1 September 2021

Engineers Australia
Engineering House
11 National Circuit
BARTON ACT 2600

Attn: Thomas Mortimer, Senior Policy Advisor – Climate Change

RE: CLIMATE POSITION STATEMENT AND SUPPLEMENTARY DOCUMENT REVIEW COMMENTS

Dear Sir

Thank you for the opportunity to comment on the Climate Change Position Statement and Supporting Document. It is disappointing though to have such a small period of time to comment on the documents, given that nothing has happened in this space for over 2 years.

The following statement on the website is also misleading.

> *The development of this draft position has been informed by membership-wide consultation in 2019, Engineers Australia's 2020 Engineering Responses to Climate Change Roundtable and 2021 discussions with office bearers including the Chairs of the Sustainable Engineering Society and the Environmental College.*

There does not appear to be anything from the 2019 Draft Position Statement included in the latest versions and the document does not reflect my opinions on what should be incorporated in the document. I have had people contact me asking me if the Environmental College really did provide input and agree with the document as it stands because they didn't think it was acceptable as is.

It is disappointing that the colleges did not have an opportunity to provide comment on the document before it went to the greater membership and that we were only informally advised, by yourself, that the eNews article was coming out. Survey monkey is also a poor method of gaining members feedback. The survey questions did not provide spaces for comment for each selection, which increases the risk of misinterpreting the answers provided by respondents due to loaded questions. Targeted discussion groups would be more reflective of members' views and should remove the skewed opinions of members such as climate deniers; they would also provide the opportunity to inform those that may not have a good understanding of the science.

More detailed comments from the Environmental College Board on both documents are included in Attachments 1 and 2.

Some general comments are below:

- Embracing an economy wide emissions pricing mechanism is a very positive move.
- The strong support for much wider consideration and incorporation of climate mitigating and adaptive actions into engineers' everyday work is welcome.
- The documents sound like they are designed to sell engineers rather than a policy documents. What is their purpose? To inform submissions and advocacy or to sell engineers to the government?

Engineering House
11 National Circuit, Barton ACT 2600
Phone: +61 2 6270 6555 | Facsimile: +61 2 6273 1488
engineersaustralia.org.au

- The documents are long, repetitive (both documents include the same content) and self-promoting. While it is agreed that Engineers have a vital role to play the transition to a zero carbon future, it fails to mention that it is largely through engineering activity that we have inadvertently arrived at the climate emergency. Combining the two documents into a single "Engineers Australia Climate Policy" with the supplementary information in "Appendix A" will avoid confusion and conflicting/mixed messages between the documents.
- There is no leadership in this document. It makes reference to the IPCC and 2050 targets which have already been accepted by the broader community, but fails to pick up the urgency stressed when looking at the finer detail in the IPCC AR6 Report (Refer Attachment 3). The Vision 2020+3 includes "Impactful leadership" as a strategic focus. For this to be achieved it is essential that the Climate Policy demonstrates this leadership.
- There is no mention of renewables in either document, yet they will be essential now, while transitioning and forever.
- An internal policy/position statement should not be referencing current government policy. The documents need to advocate for what is needed in broad terms, but specific government policy should be irrelevant.
- What is the reason for changing from a Policy to a Position Statement? The original 2014 policy was good for its time and is still quite a strong document, yet none of this content has been used in the latest versions. Typically Policies are updated rather than reinvented. SENG and CEEB submitted updates to the 2014 policy document but only one sentence seems to have made it to the new documents.

While there may be many members who simply do not understand the science and so may be less willing to accept a strong policy. Leadership is about saying what needs to be said and doing what needs to be done. It is therefore vitally important that the policy should be based on science not emotion. Engaging a Climate Scientist to assist with interpreting the existing evidence and assisting in the development of a strong policy would be a prudent step in the process.

Engineering is a science based profession, and the science is clear, the time to act is now and 2050 really is too late. Engineers Australia really does have the potential to positively influence this important discussion, but the proposed documents have little to contribute in their present form.

Time is short, every day we waste is an opportunity lost, I trust that Engineers Australia will step up and develop a strong policy which has meaning and value.

This isn't just any policy, it is one relating to an issue where all our futures are at stake.

Yours sincerely

Lara Harland
FIEAust CPEng NER APEC Engineer IntPE(Aus)

2021 Chair
Environmental College

ENGINEERS AUSTRALIA

CC – Environmental College Board

Attachments:

Attachment 1 – Position Climate Change CEEB Comments

Attachment 2 – Position Climate Change, Supporting Information CEEB Comments

Attachment 3 – IPCC AR6 Carbon Budget Calculations

Attachment 1
Position on Climate Change CEEB Comments

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Position on Climate Change

Draft for board endorsement

August 2021

Engineers Australia
11 National Circuit, Barton ACT 2600
Tel: 02 6270 6555
Email: publicaffairs@engineersaustralia.org.au

www.engineersaustralia.org.au

Our climate change position

The engineering profession has played, and will continue to play, a positive and proactive role in meeting the profound challenges to humanity posed by climate change. The profession is unequivocal in recognising the scale and increasing urgency of action required, and is responding with tangible and effective measures to mitigate and adapt to the changing climate. This reflectsengineers' practical, evidence-driven approach to problem-solving, as well as their expert understanding of risk, and ethical responsibilities to safeguard communities and the natural world. An effective response to climate change will require engineers being 'at the table' more often - with the profession widely represented in decision-making by governments, in business, and throughout the community.

This statement updates Engineers Australia's *Climate Change Policy* (2014). It is supported by the *Position on Climate Change: Supporting Information*.

Scientific consensus

Engineers Australia accepts and is informed by the best available climate science, including the findings presented by the Intergovernmental Panel on Climate Change (IPCC). It recognises the urgent and increasing threat of climate change caused by anthropogenic greenhouse gas emissions. Human-induced emissions and the destruction of carbon sinks continue to contribute to rises in observed global mean surface temperatures, and impose adverse impacts on human communities, economies and natural systems. These risks will continue to escalate as climate change intensifies. In its *Special report on the impacts of global warming of 1.5°C*, the IPCC finds that climate risk will rise as global warming approaches 1.5°C, and would increase further with additional warming to 2°C.

Global framework for action

Engineers Australia affirms the centrality of United Nations Framework Convention on Climate Change (UNFCCC), and the Paris Agreement under the UNFCCC, in directing national responses to climate change. All nations must take steps across all sectors to limit the mean global temperature increase to well below 2°C, and pursue efforts to limit warming to 1.5°C. This will require global emissions to peak as soon as possible, and reach net zero emissions (carbon neutrality) by 2050 or sooner.

Australia's role

All countries must play a proportionate role in responding to climate change. The Paris Agreement encourages developed countries to lead efforts to meet its objectives, including by providing support to developing countries. Such assistance will also assist with realisation of the United Nations Sustainable Development Goals. Engineers Australia believes it is also appropriate for high emitting countries to take the lead in climate change mitigation. As a developed country, as well as a relatively high emitter, Australia should assume a leading role in addressing climate change in the global context.

Shared responsibility

Australia's responsibility to address climate change is shared by all governments, the private sector, civil society and individuals. Climate change gives rise to opportunities as well as challenges requiring a multi-sectoral and multi-disciplinary approach, and a contribution from all stakeholders.

The Commonwealth must play a key role, due both to its unique, pervasive community influence, as well as its formal responsibilities under the UNFCCC. Engineers Australia calls on the Australian Government to adopt highly ambitious emissions reduction pledges - including through the Paris Agreement's Nationally Determined Contribution system - and to coordinate a comprehensive national emissions reduction strategy. It advocates that the Commonwealth pursues measures to facilitate large-scale investment in climate solutions, including establishing an economy-wide carbon pricing mechanism.

The role of engineers

Engineers have an important and dynamic role to play in responding climate change. This reflects not only engineers' capabilities, but the moral and ethical responsibilities that guide the profession. The profession's diverse technical contributions are critical to meeting the climate challenge. However, Engineers Australia believes that addressing climate change requires engineers' contribution to extend beyond technical matters alone. Engineers must be at the table in a holistic sense: that is, the profession must be widely represented and consulted in all aspects of decision-making concerning climate change.

Climate change is in key respects a technical engineering challenge, and engineers in every sector have already made important contributions to meeting that challenge. The profession continues to design, build, and manage our most innovative and effective low emissions solutions. Achieving net zero emissions will ~~rely further on engineers to realise experimental and speculative technologies~~ require innovative solutions. So too are engineers' technical inputs crucial to adaptation and resilience.

Comment [LH1]: In their current form, the documents give too much credit to engineers and other stakeholders for their climate action taken to date and fails to highlight the fact that, if engineers and other stakeholders continue doing what they've been doing for the past decade, we will be unable to achieve 2050 net zero, let alone 2030 net zero.
The documents fall short of highlighting a critical finding of AR6: that the quantity **and** rate of decarbonisation moving forward matters – we need to reduce our emissions by a lot, quickly, in order to achieve the best temperature scenario outcomes highlighted by the IPCC which only have a 50% chance of success.
Without being too critical of past activity, the policies should highlight that a step-function change in climate action is required across the engineering profession, government and private industry is required to even come close to 2050, let alone 2030.

Comment [LH2]: The challenges are not only to humanity but to environment (rising water levels), ecosystem loss and natural resources (water etc)

Comment [LH3]: This is referencing the 2018 report, the recent IPCC AR6 report should be used.

Comment [LH4]: Table SPM 2 of IPCC SR6 indicates that for an 83% chance of meeting 1.5 degrees, we have a carbon budget of 300Gt, assuming a linear reduction in emissions this gives us until 2036 to achieve net zero emissions.

The 2050 timeframe for SPP1-1.9 is based on a 50% probability of success and includes the requirement for negative emissions after 2050.

Compare this 1 in 2 or 1 in 6 with engineering standards of 1 in 10,000.

If EA advocated for a structural standard where a bridge has a 50% or even 17% chance of falling down it wouldn't have any credibility, so why advocate for a position which has a 50% chance of success when a livable planet is at stake.

Comment [LH5]: On a per capita basis we are in the top 10 countries, so relatively high is a bit weak, and this is repeated in the supporting documentation.

Comment [LH6]: Must show leadership

Comment [LH7]: I think you need to acknowledge that engineering work has significant impacts across the natural environment and on society

Engineers play a key role in shaping and managing the built and natural environments; the profession drives initiatives that promote sustainability, productivity, and resiliency in the changing climate.

Engineers Australia calls on all engineers to strengthen these efforts by incorporating climate change-related considerations into all their technical work. Engineers should assess and advise on the suitability and longevity of their designs and projects in light of the changing climate. The profession should also maintain an awareness of contemporary climate science and contribute to the refinement of engineering knowledge and practices reflecting this knowledge. Likewise, engineers should undertake sustained continuing professional development to ensure they are familiar with current and emerging technologies and materials, as well as evolving methods and standards.

As critical as these contributions are, the profession's role in meeting the climate challenge extends beyond technical insight. The profession's approach is inherently risk-based so engineering methods and approaches can be useful beyond technical boundaries. The UNFCCC adopts the precautionary principle because the dynamics of climate change are non-linear and multi-dimensional – and so require thorough, prudent consideration of risk for proposed responses. Thus, as the impacts of the changing climate increase, the profession's risk management skills are increasingly valuable in shaping responses.

The engineering problem-solving mindset is also well-suited to engaging with climate change-related matters. Informed by data and the best available science, engineers devise practical measures to meet the real needs of a given situation. This pragmatic approach allows the profession to navigate and work productively in what is often a fractious space.

Furthermore, engineers are compelled to bring an acute sense of social and environmental responsibility to their work. The Engineers Australia's Code of Ethics[1] reminds and requires engineers to practice engineering to foster the health, safety and wellbeing of the community and the environment, and to balance the needs of the present with those of future generations. In relation to climate change, this suggests a responsibility to support and contribute to transformative change. It is important and humbling to acknowledge that in the past, engineers' actions have in part, contributed to the exacerbation of climate change; and to recognize that past engineering actions considered acceptable or appropriate may no longer be tenable or consistent with climate responsive actions or the Code of Ethics.

Engineers have made a valuable contribution to responding to climate change in their day-to-day work, and will continue to do so. But the required response to climate change requires the engineering approach to permeate beyond the profession itself, to guide and inform approaches and policies addressing climate change more broadly. Increasing engineers' representation in policy consultations, minister-level advisory panels, private sector decision-making and community initiatives will assist with addressing the challenges and realising the opportunities presented by climate change.

This outlook is consistent with the role that engineers have always played in shaping society for the better. From infrastructure to electronics - engineering drives healthier, more sustainable, prosperous and secure communities. Amidst the scale and urgency of the climate challenge, the profession, in collaboration with stakeholders from across the community, continues to pursue these same ends.

Playing our part

Engineers Australia will need to ~~play~~ a progressive, positive and collaborative role in addressing and responding to climate change. We are committed as an organisation to achieving carbon neutrality. We will also enhance the capacity of our members to practice climate-friendly engineering through training and education initiatives, standards and tools, as well as through ourglobally benchmarked professional accreditation processes.

Positions and recommendations

Engineers Australia supports the following positions:

1) The work of the IPCC is accepted as reflecting the best available science, and Engineers Australia's outlook on climate change is informed by its past, present and future findings.

2) The scale of mitigation, adaptation and resilience action required exceeds the capacity of any one sector to realise alone. Action within the private sector will be particularly important. Governments also have an important and complementary role to play through leadership and policymaking to foster investment and innovation.

3) The engineering profession plays a crucial role in developing and implementing reliable and cost-effective ~~low-~~emission reduction ~~s~~technologies, and in informing systems and policies that rely on these technologies. Engineers should be represented in policy consultations, ministerial-level advisory panels, private sector decision-making and community initiatives.

4) Engineers have an obligation to incorporate climate change considerations into their work, and to ensure currency of knowledge and practice in relation to climate science and related policies, technologies, methods and standards.

Comment [LH8]: Warming world

Comment [LH9]: If we adopt the precautionary principle 2050 is way too late.

Comment [LH10]: Strives for' would be better than 'drives' for the reasons given in the next comment; engineering has historically & in part, contributed to the existing blow-out in emissions and climate warming activities, despite being undertaken for positive reasons at the time

Comment [LH11]: I don't think it is at the moment, it is actually one of the leading causes of the destruction of the environment and GHG emissions. Engineering can only drive healthier more sustainable societies etc given the will

Comment [LH12]: •IEA report IEA (2021), Net Zero by 2050, IEA, Paris https://www.iea.org/reports/net-zero-by-2050 calls for no new fossil fuel projects. The policy should embody this, plus the cessation of government funding for fossil fuels as well as clearly condemning the Gas Led Recovery.

Comment [LH13]: It isn't the best available science it is watered down science to appease 195 member countries and most of the document projections are based on a 50% chance of success . Talk to some of the leading Australian climate scientists such as Will Steffen, Andy Pittman, Mark Howden etc, to determine the best available science.

[1] Engineers Australia, *Code of Ethics and Guidelines on Professional Conduct*, 2019. Available at https://www.engineersaustralia.org.au/sites/default/files/resource-files/2020-02/828145%20Code%20of%20Ethics%202020%20D.pdf. Accessed 18 August 2022.

5) The recommendations of the Task Force on Climate-related Disclosures (TCFD) and its risk management practices are supported.

6) Engineers Australia is committed to achieving net zero emissions as an organisation in the near future.

7) Engineers Australia is committed to contributing to Australia's climate dialogue and processes in a progressive, positive and collaborative manner, and to supporting our members to practice climate-friendly engineering.

Engineers Australia advocates that the Australian Government:

8) Submit highly ambitious Nationally Determined Contributions (NDCs) under the Paris Agreement – both in relation to emissions reductions to 2030 and thereafter.

9) Commit to achieving net zero emissions by 2035 and no later than 2050 ~~or sooner~~.

10) Coordinate national mitigations policy and actions to achieve outcomes consistent with Australia's Paris Agreement obligations in a cost-effective and pragmatic manner.

11) Establish an economy-wide, legally binding emissions pricing mechanism, to facilitate least-cost emissions abatement and a healthy system of investment and innovation.

12) Implement measures which complement and enhance efforts in the private sector and civil society to mitigate, adapt to and become resilient to current and future impacts of climate change.

13) Support a 'just transition' for disrupted communities as Australia's ~~economy~~ diversifies and transitions to a net zeroemission economy~~s~~.

14) Support and coordinate a national climate adaptation and resilience blueprint - identifying needs and opportunities now and into the future.

15) Collaborate with the engineering profession to ensure engineering standards, specifications and guidelines are appropriate for current and anticipated climate scenarios, and support climate positive outcomes.

Comment [LH14]: This I vague, why not choose 2022, even if you don't meet it, at least it is a target to aim for and the difference could be met with offsets.


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Attachment 2 -
Position on Climate Change, Supporting Information
CEEB Comments

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Position on Climate Change – supporting information

Draft for board endorsement

August 2021

Engineers Australia
11 National Circuit, Barton ACT 2600
Tel: 02 6270 6555
Email: publicaffairs@engineersaustralia.org.au

www.engineersaustralia.org.au

Our climate change position - supporting information

1. Overview

Climate change is a pervasive threat to human society and the natural world. Urgent action is necessary to limit atmospheric greenhouse gas emissions to a level that avoids dangerous impacts of climate change, and allows communities and ecosystems to adapt to and become more resilient to its effects.

Governments are obligated to implement sufficient and appropriate measures in accordance with the United Nations Framework Convention on Climate Change (UNFCCC), including the objectives of the Paris Agreement made under the UNFCCC.

It is clear that meeting the climate challenge far exceeds the capacities of any one sector to effect unilaterally. Collective action by governments, the private sector, civil society and individuals is required to achieve global carbon neutrality in atimely and efficient manner. Achieving the required emission reduction will require a dramatic reset of assumptions about the pace of change, the type of actions needed and the economic disruption that will inevitably result.

Comment [LH1]: The need for private sector action doesn't come through very strongly in the documents

1.1 A scientific reality

Comment [LH2]: This section does not convey any real sense of urgency.

Engineers Australia accepts the findings presented by the Intergovernmental Panel on Climate Change (IPCC), re-affirming the reality of climate change caused by anthropogenic greenhouse gas emissions.[1] Human-induced warming and the destruction of carbon sinks continue to drive an increase in global temperatures and impose dynamic, non-linear and potentially irreversible changes to natural systems. The global average surface temperature is now estimated to be 1.1°C higher than the pre-industrial level. The temperate increase on the Australian mainland is around 1.4°C[2].

These impacts pose highly significant risks to all communities, economies and ecosystems, the threat rapidly increasing. Climate risk will continue to rise as global warming approaches 1.5°C, and would increase further with additional warming to 2°C.[3]

Comment [LH3]: There should be a time-frame on this, "rapidly increasing, how rapid??

A number of 'tipping points' in the global climate system may give rise to accelerated climate change if they are reached. There is also substantial inertia in changing temperatures and climate, making further climate change inevitable. In Australia, hot days are likely to become hotter and more frequent, incidences of severe rainfall will increase, and southern regions will spend more time in drought – resulting in harsher fire weather (among other impacts).[4]

1.2 Global framework for action

The scale of climate change and the magnitude of associated risks will depend on limiting emissions and stabilising atmospheric greenhouse gas concentrations at a level that avoids dangerous impacts. The overarching objective of the UNFCCC is to stabilise greenhouse gases at this level. Engineers Australia supports this objective.

Engineers Australia also unequivocally affirms the centrality of the Paris Agreement in guiding national responses to climate change under the UNFCCC. All nations must take steps across all sectors to limit the global temperature increase to well below 2°C, and pursue efforts to limit warming to 1.5°C.

Comment [LH4]: By adopting the 2050 target you are acknowledging that a 50% chance of success is acceptable to Engineers Australia.

The Paris Agreement requires global emissions to peak as soon as possible, and for emissions to reach a state of balance

[1] See in particular, IPCC, *Sixth Assessment Report Working Group I – The Physical Science basis: Summary for policymakers*. Available at https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf. Accessed 18 August 2021.
[2] IPCC, *Sixth Assessment Report Working Group I – The Physical Science basis: Regional fact sheet - Australasia*, 2021. Available at https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Australasia.pdf. Accessed 18 August 2021; United Nations Environment Programme, *Facts about the climate emergency*, 2021. Available at: https://www.unep.org/explore-topics/climate-change/facts-about-climate-emergency. Accessed 2 August 2021
[3] IPCC, *Special report: Global warming of 1.5°C*. Available at https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf. Accessed 18 August 2021.
[4] IPCC, *Sixth Assessment Report Working Group I – The Physical Science basis: Regional fact sheet - Australasia*, 2021. Available at https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Australasia.pdf. Accessed 18 August

2021; CSIRO, *Climate change information for Australia*, 2018. Available at: https://www.csiro.au/en/Research/OandA/Areas/Oceans-and-climate/Climate-change-information. Accessed 2 August 2021.

with removal of greenhouse gases (net zero emissions) by mid-century at the latest. The IPCC considers the world may only have between one to three decades before the global carbon budget is exhausted, at current global annual emissions, under both a 1.5°C and a 2°C warming scenario. To achieve the Paris Agreement's objectives, governments must facilitate ambitious emissions reductions, now and over the coming decades.

1.3 Australia's role

An appropriate, sufficiently comprehensive response to climate change is one in which all countries to play a proportionate role. The Paris Agreement encourages developed countries to lead efforts to meet its objectives, and to support developing countries to enhance their capacities to commit to and meet more ambitious pledges. It is therefore incumbent on higher-emitting developed countries, including Australia, to play an ambitious role in reducing their own emissions, and support developing nations in their mitigation efforts.

Engineers Australia also believes it is appropriate that high emitting countries take the lead in responding to climate change. In absolute terms, Australia is the sixteenth-highest emitting country globally.[5] It is also the eighth highest emitter on a per capita basis.[6] Australia's status as a relatively high emitter underscores its ethical obligation to play a leading role in the global emissions mitigation and adaptation effort.

1.4 The role of government

The responsibility to address climate change is shared by all governments, the private sector, civil society and individuals across Australia. The Australian Government plays a key role, due to its scale of influence across all sectors through public policy, as well as its central contribution to the policy discourse. The Commonwealth also has formal obligations as a party to the UNFCCC and Paris Agreement; Because these treaties have been ratified, the Australian Government is both empowered and obligated to pursue the objectives of these agreements. As the ultimate representative body of all Australians, the Government is morally obligated to seek intergenerational equity for all of Australia's peoples by virtue of its supreme role in determining national policy and lead a sustainable future.

2. Mitigation

Engineers Australia supports the following actions to facilitate an orderly and predictable transformation towards cost-effective and scalable responses to climate change in all sectors of the economy, in a manner consistent with Australia's international obligations.

2.1 Nationally Determined Contribution

Engineers Australia believes it is in Australia's national interest for it to adopt a global leadership role in meeting the objectives of the Paris Agreement. This will ensure Australia plays a proportionate role in addressing climate change, and help deliver on Australia's international obligations. It would also assist with least-cost abatement, facilitate economic opportunities, and support a healthy national innovation system (see also Section 3.1).

Engineers Australia advocates that the Australian Government submit highly ambitious Nationally Determined Contributions ('NDC'; an emissions reduction objective declared under the Paris Agreement). ~~Australia's current NDC commits the nation to achieving emissions reductions of 26% to 28% below 2005 levels by 2030. Though Australia is arguably on course to meet this target, its trajectory towards net zero emissions – an overarching objective of the Paris Agreement - is uncertain. Engineers Australia supports Australia strengthening its current NDC, as well as submitting a highly ambitious NDC for the post-2030 period.~~

2.2 Net zero target

Engineers Australia strongly supports the Australian Government setting a target for Australia to achieve net zero emissions by 2050 or sooner. The IPCC's *Special report on the impacts of global warming of 1.5°C* provides that the world's carbon budget – that is, future emissions allowable for medium to high confidence of restricting warming to 1.5°C – may be exhausted in one to three decades at current global emissions rates. Reaching net zero no later than mid-century would make Australia's decarbonisation consistent with this pathway. Likewise, it would ensure that Australia's transition is consistent with the objectives of the Paris Agreement. Domestically, a short, medium and long-term targets should also provide an important

Comment [LH5]: Agreed, but shouldn't we also be advocating for Australia to show some leadership

Comment [LH6]: What about a duty of care to our emerging and future generations???

Comment [LH7]: Like the add says " You don't have to be amazing to start but you need to start to be amazing". Same with emssions - "you don't need to know how to get there but you need to set the target to have any chance of achieving it"

Comment [LH8]: This is too late, and sooner does not convey any sense of urgency (see comments in position statement)

Comment [LH9]: As per comment 2 in position statement the IPCC AR6 report says we have an 83% of limiting to 1.5 degrees and have until 2036 from 2020 to do it (assuming a linear reduction in emissions, (which involves significant change)

Comment [LH10]: No it doesn't - The net zero projections in IPPC AR6 are based on a 50% chance of success, as engineers this is unacceptable.

impetus and referencefor national emissions reduction efforts, and a means of assessing progress.

[5] The World Bank, *CO2 emissions (KT)*, 2021. Available at https://data.worldbank.org/indicator/EN.ATM.CO2E.KT. Accessed 2 August 2021.
[6] The World Bank, *CO2 emissions (metric tons per capita)*, 2021. Available at https://data.worldbank.org/indicator/EN.ATM.CO2E.PC. Accessed 2 August 2021.

Engineers Australia acknowledges and supports the ambitious emissions mitigation targets adopted by Australian states and territories by way of legislation[7] or as a policy aspiration[8]. We nonetheless believe a national target is necessary to ensure the objective is realised and achieved in an optimal manner.

~~Regardless of the target date nominated,~~ it is imperative that Australia's net zero emissions target does not serve as an end in itself. Rather, it must facilitate prompt and tangible action towards the realisation of a carbon neutral state to be sustained indefinitely. Policy pathways that delay action and rely on deeper and more rapid reductions at a later date are very likely to result in higher cumulative emissions and economic costs of transition, as well as abrupt social disruption.

Comment [LH11]: 2045 & 2050 are too late (see reference 7), see our earlier comments

Comment [LH12]: To achieve the required cuts, deep and rapid reductions are needed now. COVID 19 has shown us it can be done, if there is a will.

2.3 National mitigation strategy

Engineers Australia supports progressive and effective leadership from the Australian Government on climate change action. A national climate change mitigation strategy, informed by Australia's emissions reduction targets, would support the coordination of policy settings to realise cost-effective, progressive emissions reductions at the Commonwealth and state and territory levels.

The national strategy should encourage all sectors to contribute in an equitable manner to Australia's transformation to net zero emissions. The strategy should also be developed and supported on a multi-partisan basis, and with intent for sustained implementation to minimise uncertainty as to future policy settings.

~~We note that that the Australian Government and energy markets support the use of gas for domestic power, hydrogen production, and export. To align with Australia's transition to a net zero emissions economy, carbon intensive energy sources such as gas need to be mitigated through engineering solutions like carbon capture and storage - both to ensure compatibility with emissions reduction objectives, and to secure a social licence to operate.~~

Comment [LH13]: This is political statement and should not be included. It also implies indirect support for such policies. I also disagree that energy markets support a gas led recovery (where did this come from?). The document should clearly state that continued investment in fossil fuels such as gas will not achieve the emission reductions required.

2.4 Investment

Engineers possess an intimate understanding of the function, benefits and limitations of low emissions technologies and systems. There is no single panacea or 'silver bullet' to achieving the scale of mitigation required within the timeframe afforded by the scientific evidence and Australia's international obligations.

Large-scale and wide-ranging investment in innovation supporting mitigation (as well as adaptation and resilience) across all sectors is thus necessary. The International Energy Agency (IEA) projects that, to limit global warming to 1.5°C, annual global energy investment may need to increase by 150% by 2030, to around US$5 trillion. This implies substantial capital flows to technologies which currently attract little investment.[9] The IPCC's findings in its Working Group I Sixth Assessment Report ('*Climate Change 2021: The Physical Science Basis*') further underscore the significance of the financial sector in shaping mitigation through the allocation of capital. Investor-led climate responses, including transparent climate-related financial disclosures, will increasingly determine whether low emissions technologies and systems have access to affordable capital, as well as the ability to underwrite climate-related risks. While there is an important role for public sector interventions, these should incentivise and or compel the private sector to invest, innovate and deploy in appropriate solutions, rather than crowd it out.

Comment [LH14]: This section is not clear in its intent. Definitive statements need to be made such as:
-calling for the cessation of government funding for fossil fuels
-If this section is referring to the present existence of a large and potentially long-lived natural gas industry serving domestic and export markets, then it is imperative it is made clear that significant actions need to be taken to mitigate and/or neutralize the carbon footprint of this industry, ultimately working towards quickly phasing out as renewables completely replace it.

Engineers Australia considers that an economy-wide, legally binding mechanism to price emissions would be the most effective and efficient mechanism of facilitating investment and deployment in mitigation technologies and applications, particularly in hard-to-abate sectors. Emissions pricing can also incentivise Australian innovation in the design, production, and deployment of low-carbon engineering, and help us grasp economic opportunities associated with decarbonisation (see also Section 3.1). Such a measure should be made a core component of Australia's emissions mitigation strategy.

Irrespective of the specific measures adopted, a comprehensive and stable emissions reduction policy platform is necessary to foster the certainty needed to catalyse further investment.

Engineers Australia also emphasises the increasingly important economic role of engineers - informing the financial sector and policymakers on the engineering implications of their climate-related financial decisions, and positively influencing climate-friendly investments.

Comment [LH15]: This is a reactive statement, leadership would imply that we lead the financial sector based on engineering studies which determine the most robust cost effective solutions.

[7] Victoria by 2050, ACT by 2045
[8] QLD, NSW, SA, WA, NT and Tasmania, by 2050
[9] International Energy Agency, *Net zero by 2050: A roadmap for the global energy sector*, 2021, p. 82. Available at https://iea.blob.core.windows.net/assets/0716bb9a-6138-4918-8023-cb24caa47794/NetZeroby2050-ARoadmapfortheGlobalEnergySector.pdf. Accessed 2 August 2021.

3. Opportunity and cost

3.1 Prosperity in tomorrow's economy

Engineers Australia believes Australia's transition to net zero emissions will deliver a net benefit for the community. There is substantial opportunity in a future carbon neutral economy - both nationally and globally - through the development, deployment, application and export of low emissions technologies and their associated industries. It is in Australia's national interest to pursue the realisation of these opportunities.

Comment [LH16]: This needs to be stronger in that a transition to net zero emissions is essential for a prosperous community. There is no mention of the cost of inaction.

Our nation possesses or can develop global comparative advantage in many emerging industries. Australia's low population density, geography, and climate makes it well-placed to continue to innovate and deploy solar and wind energy at grid-parity prices (and lower), and at scale. We are also well positioned to roll out large scale, low cost hydroelectric and geothermal energy, as well as utility scale energy storage. Furthermore, Australia enjoys large deposits of minerals which are crucial inputs to support the shift to renewables, and to assist businesses to decarbonise through electrification of processes and equipment.

In addition, Engineers Australia supports Australia's transformation to a circular economy model. It believes the profession will play a pivotal role in integrating novel engineering practices, including innovative engineering designs, that further extract value beyond conventional, linear models of economic growth. This will ultimately drive more climate-friendly, sustainable and resilient supply chains by eliminating waste through continual use of resources.

There are substantial opportunities for the engineering profession associated with this economic transformation. Engineers are central to not only transforming the economy but ensuring national prosperity and preserving, if not enhancing, the living standards of all Australians, including future generations. The profession's centrality to developing tomorrow's industries underscores the need for engineers to more deeply and meaningfully participate in decision-making related to climate change.

3.2 A just transition

Comment [LH17]: Should include something about establishing a commonwealth authority to plan and lead economic transition for communities and industries currently dependent on fossil fuel mining

Engineers Australia recognises that the shift to net zero emissions will require economic structural reform resulting in disruption to some industries and communities. Some of the engineering workforce will be affected, with those currently employed in fossil fuel extraction and power generation appearing most at risk. In total, fossil fuel extraction employs 67,000 people, fossil fuel processing 4,000, and power supply 68,000.[10] The multiplier effect is also important in areas where these industries are a dominant presence.

Engineers Australia supports the concept of a just transition for communities reliant on employment in emissions-intensive industries. As mitigation policies are introduced and scaled up, a nationally coordinated transition policy should support the needs of those affected. This policy could include initiatives such as reskilling and structural adjustment assistance.

It could also encompass the development of low carbon industries and applications in regions likely to experience disruption. This may involve extending the future of traditional sectors in a more environmentally responsible manner, and developing new opportunities. In addition to supporting a just transition for affected engineers and other workers, such measures could assist with regional economic diversification.

Engineers Australia further acknowledges that the transition to net zero emissions will adversely impact communities in developing nations throughout the Indo-Pacific. These impacts will require discrete solutions. Engineers Australia calls on Australia to assist regional partners to meet these challenges through development, finance, and active participation in multilateral assistance programs.

Engineers Australia will work to better understand how the engineering profession can assist in delivering a just transition in Australia and the Indo-Pacific.

[10] Power supply employment figure inclusive of power generated by fossil fuels as well as other sources; see Australian Bureau of Statistics, *6291.0.55.001 Labour Force, Australia, Detailed: Table 06. Employed person by Industry sub-division of main job (ANZSIC) and Sex*, 2021. Available at https://www.abs.gov.au/statistics/labour/employment-and-unemployment/labour-force-australia-detailed/may-2021/6291006.xls. Accessed 2 August 2021; Engineers Australia, *The Engineers Profession – A Statistical Overview, Fourteenth Edition*, 2019, p. 66. Available at https://www.engineersaustralia.org.au/sites/default/files/resources/Public%20Affairs/2019/The%20Engineering%20Profession%2C%20A%20Statistical%20Overview%2C%2014th%20edition%20-%2020190613b.pdf. Accessed 2 August 2021.

4. Adaptation and resilience

Engineers Australia acknowledges that climate change is a present as well as a prospective reality. In Australia, extreme weather events are already more frequent and more intense.[11] Moreover, past emissions, and the inevitability of substantial further emissions before carbon neutrality is achieved, make additional climate change certain.[12] As the world continues to warm, Australia faces an acute risk of more intense and frequent rainfall, as well as more frequent drought and harsher fire weather (among other impacts). Rapid and substantial mitigation efforts will help limit the risks associated with increasing global warming. Nonetheless, engineering solutions are needed to further enable communities and businesses to adapt and enhance their resilience to the risks posed by climate change.

It is apparent that building and design codes intended for past climates are no longer be fit for purpose, or may soon reach that point. Many will require modification - for instance, to ensure engineers design for greater rainfall intensity, increased wind speed, and rising sea levels. Engineers Australia recommends that the Australian Government lead collaboration with industry, national and international standards bodies to review engineering standards, specifications and guidelines, and determine their suitability to a changing climate. This review should be conducted at regular intervals.

Comment [LH18]: Should also include the need for standard carbon calculation metrics and introducing compliance requirements in Australian Standards regarding emissions and sustainability.

Beyond maintaining standards, adaptation and resilience will require new approaches to design and maintenance – for instance, to mitigate problems associated with extreme weather and the urban heat island effect, as well as water-sensitive design. Work to ascertain and ensure the resilience of existing structures should also be conducted.

~~It is acknowledged that a range of national and multinational efforts to meet these challenges are underway. Engineers Australia notes, in particular, efforts to update the Australian Government's National Climate Resilience and Adaptation Strategy,[13] and the establishment of the National Recovery and Resilience Agency. Such efforts should help to ensure that our communities are better placed to adapt to climate-related risks.~~

5. Playing our part

Engineers Australia is committed to playing a positive role in responding to climate change. In calling for urgent emissions reduction action, we recognise that we too must decarbonise as rapidly as practicable. We further acknowledge that, as the peak national body for the engineering profession, our members and the wider profession expect support to help drive mitigation, adaptation and resilience through their own practices and organisations. Engineers Australia will support members and the profession to assist every sector of the economy and civil society to effect sustainable, ethical, affordable, accessible, safe and reliable climate solutions. Engineers Australia's approach will be objective and pragmatic - informed by the best available science and engineering practices.

Comment [LH19]: The document doesn't reflect this statement.

Comment [LH20]: From whom, government, private entities, community, EA members?

5.1 Our emissions

Engineers Australia is determined to achieve net zero emissions in the near future, and as soon as practicable. It purchases renewable energy for its properties wherever possible, as well as certified offsets generated by a non-profit engaged in native reforestation in Australia and New Zealand. Reforested areas are selected based on high confidence of a 100-year lifecycle for the forest, ensuring that fires or human activity do not cause the release of the carbon captured. These offsets account for our estimated carbon footprint from consumption of gas and electricity as well as staff air travel. They are estimated to be equivalent to a majority of our total emissions. Engineers Australia also uses LED lighting throughout its property portfolio to improve energy efficiency, and has installed rooftop solar panels at its Perth facility.

In 2021, Engineers Australia will complete a comprehensive calculation of its carbon footprint, to further inform emissions reduction strategies, policies and actions in pursuit of carbon neutrality.

Comment [LH21]: Not sure is this is needed in this document. But if it is used it should not rely on offsets.

[11] Royal Commission into National Natural Disaster Arrangements, *Report*, 2020, p. 22. Available at https://naturaldisaster.royalcommission.gov.au/system/files/2020-11/Royal%20Commission%20into%20National%20Natural%20Disaster%20Arrangements%20-%20Report%20%20%5Baccessible%5D.pdf. Accessed 18 August 2021.

[12] See Australian Department of Agriculture, Water and the Environment, *National Climate Resilience and Adaptation Strategy*, 2021. Available at https://www.environment.gov.au/climate-change/adaptation/strategy. Accessed 18 August 2021.

[13] Ibid.

5.2 Supporting the profession

Engineers Australia supports its members to effect positive climate outcomes. We recognise that climate change requires engineers to upskill and reskill; the body of knowledge is ever-expanding and evolving, and the challenges dynamic.

Engineers Australia provides a wide range of professional development, training and education offerings to Members and the profession, with climate change and related issues a priority area of focus. Our Learned Society network (our member-led and operated groups, focused on specific engineering disciplines and practice areas) is committed to supporting members' practice in a climate-friendly manner. Engineers Australia also encourages and supports engineering organisations to achieve carbon neutrality, and to improve their reporting in line with the recommendations of the Task Force on Climate-Related Financial Disclosures.[14]

[14] See Task Force on Climate-Related Financial Disclosures, *About*, 2020. Available at https://www.fsb-tcfd.org/about/. Accessed 2 August 2021.


ENGINEERS
AUSTRALIA

Attachment 3
IPCC Carbon Budget Calculations

1.5 Degree S 1.5 Degree Secnario (SSP1-1.9)

Years	Annual Emissions (Gt)	Years	Carbon Budget used (Gt)
2020-2025	40	5	200
2025-2030	34	5	170
2030-2035	24	5	120
2035-2040	18	5	90
2040-2045	10	5	50
2045-2050	5	5	25
2050-2055	2	5	10
		TOTAL	**665**

* Note the budget allows for overshoot which is why negative emissions are required post 2050, this is why the budget looks like the 33% scenario

IPCC AR6 - Box SMP1.4 - Figure SPM.4

a) Future annual emissions of CO_2 (left) and of a subset of key non-CO_2 drivers (right), across five illustrative scenarios

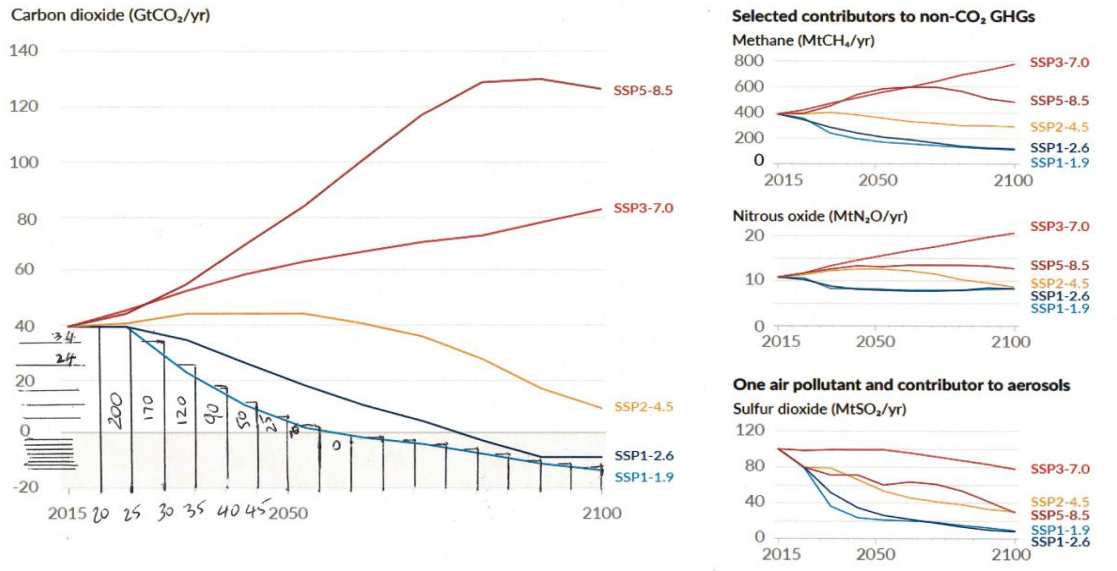

Table SPM.2: Estimates of historical CO_2 emissions and remaining carbon budgets. Estimated remaining carbon budgets are calculated from the beginning of 2020 and extend until global net zero CO_2 emissions are reached. They refer to CO_2 emissions, while accounting for the global warming effect of non-CO_2 emissions. Global warming in this table refers to human-induced global surface temperature increase, which excludes the impact of natural variability on global temperatures in individual years. {Table TS.3, Table 3.1, Table 5.1, Table 5.7, Table 5.8, 5.5.1, 5.5.2, Box 5.2}

Global warming between 1850–1900 and 2010–2019 *(°C)*	Historical cumulative CO_2 emissions from 1850 to 2019 *($GtCO_2$)*
1.07 (0.8–1.3; *likely* range)	2390 (± 240; *likely* range)

Approximate global warming relative to 1850–1900 until temperature limit *(°C)**(1)	Additional global warming relative to 2010–2019 until temperature limit *(°C)*	Estimated remaining carbon budgets from the beginning of 2020 *($GtCO_2$)* — *Likelihood of limiting global warming to temperature limit*(2)*					Variations in reductions in non-CO_2 emissions*(3)
		17%	*33%*	*50%*	*67%*	*83%*	
1.5	0.43	900	650	500	400	300	Higher or lower reductions in accompanying non-CO_2 emissions can increase or decrease the values on the left by 220 $GtCO_2$ or more
1.7	0.63	1450	1050	850	700	550	
2.0	0.93	2300	1700	1350	1150	900	

1.5 degree Annual Emission Budget

No Reduction

Scenario	Start Year	2020 emissionsGt	Gt	Years	Date
83%	2020	40	300	7.5	2027.5
50%	2020	40	500	12.5	2032.5

Linear Reduction

Scenario	Start Year	2020 emissionsGt	Gt	Years	Date
83%	2020	40	300	15	2035
50%	2020	40	500	25	2045

2 degree Annual Emission Budget

No Reduction

Scenario	Start Year	2020 emissionsGt	Gt	Years	
83%	2020	40	900	22.5	2042.5
50%	2020	40	1350	33.75	2053.75

Linear Reduction

Scenario	Start Year	2020 emissionsGt	Gt	Years	
83%	2020	40	900	45	2065
50%	2020	40	1350	67.5	2087.5

Extract IPCC AR6

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1.7	0.63	1450	1050	850	700	550	
2.0	0.93	2300	1700	1350	1150	900	

*(1) Values at each 0.1°C increment of warming are available in Tables TS.3 and 5.8.
*(2) This likelihood is based on the uncertainty in transient climate response to cumulative CO_2 emissions (TCRE) and additional Earth system feedbacks, and provides the probability that global warming will not exceed the temperature levels provided in the two left columns. Uncertainties related to historical warming (±550 $GtCO_2$) and non-CO_2 forcing and response (±220 $GtCO_2$) are partially addressed by the assessed uncertainty in TCRE, but uncertainties in recent emissions since 2015 (±20 $GtCO_2$) and the climate response after net zero CO_2 emissions are reached (±420 $GtCO_2$) are separate.
*(3) Remaining carbon budget estimates consider the warming from non-CO_2 drivers as implied by the scenarios assessed in SR1.5. The Working Group III Contribution to AR6 will assess mitigation of non-CO_2 emissions.

What is left in the global carbon budget?

ARC Centre of Excellence for Climate Extremes Briefing Note 16

- The Paris Agreement requires countries to commit to reducing their greenhouse gas emissions to ensure that the global average temperature remains well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C.
- It is too late to limit warming to 1.5°C with certainty; but, in theory, there is a chance. Achieving net zero emissions before the end of 2027 gives an 83% chance of limiting warming to 1.5°C but is almost certainly not practical[1].
- It is not too late to limit warming to 2.0°C. At current emission rates the carbon budget will be exhausted in 21 years. This implies achieving net zero emissions by around 2040 for an 83% chance of limiting warming to 2°C but a 17% risk of failing to limit warming to 2°C.
- Net zero emissions by 2050 is almost certainly too slow to limit warming to 2°C with a high degree of probability unless most of the reduction in emissions is achieved in the next decade.

Many of you will have heard that we have about 500 billion tonnes left in the global carbon budget. This is the amount of carbon dioxide humans can release into the atmosphere and still avoid 1.5°C. It is about 1350 billion tonnes to avoid 2°C of warming. These numbers come from the new report by the Intergovernmental Panel on Climate Change (IPCC)[2]. They compare with present global emissions of around 40 billion tonnes per year.

Two things keep being forgotten. First, the budget is calculated from the beginning of 2020 and so the budget at the time of writing in mid-2021 is smaller due to emissions over past 18 months, and, second, that these two numbers are the budgets that give us a 50% chance of avoiding those warming limits. At current emission rates, this means the total carbon budget will be exhausted in about 11 years for the 1.5°C limit, and roughly 32 years for the 2°C warming limit.

You may have missed a critical point here. These are the carbon budgets that give you a **50% chance**–a toss of a coin chance–of avoiding exceeding those temperature changes. Is a 50% chance of achieving the Paris agreement adequate? Remember, the Paris agreement limit of 2°C is not a 'target' or 'ambition', it is a legislated *limit* of warming and we have agreed not to exceed it.

So, how lucky do you feel? The IPCC gives the equivalent carbon budgets, as at January 2020, for an 83% chance of avoiding 1.5°C or 2°C of warming (Table 1). To avoid exceeding 1.5°C, the budget reduces to 300 billion tonnes (used up in 6 years from now at current emission rates) and the 2°C limit reduces to 900 billion tonnes (used up in 21 years from now at current emission rates).

You might feel that a 17% risk of failing to meet these targets is too high. We expect our vaccines to be safe and many people are hesitant where there is a 1 in 100,000 risk of bad side effects. We expect an even higher level of safely in our aeroplanes – a 1 in a million risk of a crash at Heathrow implies roughly one crash every four years. If we impose a limit on global warming of 2°C and accept a 1 in 100,000 risk of exceeding it, how much carbon is left to burn?

Well, it's difficult to calculate this because there are a great many uncertainties. However, first of all, the budget is lower and effectively zero for the 1.5°C limit. There may be some time left for 2°C but this requires we start deeply cutting emissions immediately.

Warming target (relative to 1850-1900)	**IPCC estimates of carbon budgets and years before the carbon budget is fully spent at current emission rates**	
	50% chance	*83% chance*
1.5°C	500 $GtCO_2$ (11 years)	300 $GtCO_2$ (6 years)
2°C	1350 $GtCO_2$ (32 years)	900 $GtCO_2$ (21 years)

Table 1: IPCC estimates of the remaining carbon budget for a given chance of limiting warming to a given warming target, as at the beginning of 2020 ($GtCO_2$) and years before the carbon budget is fully spent (from July 2021) at current emission rates.

You will hear a lot about 'net zero by 2050'. Well, if you want certainty – certainty like 'my aeroplane won't crash', or 'my vaccine is safe' - it is too late to avoid 1.5°C and **'net zero by 2050' is too late to avoid 2°C with certainty**. Our climate system is not fussed whether that is difficult or politically inconvenient. We are in this position because governments around the world did not react to the science appropriately following the release of previous IPCC reports in 1995, 2001, 2007, 2013, or even when a special report on the benefits of limiting warming to 1.5 degrees was released in 2018[3].

Perhaps 1.5°C does not sound too bad to you despite the observed increases in the intensity, frequency and magnitude of many extreme events with warming that has already occurred (1.1°C). Global warming of 1.5°C has extremely serious consequences. As was stated in 2018, pursuing 'policies that are considered to be consistent with the 1.5°C aim will not completely remove the risk of global temperatures being much higher or of some regional extremes reaching dangerous levels for ecosystems and societies over the coming decades'[4]. However, the consequences of warming nearer 1.5°C are much less damaging than those of warming of 2°C or more.

The recent IPCC report highlights many risks that are much worse at warming levels higher than 1.5°C. The negative impacts from climate extremes increase, and the risk of triggering a tipping point in the climate system increases. Tipping points are large, irreversible changes to the climate system, usually associated with catastrophic consequences. Examples include the ultimate collapse of the West Antarctic Ice Sheet, leading to multiple metres of sea-level rise, and a loss of Arctic permafrost, leading to massive releases of methane into the atmosphere and accelerated global warming. The precise amount of warming required to trigger tipping points is highly uncertain and the risk of triggering some tipping points may be mitigated if the temperature of the globe exceeds 1.5°C for only a short period of time[5]. However, recent research suggests that tipping points associated with irreversible loss of ice from the West Antarctic Ice Sheet, loss of summer sea ice in the Arctic and the destruction of coral reef ecosystems, including the Great Barrier Reef, could be triggered with warming of around 1.5°C to 2°C above the preindustrial temperature.

Andy Pitman and Ian Macadam, 17th August 2021

References

1 - Can we limit global warming to 1.5°C? ARC Centre of Excellence for Climate Extremes Briefing Note 15. https://climateextremes.org.au/briefing-note-15-can-we-limit-global-warming-to-1-5c/

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5 - Ritchie et al. (2021). Overshooting tipping point thresholds in a changing climate. Nature. https://doi.org/10.1038/s41586-021-03263-2

Contacts

ARC Centre of Excellence for Climate Extremes science contact:
Prof Andy Pitman, UNSW Sydney
a.pitman@unsw.edu.au

ARC Centre of Excellence for Climate Extremes knowledge broker:
Dr Ian Macadam, UNSW Sydney
i.macadam@unsw.edu.au

UNSW SYDNEY · MONASH University · THE UNIVERSITY OF MELBOURNE · Australian National University · UNIVERSITY of TASMANIA

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Contacts

ARC Centre of Excellence for Climate Extremes science contact:
Prof Andy Pitman, UNSW Sydney
a.pitman@unsw.edu.au

ARC Centre of Excellence for Climate Extremes knowledge broker:
Dr Ian Macadam, UNSW Sydney
i.macadam@unsw.edu.au

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