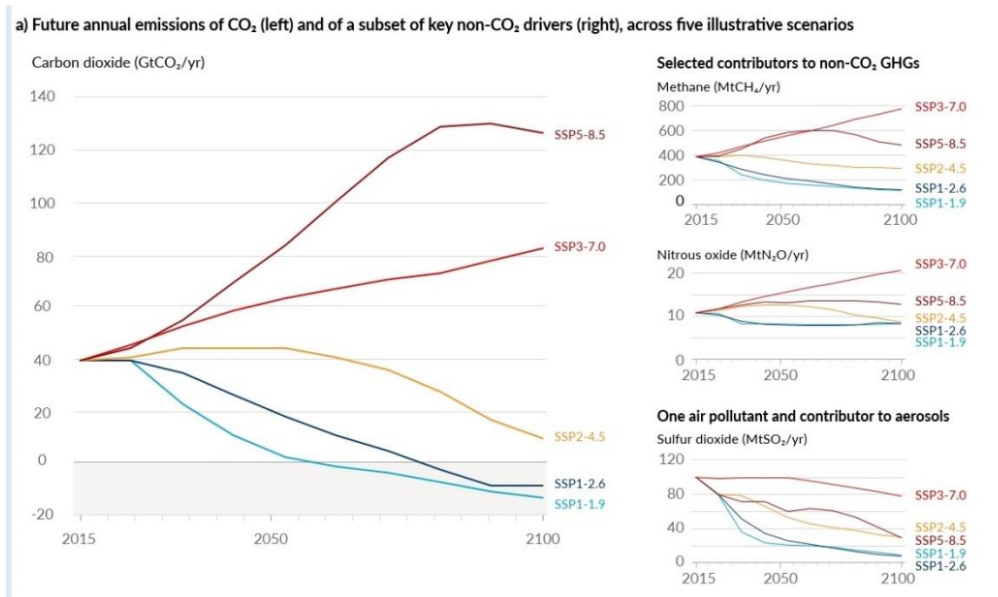


Figure 1: Part of Figure SPM 4a of *The Physical Science Basis (IPCC AR6 WGI)*

NOTE: Only the lowest profile SSP1-1.9 would provide a chance of meeting the 1.5C target. The higher profiles would lead to a run-away climate.

Global total net CO₂ emissions

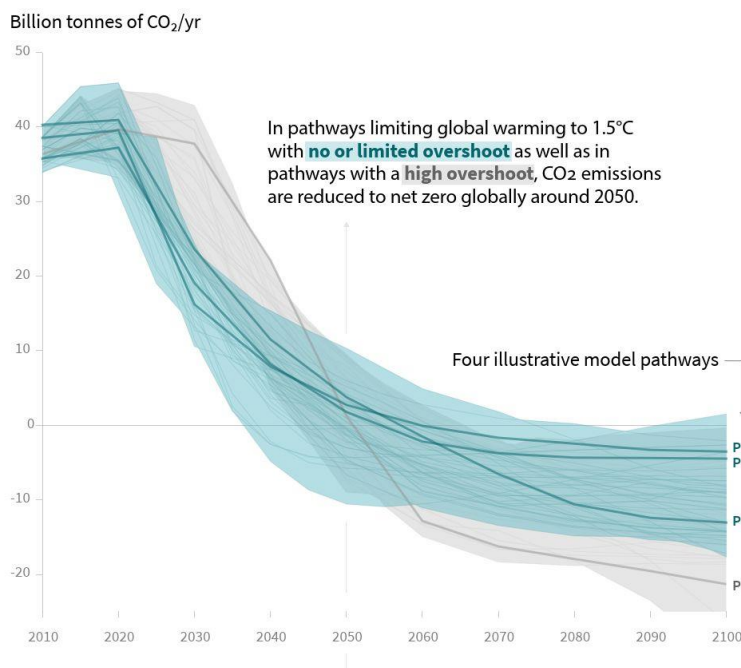


Figure 2: Part of Figure SPM 3a from SR15, IPCC Special Report on 1.5C

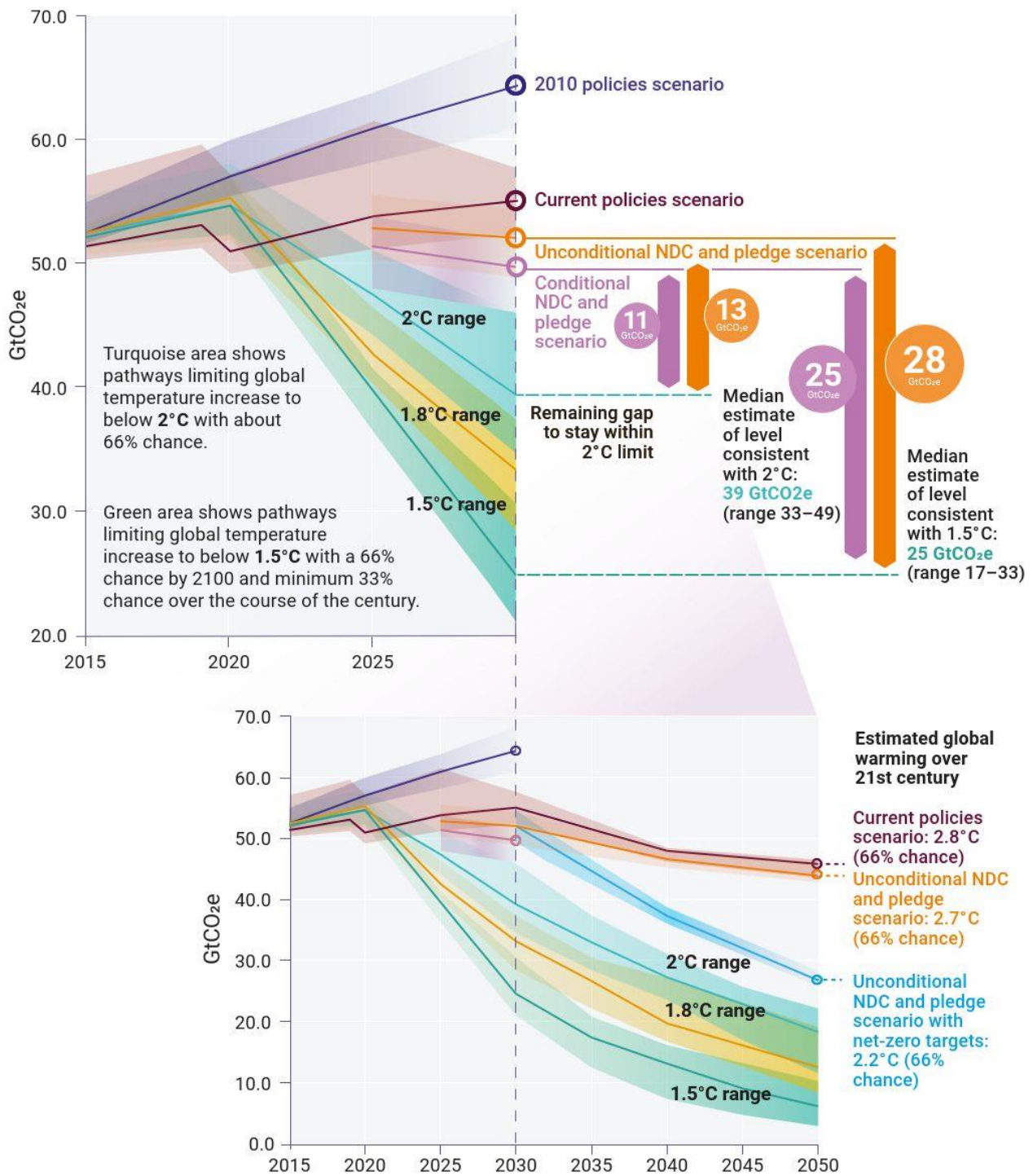


Figure 3: Figure ES.6 from UNEP Emissions Gap Report 2021

NOTES:

1. These emissions pathways provide only a **two in three** chance of achieving the target temperature limit stated (66%). So, there is a **one in three** chance of breaking past the temperature limit.
2. The curves are not linear due to the need to stay within the cumulative emissions budget. The delay of the last 3 years has used up part of that budget already resulting in the cuts needing to be sharper than in these graphs. The longer the delay in achieving cuts the earlier we will need to implement direct capture from the atmosphere (negative emissions).
3. Note the difference between graphs showing cuts in CO₂ and those showing cuts in CO₂e. The fundamental aim is to reduce emissions of all greenhouse gases, generally referred to as a CO₂ equivalent.

1.3 Application to a Region

The profile defined in Section 2 reflects Australia's fair share of emissions cuts. Thus, it can be applied to any state or council region within Australia as necessary.

For those wanting to set targets for a specific region, data on the relevant economic sectors can be reviewed using information in the Climate Snapshot Reports published by Ironbark Sustainability and Beyond Zero Emissions. These are available for each council region and for the states and territories (see example below in Fig 4).

Comparison of the level of emissions in the various sectors (such as electricity, transport and gas) combined with the availability of solutions for each sector can be used to give sector specific target reduction profiles.

Although the Snapshot reports cannot be used to monitor the success of cuts within a local government region, they provide some confidence that a reasonable benchmark has been set for the 2019 emission levels.

At the state level, reference to information from the NSW government could assist in monitoring the success of implementation of a plan to cut emissions with additional data provided in the Australian Emissions Projections reports which are issued annually by the Federal Government.

New South Wales

2019 state emissions snapshot

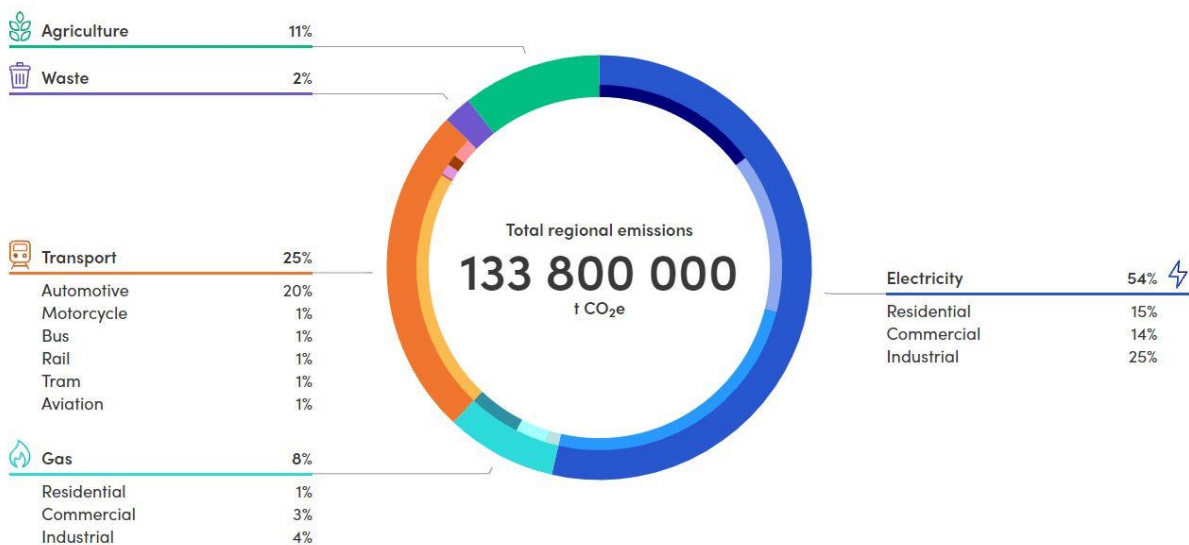


Figure 4: Extract from the Snapshot Climate Report for NSW (Ironbark Sustainability, Beyond Zero Emissions)



2 Target Emissions Reduction Profile

The target profile set for this plan is to cut greenhouse gas emissions below the 2019 levels across the economy following the profile below in order to stay within the total budget required to meet the target:

- By end of 2025:- 30%
- By 2030:- 65%
- By 2035:- 90%
- By 2040:- Zero carbon economy
- After 2040:- Negative emissions period to be ramped up ASAP

This profile would be expected to provide better than a 66% chance of staying well below the 2°C target which is consistent with the aims of the Paris Agreement. It will need to be reviewed at yearly intervals depending on how extreme events and climate trends unfold and also how successful global efforts are to cut emissions. This second point is critical because if global emissions continue to rise, the remaining emissions budget to achieve the Paris Agreement goals will be used up in only a few years. All levels of government must lobby for rapid action by all nations.

Further Notes

Curved Profile

The curved profile with fast initial cuts followed by the longer tail, are necessary to stay within the budget for the target and reflect the increased difficulty in providing alternatives for emissions sources

as we work deeper towards the zero carbon economy. For example, the biggest cuts are most easily made in the energy and transport sectors. Cuts to more difficult sources such as from agriculture, steel making or cement production will take longer to implement as solutions are not as well developed.

Negative Emissions and Overshooting the Target Temperature

The IPCC AR6 WGI, IPCC SR15 and UN Gap Report profiles referred to above rely on negative emissions following reaching zero. Negative emissions means that we would be required to actively remove CO₂ from the atmosphere. This part of the profile following reaching zero emissions, aims to allow some overshooting of the Paris goals (that is, going to a higher temperature) then returning back down towards the longer term temperature goal of well below 2 °C.

There is scientific support for the idea that overshooting the target temperature would push our climate past dangerous levels, triggering more climate feedbacks and tipping points. It is highly likely that it would not be possible to then return global temperatures back down to the Paris goal.

Even if it turns out to be possible to return to the Paris goal of well below 2 °C, we may not be able to retain some natural ecosystems or agricultural practices. Coral reefs are already under severe pressure and are one of the ecosystems that has been committed to passing its tipping point. Sea level rise is one impact that cannot be reversed. Rising sea levels will remove parts of our continents, reducing the area available for use by humans.

Whatever the outcome regarding our ability to undertake negative emissions to the order of 10 GtCO₂/y and to store the captured material permanently, this situation makes it more imperative than ever to turn the curve downwards and begin the significant cuts set out in this report.

Offsets

The use of offsets must only be allowed where the captured and stored carbon remains secure for at least 100 years. There is no point in storing carbon for a few years only to release it again. For example, carbon stored in forests or soils can be lost due to increasing droughts or fire effects. This makes any offset based on such storage useless in the effort to control warming of the climate. Far better is to leave the carbon in the ground in its natural form (coal, oil and gas).

Review and Consequences of Delay

As the crisis unfolds, we should review the above profile to assess whether it needs to be tightened further to avoid some tipping point or catastrophic change to the climate system that becomes apparent.

Any further delay in the reduction of emissions will also trigger a review. The remaining budget to achieve as close as possible to 1.5 °C will be reduced for every delay in serious reductions. Each year of delay increases the rate at which we must cut and shortens the time we have left until we must get to zero. It would also increase the burden on future generations to extract CO₂ from the atmosphere that is already expected to extend for more than 100 years after net zero is reached (refer to curve P4 of Fig 2 on page 6).

Should we reach a position when the budget is exhausted, we would have to immediately switch off all use of fossil fuels to achieve the goals of the Paris Agreement, which would be impractical.

If emissions continue to rise as they have been in recent decades, it is likely the Paris goals will be out of reach well before 2030 with resultant catastrophic results for human society (such as unbearable heat, destructive storms, loss of coastal cities and collapse of agriculture with resulting threat of war).

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About the Author

Richard Weller

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Richard moved to the NSW Central Coast in the late 1980's and worked as a structural engineer locally for some years before retiring. He has been following the development of the climate crisis for the last 30 years with increasing concern at the lack of emissions reduction and preparation for change.

He worked closely with the Standards Australia Committee, *General Design Requirements and Loading on Structures*, on the Australian Standards that govern the design of structures for the forces of extreme events such as wind, snow, temperature, flood and earthquake. Richard developed a detailed understanding of extreme events, their definition from measured data and their impacts on the built environment.

By the late 1990s he had become concerned enough at the lack of global action, that he began directly following the investigations and reading scientific papers. A turning point was reached in the early 2000s when independent scientific corroboration of climate science was provided in studies by biologists who found that the measured ranges of birds were moving poleward in Europe and North America. Richard began advocating for change at the founding of Climate Future in 2009 and has since given many public talks on the science, the impacts and the solutions to the climate emergency.

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