Climate Resource

Comparison between Australia's 2030 and 2050 emission reduction targets and 1.5°C pathways

Briefing

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Dr. Z. Nicholls, A/Prof. M. Meinshausen

About the authors

A/Prof. Malte Meinshausen is a Lead Author of the Working Group 1 (the physical science) of the IPCC's Sixth Assessment Report (AR6), an author of the IPCC AR6 Assessment Report Synthesis Report (due to be released in September 2022) and has long-standing international expertise on carbon budgets, the Paris Agreement and national and subnational emission targets.

Dr. Zebedee Nicholls was a Contributing Author to 5 chapters in Working Group 1 of AR6 and was closely involved in the preparation of the carbon budget numbers. Dr. Zebedee Nicholls is also providing temperature assessments of thousands of emission scenarios to Working Group III (mitigation of climate change) of the IPCC, providing a link to the latest science on emissions reductions pathways and their warming implications.

Image: M. Meinshausen
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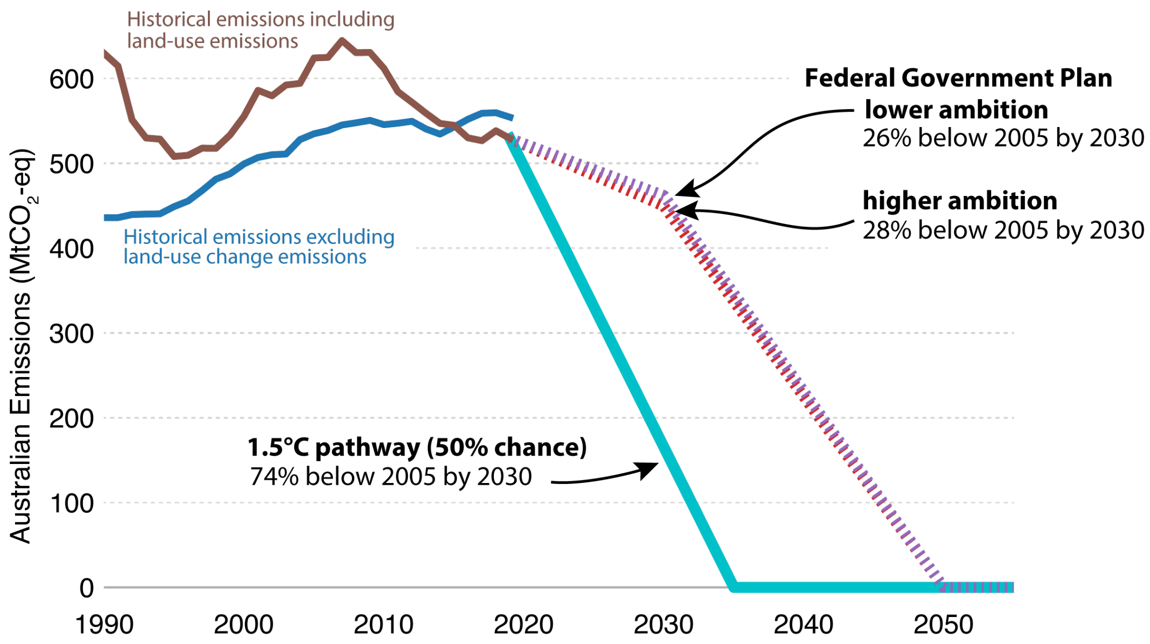
SUMMARY

The Federal Government's longer term emissions reduction strategy leads to cumulative emissions of 9.6 $GtCO_2$-eq[1] between 2020 and net zero, more than double Australia's emissions budget for a 50% chance of staying below 1.5°C of 4.0 $GtCO_2$-eq. For Australia to meet its obligations to pursue efforts to limit warming to 1.5°C, a 2030 reduction of 74% relative to 2005 emissions, and net zero by 2035 is consistent with a 50% chance of staying below 1.5°C.



[1] Emissions in this report are provided in gigatonnes of CO_2 equivalent ($GtCO_2$-eq) and megatonnes of CO_2 equivalent ($MtCO_2$-eq) as is appropriate for the context. One gigaton is one thousand megatonnes, also equal to one billion tonnes. One megaton is one million tonnes. CO_2 equivalent emissions are emissions which have been converted to their equivalent amount of CO_2 emissions (rather than being reported in their native units e.g., megatonnes of methane).

1. THE IMPORTANCE OF 1.5°C

Climate change is a global challenge, with ongoing warming leading to greater impacts and risks for humanity. With high confidence, the IPCC's Special Report on 1.5°C (SR1.5)[2] concluded that, "Climate-related risks for natural and human systems are higher for global warming of 1.5°C than at present, but lower than at 2°C". The difference between 1.5°C and 2°C is stark for coral reefs: declines of 70-90% are expected at 1.5°C of warming and declines of more than 99% are expected at 2°C of warming. More recent literature suggests that things could be even worse than in SR1.5, with even 1.5°C of warming being incompatible with saving most of the world's coral reefs[3].

2. KEY RESULTS

- **Australia's current 2030 target is out of line with the latest climate science:** the Federal Government's 2030 target of reducing emissions by 26-28% relative to 2005 emissions levels, and plan to reach net-zero by 2050 are insufficient to meet Australia's obligations to pursue efforts to limit warming to 1.5°C[4].
- **Pathways for 1.5°C.** For a 50% chance of limiting warming to 1.5°C, a 2030 emissions reduction target of 74% (compared to 2005 emissions levels) and net zero by 2035 is consistent with the latest climate science[5], based on previously used approaches to determining Australia's share of global carbon budgets[6]. For a greater than 50% chance of limiting warming to 1.5°C, reductions even stronger than those presented here are required.
- **Arguably, faster emissions reductions are required for Australia to contribute its fair share and meet its obligations under the Paris Agreement.** The required emissions reductions given above are calculated based on Australia's fair share of global emissions being 0.97% (from 2013 to 2050)[7]. Recent analysis[8] shows that such a share is high given Australia's high GDP. A 0.97% share also means that Australia receives a higher per capita share than other nations (Australia's share would be 0.33% if all countries received the same emissions per capita). Allocating a smaller share to Australia would require faster emissions reductions,

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2 https://www.ipcc.ch/sr15/chapter/spm/

3 https://doi.org/10.1371/journal.pclm.0000004

4 https://www.industry.gov.au/sites/default/files/October%202021/document/the-plan-to-deliver-net-zero-the-australian-way.pdf

5 https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_05.pdf

6 https://www.climatechangeauthority.gov.au/sites/default/files/2020-06/Target-Progress-Review/Targets%20and%20Progress%20Review%20Final%20Report.pdf

7 https://www.climatechangeauthority.gov.au/sites/default/files/2020-06/Target-Progress-Review/Targets%20and%20Progress%20Review%20Final%20Report.pdf

8 https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0016/421702/Greenhouse-Gas-Emissions-Budgets-for-Victoria.pdf

increasing the inconsistency between the Federal Government's 2030 targets and Long Term Emissions Reduction Plan and 1.5°C compatible pathways.

- **The Federal Government's longer term emissions reduction strategy exceeds Australia's emissions budget.** The Federal Government's plan leads to cumulative emissions of 9.6 $GtCO_2$-eq between 2020 and net zero, more than double Australia's emissions budget for a 50% chance of staying below 1.5°C of 4.0 $GtCO_2$-eq. We also note that the Federal Government's Plan describes no specific way to mitigate at least 15% of Australia's 2005 level emissions, stating that achieving these reductions will depend on further technology breakthroughs[9].
- **The 2030 target must be strengthened, the net zero year brought forward, or both, for Australia to meet its obligations under the Paris Agreement, given the science.** Leaving the 2030 target unchanged requires the net zero year to be greatly brought forward, given that Australia has a limited emissions budget. The earlier net zero year increases the burden on future generations to make much more rapid emissions reductions than this generation[10].
- **Updated science since the Climate Targets Panel report** The latest IPCC global carbon budgets are slightly larger, while our estimate of the temperature rise between 1750 (pre-industrial) and 1850-1900 (early pre-industrial) has also increased. The net effect of these two major changes is almost zero, leading to emissions reductions targets for 1.5°C that are very similar to those presented by the Climate Targets Panel[11].

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[9] https://www.industry.gov.au/sites/default/files/October%202021/document/australias-long-term-emissions-reduction-plan.pdf

[10] https://www.climatecollege.unimelb.edu.au/files/site1/docs/%5Bmi7%3Ami7uid%5D/Climate%20Targets%20Panel%20Report%20-%20March%202021.pdf

[11] https://www.climatecollege.unimelb.edu.au/files/site1/docs/%5Bmi7%3Ami7uid%5D/ClimateTargetsPanelReport.pdf

3. Further details

The Federal Government's target is for a 2030 emissions reduction of 26-28% relative to 2005 levels (~624 $MtCO_2$-eq / yr) and it has announced its plan to reach net zero by 2050. Assuming a linear decline to net zero, this pathway exceeds Australia's emissions budget (Table 1) and is well short of the 74% reduction required for a 50% chance of staying below 1.5°C.

Table 1 Emissions budgets (also known as cumulative greenhouse gas emissions), 2030 reductions and net zero years under different emissions pathways for Australia.

Pathway	Emissions budget from 1st Jan 2020 ($GtCO_2$-eq)	2030 reduction (relative to 2005)	Net zero year
1.5°C (50% chance)	4.0	74%	2035
Federal Government, The Plan (higher ambition)	9.6	28%	2050
Federal Government, The Plan (lower ambition)	9.8	26%	2050

In the summary figure, we show total historical emissions and historical emissions excluding land-use change emissions. We do this to highlight that Australia's total emissions are dropping, but only because land-use change emissions are dropping (and have become negative in the last few reported years, which is why the brown total line sits below the blue, where the blue line indicates everything except land-use change over this period). Excluding the highly uncertain land-use sector, Australia's emissions are rising and have increased since 2005. For an interactive examination of Australia's sectoral emissions, see https://opennem.org.au/emissions/au/.

The results given here are subject to a number of assumptions and caveats. We follow the methodology of Meinshausen et al.[12], with the addition of a step to account for results from Grassi et al.[13]. As a result, we briefly describe the assumptions and caveats here, for full details refer to Meinshausen et al.[14].

Firstly, there is uncertainty in the remaining carbon budget. Secondly, while the concept of a carbon budget strictly applies to CO_2 only, here we use a correlation between CO_2 and greenhouse gas emissions found in cost-optimal scenarios to convert IPCC carbon budgets into all greenhouse gas

12 https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0016/421702/Greenhouse-Gas-Emissions-Budgets-for-Victoria.pdf

13 https://doi.org/10.1038/s41558-021-01033-6

14 https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0016/421702/Greenhouse-Gas-Emissions-Budgets-for-Victoria.pdf

emissions budgets. As discussed in Meinshausen et al.[15], the correlation is appropriate for assessing peak warming, transparent, simple to apply and is built on the wide range of emission reduction options explored in the cost-optimal scenarios considered by the IPCC. The correlation comes with an uncertainty of +/- 100 $GtCO_2$-eq (compared to a total, global greenhouse gas budget of approximately 800 $GtCO_2$-eq for a 50% chance of 1.5C), although variations within this uncertainty don't change the broad conclusions of the analysis presented above. Thirdly, we also account for a difference in land-use emissions accounting methodologies between country-reported emissions and international modelling exercises based on Grassi et al.[16], ensuring that the targets presented are compatible with emissions as reported by the Australian government. Fourthly, we further assume that Australia's 0.97% share of the global carbon budget for 2013 to 2050 equally applies to carbon budgets from 2013 to net zero, as most cost-optimal 1.5°C scenarios reach net zero around 2050. Finally, for global historical emissions we use Nicholls et al.[17](based on Gidden et al.[18]), assuming that emissions from 2015 - 2019 follow the SSP2-4.5 scenario. For Australian emissions we use Australian Government emissions as reported to the UNFCCC[19]. Even with an optimistic reading of the uncertainty range in the remaining carbon budget, and different reasonable assumptions on these points, the Federal Government target is short of what is required for Australia to be regarded as pursuing efforts to limit warming to 1.5°C.

[15] https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0016/421702/Greenhouse-Gas-Emissions-Budgets-for-Victoria.pdf
[16] https://doi.org/10.1038/s41558-021-01033-6
[17] https://doi.org/10.5194/gmd-13-5175-2020
[18] https://doi.org/10.5194/gmd-12-1443-2019
[19] https://www.industry.gov.au/data-and-publications/national-greenhouse-accounts-2019

4. Appendix: Calculation of Australia's fair share emissions budget

This appendix outlines the steps applied to calculate Australia's fair share of the global remaining emissions budget from 2020.

We note that results are rounded as appropriate. As a result, small differences in sums and products may occur. Greater precision than shown is carried in the actual calculations so where there is a conflict, the final numbers (right-hand columns) take precedence.

4.1. Global remaining carbon budget

Converting global remaining carbon budget from 2020 for temperatures relative to 1850-1900 into a global remaining carbon budget from 2013 for temperatures relative to pre-industrial.

Temperature level and likelihood of staying below	Global remaining carbon budget from 2020 (GtCO2)	Enlarging budget to account for global emissions between 2013 and 2020 (GtCO2)	Reducing the carbon budget to make it relative to true pre-industrial (1750) , rather than early pre-industrial (1850-1900, GtCO2) and account for uncertainties in non-CO2 contribution	Global remaining carbon budget from 2013 relative to pre-industrial (GtCO2)
<1.5C with 50%	500	278	-222	556

The IPCC's remaining carbon budgets are calculated for warming relative to 1850-1900. The IPCC's Sixth Assessment Report (Cross-chapter Box 1.2) assesses the warming between 1850-1900 and the period around 1750 (before industrialisation i.e. true pre-industrial) to be 0.1C, with a likely range of 0.0C - 0.2C. Our reduction of the budgets reflects the fact that the Paris Agreement text clearly states that the targets are relative to pre-industrial. The adjustment also reflects our expert judgement that it is most appropriate to take a conservative approach to the contribution of non-CO2 emissions.

4.2. Emissions budget

Converting a global remaining carbon budget into a global remaining emissions budget.

Temperature level and likelihood of staying below	Global remaining carbon budget from 2013 relative to pre-industrial (GtCO2)	Additional non-CO2 greenhouse gas emissions until peak warming (GtCO2-eq)	Global remaining emissions budget from 2013 relative to pre-industrial (GtCO2-eq)

<1.5C with 50%	556	324	880

4.3. Handling differences in LULUCF accounting

Adjusting the carbon budget to account for differences in accounting differences between national inventories and remaining carbon budget calculations. For further details, see Grassi et al. (2021, https://doi.org/10.1038/s41558-021-01033-6).

Temperature level and likelihood of staying below	Global remaining emissions budget from 2013 relative to pre-industrial (GtCO2-eq)	Adjustment to CO2 part of emissions budget to account for different CO2 sink accounting in IPCC methodology for national inventories and IPCC methodology for remaining carbon budget (see Grassi et al.) (GtCO2)	Global remaining emissions budget from 2013 relative to pre-industrial after LULUCF adjustment (GtCO2-eq)
<1.5C with 50%	880	-83	796

4.4. Downscaling the global budget

Calculating Australia's remaining emissions budget based on its assumed share.

Temperature level and likelihood of staying below	Global remaining emissions budget from 2013 relative to pre-industrial after LULUCF adjustment (GtCO2-eq)	Australia share of remaining emissions budget (%)	Australia's remaining emissions budget from 2013 (GtCO2-eq)
<1.5C with 50%	796	0.97	7.73

4.5. Calculating the budget from 2020

Calculating Australia's remaining emissions budget from 2020.

Temperature level and likelihood of staying below	Australia's remaining emissions budget from 2013 (GtCO2-eq)	Australia's emissions from 2013 to 2020 (GtCO2-eq)	Australia's remaining emissions budget from 2020 (GtCO2-eq)

<1.5C with 50%	7.73	-3.78	3.95