The Australia Institute
Research that matters.
> Climate & Energy.

Advance Australia's fair share

Assessing the fairness of emissions targets

The fairness of a country's emissions reduction targets can be assessed with regard to population, economic costs or a combination. Regardless of the approach, Australia's 26-28% Paris target is insufficient and will need to be ramped-up.

Richie Merzian
Rod Campbell
12 June 2018

ABOUT THE AUSTRALIA INSTITUTE

The Australia Institute is an independent public policy think tank based in Canberra. It is funded by donations from philanthropic trusts and individuals and commissioned research. We barrack for ideas, not political parties or candidates. Since its launch in 1994, the Institute has carried out highly influential research on a broad range of economic, social and environmental issues.

OUR PHILOSOPHY

As we begin the 21st century, new dilemmas confront our society and our planet. Unprecedented levels of consumption co-exist with extreme poverty. Through new technology we are more connected than we have ever been, yet civic engagement is declining. Environmental neglect continues despite heightened ecological awareness. A better balance is urgently needed.

The Australia Institute's directors, staff and supporters represent a broad range of views and priorities. What unites us is a belief that through a combination of research and creativity we can promote new solutions and ways of thinking.

OUR PURPOSE – 'RESEARCH THAT MATTERS'

The Institute publishes research that contributes to a more just, sustainable and peaceful society. Our goal is to gather, interpret and communicate evidence in order to both diagnose the problems we face and propose new solutions to tackle them.

The Institute is wholly independent and not affiliated with any other organisation. Donations to its Research Fund are tax deductible for the donor. Anyone wishing to donate can do so via the website at https://www.tai.org.au or by calling the Institute on 02 6130 0530. Our secure and user-friendly website allows donors to make either one-off or regular monthly donations and we encourage everyone who can to donate in this way as it assists our research in the most significant manner.

Level 1, Endeavour House, 1 Franklin St
Canberra, ACT 2601
Tel: (02) 61300530
Email: mail@tai.org.au
Website: www.tai.org.au

Summary

While Australia debates how to reach our Paris Agreement targets, wider issues such as whether these targets are appropriate and how they might need to be adjusted in the future are receiving scant attention.

Australia's current 2030 emissions reduction target is for a 26-28 percent reduction on 2005 levels. The Australian Labor Party has said that it would adopt a 2030 target of 45 percent below 2005 levels. In the context of the global carbon budget, neither policy would see Australia doing a 'fair share'.

The UN's Intergovernmental Panel on Climate Change (IPCC) estimates the world has a remaining emissions budget this century of 1,040 $GtCO_2$-e to have mid-probability of meeting the Paris goals. Different approaches are taken on the question of how to divide these remaining emissions and related abatement tasks between countries. Key approaches include:

- population-based approaches, which divide up the emissions budget between countries based on their current and projected populations;
- cost sharing approaches, which consider and try to equalise economic impacts;
- historic responsibility approaches, which consider countries' past emissions and responsibility for climate change; and
- hybrid approaches that combine population, cost and other measures of welfare.

If the remaining IPCC emissions budget was shared via a pure population approach, Australia would receive a share of 3,392 million tonnes. In 2015 Australia emitted 526 million tonnes, meaning at this rate our 'fair share' would be expended and Australia would need to have achieved net zero emissions in just over six years.

Using a modified population-based approach, which considers levels of development, the Climate Change Authority calculated Australia's emissions budget as 10,100 million tonnes CO_2-e for 2013-2050. Australia's current target of 26 percent reduction by 2030 would then require complete decarbonisation just five years later in 2035. Labor's 45 percent target requires complete decarbonisation by 2040.

Under a cost sharing approach, the IPCC estimates that achieving the Paris targets would see global consumption 1.7 percent lower in 2030 compared to a no-action scenario. Modelling for the Australian government estimates that a 26 percent target would see Australian consumption just 0.6 percent lower, while a 45 percent target would see consumption 0.9 percent lower in 2030. Both policies would see Australia's consumption grow, but experience reductions in growth of around half what is expected internationally.

Given Australia's high historic emissions, high per capita emissions and high income, other approaches to assessing nations' contributions to climate action all show that Australia's climate targets are not doing a 'fair share'. Any principle-based approach to target setting will result in highly developed, emissions-intensive nations like Australia having to pursue aggressive emissions reductions immediately and sustaining these reductions over the coming decades.

The small size of the remaining global emissions budget poses a significant challenge. All countries will need to ramp-up mitigation efforts. If the global community is to succeed in keeping emissions within the 2°C budget, mitigation efforts in Australia and elsewhere need to be significantly accelerated on timescales shorter than those contained in the Paris Agreement.

Introduction

Under international climate change processes, countries have periodically been asked to put forward targets to reduce greenhouse gas emissions by or over a specified period. The first of these was under the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. Pressured by developing countries to show leadership in taking action to mitigate emissions, developed countries, including Australia, committed to 'individually or jointly' return their net emissions to 1990 levels by the turn of the century.[1] Soon after the UNFCCC came into force in 1994, negotiations commenced on the Kyoto Protocol, under which developed countries were ultimately required to adopt legally binding cumulative emission targets for the period 2008-2012, and later, for 2013-2020.[2]

The Kyoto Protocol's top-down, legally binding 'targets and timelines' structure was abandoned in the Paris Agreement in 2015.[3] In its place, the Paris Agreement adopted a bottom-up, soft law-based approach in which all parties, developed and developing alike, are required to submit non-binding pledges (known as 'Nationally Determined Contributions' (NDCs)) to take mitigation actions.[4] There is an expectation that developed country NDCs will take the form of 'economy-wide absolute emission reduction targets'.[5] Other countries have the flexibility to submit alternative types of NDCs—e.g. emission or energy intensity targets, sectoral targets or commitments to introduce particular policies—but are encouraged to 'move over time towards economy-wide emission reduction or limitation targets in the light of different national circumstances'.[6]

The NDCs of all parties are required to be periodically reviewed and updated with the aim of progressively increasing ambition to achieve the Paris Agreement's objective of keeping the increase in the global average surface temperature 'to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels' (Art. 2(1)).[7] Consistent with this, Article 4(3) of the Agreement requires each successive NDC of the parties to 'represent a progression' beyond the relevant country's existing NDC. Through 2018, a facilitative dialogue is being undertaken (known as the 'Talanoa Dialogue') to take stock of the efforts made to date under the Paris Agreement and inform the preparation of NDCs. The first formal review of the NDCs will take place in 2023 and every five years thereafter.[8]

[1] UNFCCC, Art. 4(2)(b).

[2] Kyoto Protocol to the UNFCCC 1997, Art. 3 and UNFCCC Secretariat, *Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its seventh session, held in Durban from 28 November to 11 December 2011* (UNFCCC, 2011), Decision 1/CMP.7.

[3] Paris Agreement to the UNFCCC 2015.

[4] Paris Agreement to the UNFCCC 2015, Arts. 3 and 4(2).

[5] Paris Agreement to the UNFCCC 2015, Art. 4(4).

[6] Ibid.

[7] Paris Agreement to the UNFCCC 2015, Arts. 2(1), 4(3), 4(13), 13 and 14.

Against this backdrop, there is debate about the adequacy of Australia's current 2030 emission reduction target of a 26-28 percent reduction on 2005 levels. This pledge was first made in 2015 as an indicative NDC in the lead up to the Paris Convention.[9] In accordance with the Paris Agreement processes, in November 2016, it became Australia's first NDC. The target has been subject to criticism from a number of quarters on the basis it is inconsistent with the Paris Agreement's 2°C objective.[10] The Australian Labor Party has said that, in government, it will adopt a 2030 target of 45 percent below 2005 levels.[11] While significantly more ambitious than the current Government's target, some have still argued that it does not represent a fair contribution to the global effort to keep warming to 2°C.[12]

This paper provides an overview of the approaches that can be used to determine mitigation targets and judge their adequacy in the context of the Paris Agreement's 2°C target. The adequacy of the targets put forward by the Australian Government and Opposition are evaluated using these approaches. In section 2, we outline the four main theoretical approaches to devising national emission targets. Section 3 uses two of these, population-based and cost sharing approaches, to provide an indication of the perceived fairness of the Australian Government's 26-28 percent 2030 target and the Opposition's 45 percent target. Section 4 provides a conclusion.

[8] Paris Agreement to the UNFCCC 2015, Art. 14(2).

[9] Australian Government, *Australia's Intended Nationally Determined Contribution to a new Climate Change Agreement* (Australian Government, 2015).

[10] Ecofys, Climate Analytics and New Climate Institute, *Climate Action Tracker: Australia* (Climate Action Tracker Partners, 2017); 'Australia's post-2020 climate target not enough to stop 2C warming: experts', *The Conversation*, 11 August 2015; Fraser, B., *Some Observations on Australia's Post-2020 Emissions Reduction Target: Statement by the Chair* (Climate Change Authority, 2015).

[11] Australia's first NDC states it will account for the 2030 target using UNFCCC inventory reporting and a net-net approach (Australian Government 2015). To ensure consistency, all Australian emissions data presented here is based on UNFCCC reporting rather than Kyoto Protocol reporting, which is used to account for the 2020 target.

[12] The Climate Institute, *Labor Climate Policy Credibility Assessment* (The Climate Institute, 2016); Environment Victoria, 'Environment Victoria welcomes ALP plan to cut pollution and clean up Australia's energy supply', media release (Environment Victoria, 27 April 2016).

Setting climate targets

In practice, emissions reduction targets are set by national governments having regard to a collection of domestic and international environmental, economic and political factors. At its most simple, countries try to balance their domestic self-interest against the international benefits of collective action. Typically, self-interest drives countries to try to minimise their contribution to global mitigation efforts so as to reduce short- and medium-term economic and political costs. Working against this is the recognition that all parties face similar incentives to free-ride and the adverse impacts of climate change can only be managed effectively through an equitable sharing of the mitigation task.

The centrality of an equitable distribution of the mitigation task to global effort to combat climate change has spawned an extensive literature on ways of devising and evaluating national targets.[13] No consensus has emerged amongst policymakers or the academic community about what constitutes the best or fairest method of determining national mitigation objectives.[14] However, the methods that have been devised provide a guide as to what other countries are likely to view as Australia's fair share of the task. These methods can be placed in four broad categories:

- population-based approaches;
- cost sharing approaches;

[13] Beckerman, W. and J. Pasek. 1995. 'The equitable international allocation of tradable carbon emission permits'. *Global Environmental Change* 5(5):405-413; Rose, A., B. Stevens, J. Edmonds and M. Wise. 1998. 'International Equity and Differentiation in Global Warming Policy'. *Environmental and Resource Economics* 12:25-51; Baer, P., J. Harte, B. Haya, A. Herzog, J. Holdren, N. Hultman, D. Kammen, R. Norgaard and L. Raymond. 2000. 'Equity and Greenhouse Gas Responsibility'. *Science* 289:2287; Berk, M. and M. den Elzen. 2001. 'Options for differentiation of future commitments in climate policy: how to realise timely participation to meet stringent climate goals?'. *Climate Policy* 1:465-480; Germain, M. and V. van Steenberghe. 2003. 'Constraining Equitable Allocations of Tradable CO_2 Emission Quotas by Acceptability'. *Environmental and Resource Economics* 26:469–492; Gupta, S., D. Tirpak, N. Burger, J. Gupta, N. Höhne, A. Boncheva, G. Kanoan, C. Kolstad, J. Kruger, A. Michaelowa, S. Murase, J. Pershing, T. Saijo and A. Sari, '2007: Policies, Instruments and Co-operative Arrangements', In B. Metz et al (eds), Climate *Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press, 2007); Chakravarty, S., A. Chikkatur, H. de Coninck, S. Pacala, R. Socolow. 2009. 'Sharing global CO_2 emission reductions among one billion high emitters'. *Proceedings of the National Academy of Sciences (PNAS)* 106:11884-11888; Ekardt, F. and A. von Hövel. 2009. 'Distributive Justice, Competitiveness, and Transnational Climate Protection: "One Human - One Emission Right"'. *Carbon and Climate Law Review* 3(1):102-113; Meyer, A. 2004. 'Briefing: Contraction and convergence'. *Proceedings of the ICE - Engineering Sustainability* 157(4):189-192; Müller, B., N. Höhne and C. Ellermann. 2010. 'Differentiating (historic) responsibilities for climate change'. *Climate Policy* 9:593-611; Oberheitmann, A. 2010. A new post-Kyoto climate regime based on per-capita cumulative CO_2-emission rights—rationale, architecture and quantitative assessment of the implication for the CO_2-emissions from China, India and the Annex-I countries by 2050'. *Mitigation and Adaptation Strategies for Global Change* 15(2):137-168.

[14] Gupta et al. (2007), above n 13.

- historic responsibility approaches; and
- hybrids.[15]

POPULATION-BASED APPROACHES

Research suggests there is a near linear relationship between cumulative global carbon dioxide emissions (CO_2) and projected global temperature change.[16] In its 5th Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) found that, in order to provide a greater than 66 percent chance of keeping average surface temperature increases below 2°C above pre-industrial levels, cumulative CO_2 emissions from 2011 would need to be limited to 1,000 billion tonnes (1,000 Gt CO_2).[17] This suggests total emissions of the so-called 'Kyoto gases' (the gases reported under the UNFCCC and Kyoto Protocol)—CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen triflouride (NF_3)—would need to be limited to around 1,200-1,400 $GtCO_2$-e.[18] This cumulative global emissions limit is often referred to as the 'global emissions budget' or 'global emissions pie'.[19]

Population-based approaches start from the premise that the global emissions budget (or the freedom to emit up to the specified limit) is a resource that should be divided up amongst nations on the basis of their populations. Possibly the most well-known population-based approach is 'contraction and convergence', which was first put forward by Aubrey Meyer and the Global Commons Institute in the 1990s.[20] Under contraction and convergence, global emissions contract to net zero so as to stabilise atmospheric greenhouse gas concentrations at an agreed level, while national targets are set so per capita emissions converge and equalise at a given point in time.

There are a number of potential weaknesses associated with contraction and convergence. These include the fact it does not account for historical emissions and the economic capacity of countries and their ability to absorb the costs associated with mitigation. A further issue associated with contraction and convergence is that, due to the delay in convergence, it

[15] Macintosh, A. (2014) 'Mitigation Targets, Burden Sharing and the Role of Economic Modelling in Climate Policy', *Australian Journal of Public Administration* 73(2): 164-180; Climate Change Authority, *Comparing Countries' Emissions Targets: A Practical Guide* (Australian Government, 2015).

[16] Intergovernmental Panel on Climate Change (IPCC), Climate Change 2014: Synthesis Report (IPCC, 2014) pp 62-63.

[17] This equates to 273 Gt of carbon (C). See IPCC, above n 16, pp 62-64.

[18] Based on non-CO_2 forcing from RCP2.6. Meinshausen, M., S. J. Smith, K. V. Calvin, J. S. Daniel, M. L. T. Kainuma, J.-F. Lamarque, K. Matsumoto, S. A. Montzka, S. C. B. Raper, K. Riahi, A. M. Thomson, G. J. M. Velders and D. van Vuuren (2011) 'The RCP Greenhouse Gas Concentrations and their Extension from 1765 to 2300', *Climatic Change* 109: 213-241.

[19] Global Commons Institute (GCI), *Contraction and Convergence: A Global Solution to a Global Problem* (GCI, 1997); Broecker, W (2009) 'CO_2 Arithmetic', *Science* 315: 1371; Macintosh, A. (2009) 'The Garnaut Review's Targets and Trajectories: A Critique', *Environmental & Planning Law Journal* 26: 88-112; Macintosh, above n 15.

[20] GCI, above n 19.

necessarily results in the largest per capita emitters receiving a disproportionate share (based on population levels) of the remaining emissions budget.

Other than contraction and convergence, the other main 'pure' population-based approach is the simple per capita method, where national targets are determined on the basis of existing or projected population levels at a given time or over a given period.[21] One of the advantages of the simple per capita approach is it addresses the concerns associated with the delay in convergence. However, even with the simple per capita approach, it arguably still favours wealthy nations because it does not account for historical emissions, meaning that, in most cases, they will end up with a disproportionate share of cumulative emissions since the Industrial revolution (i.e. the all-time emissions budget).

COST SHARING APPROACHES

In contrast to population-based approaches, cost sharing approaches start from the premise that targets should be based on a division of the global abatement task. This change in focus means target setting under cost sharing approaches essentially involves a division of an 'abatement pie' (the difference between what emissions would be in the absence of mitigation measures and where they need to be to achieve the desired climate outcome) rather than an emissions pie. In their pure form, cost sharing approaches divide the abatement pie on the basis of economic cost; the welfare losses associated with reducing emissions. This typically involves setting national targets so as to equalise welfare losses across countries.[22] The adoption of this approach means countries with fewer low cost abatement opportunities and higher overall mitigation costs receive higher targets (a smaller share of the abatement pie and a larger share of the emissions budget) and *vice versa*.

Historically, the Australian Government has relied heavily on cost sharing arguments to support its international negotiation positions. The Government, industry groups and others have repeatedly asserted that the costs of reducing emissions in Australia are high relative to most other nations because of its heavy reliance on fossil fuels and large agricultural (particularly beef) sector. On this basis, they have argued Australia should receive concessional targets relative to other nations because the welfare losses associated with the transition to a low carbon economy are higher.[23]

[21] Baer et al., above n 13; Gupta et al. (2007), above n 13.

[22] Babiker, M., R. Eckhaus. 2002. 'Rethinking the Kyoto targets'. *Climatic Change* 54:99-114; Rose et al., above n 13; Gupta et al. (2007), above n 13.

[23] Australian Bureau of Agricultural and Resource Economics (ABARE) and Department of Foreign Affairs and Trade (DFAT), *Global Climate Change: Economic Dimensions of a Cooperative International Policy Response Beyond 2000* (Australian Government, 1995); Brown, S., D. Donovan, B. Fisher, K. Hanslow, M. Hinchy, M. Matthewson, C. Polidano, V. Tulpulé and S. Wear, *The Economic Impact of International Climate Change Policy* (ABARE, 1997); Brown, S., D. Kennedy, C. Polidano, K. Woffenden, G. Jakeman, B. Graham, F. Jotzo and B. Fisher, *Economic Impacts of the Kyoto Protocol: Accounting for the three major greenhouse gases* (ABARE, 1999); ABARE, *COP7: The economic implications of the Kyoto Protocol for Australia* (Australian Government, 2002); Australian Treasury, *Australia's Low*

Like population-based approaches, cost sharing approaches have a number of weaknesses. They ignore the resource characteristics of emissions entitlements (e.g. would it be fair to divide up an international mineral resource on the basis of the welfare losses countries would incur if they did not receive it?) and can skew allocations to wealthier nations that bear greater responsibility for historical emissions. They are inconsistent with the customary law principle that no state has the right to damage the environment outside their jurisdiction (called the 'no-harm principle').[24] They do not account for countries' capacity to absorb the costs of mitigation. From a practical perspective, they are also difficult to implement objectively because they are reliant on economic projections that are inherently unreliable, particularly over the decadal timeframes associated with global mitigation efforts.[25]

HISTORIC RESPONSIBILITY APPROACHES

Historic responsibility approaches involve the determination of nation mitigation targets on the basis of historic responsibility for past emissions or warming. The most well-known of these is the so-called 'Brazilian proposal', which was put forward by the Brazilian Government during the Kyoto Protocol negotiations in 1997.[26] Under this proposal, targets were proposed to be set for developed countries on the basis of responsibility for emissions after 1990.

Historic responsibility approaches share a number of weaknesses with population-based and cost sharing approaches, including the fact they do not explicitly consider population levels or economic capacity. The other main deficiency of pure historic responsibility approaches is they never adequately addressed the question of when and how targets would be set for developing countries. Due to this deficiency, pure historic responsibility approaches are widely seen as lacking credibility. However, many believe past emissions are a relevant variable in setting national targets. A number of developing countries in particular continue to argue that developed countries and other high emitters have an emissions debt that should be reflected in future emission entitlements.

Pollution Future: The Economics of Climate Change Mitigation (Australian Government, 2008); Australian Government, *Economic cost as an indicator for comparable effort: Submission to the AWG-KP and AWG-LCA* (Australian Government, 2009); Australian Government, *Setting Australia's Post-2020 Target for Reducing Greenhouse Gas Emissions: Final Report of the UNFCCC Taskforce* (Australian Government, 2015).

[24] Tol, R. and R. Verheyen (2004) 'State responsibility and compensation for climate change damages—a legal and economic assessment', *Energy Policy* 32:1109-1130.

[25] Climate Change Authority, *Reducing Australia's Greenhouse Gas Emissions – Targets and Progress Review* (Australian Government, 2014); Macintosh, above n 15.

[26] UNFCCC Secretariat, *Ad Hoc Group on the Berlin Mandate, Seventh Session, Bonn, 31 July - 7 August 1997, Implementation of the Berlin Mandate, Additional Proposals from Parties, Addendum, Paper No. 1, Brazil: Proposed Elements of a Protocol to the UNFCCC, Presented by Brazil in response to the Berlin Mandate* (UNFCCC, 1997).

HYBRID APPROACHES

The various limitations of pure population-based, cost sharing and historic responsibility approaches has prompted the development of a range of hybrid models. Most of these have their intellectual origins in population-based and cost sharing approaches. For example, pure population-based approaches have been modified to give fast growing developing country emitters greater time to transition (known as 'modified contraction and convergence'),[27] to account for economic capacity to absorb costs (e.g. 'adjusted per capita' and 'common but differentiated convergence')[28] and to address perceived inequalities associated with the transition period in contraction and convergence (e.g. 'equal per capita emissions over time').[29] Similarly, cost sharing approaches have been adjusted to account for economic capacity, population levels and historic responsibility for past emissions (e.g. 'ability to pay', 'multi-criteria', 'triptych' and 'greenhouse development rights').[30] All hybrid models have strengths and weaknesses, the importance of which depends on the weighting assigned to different philosophical and practical considerations.

[27] Garnaut, R., *The Garnaut Climate Change Review* (Cambridge University Press, 2008); Climate Change Authority, above n 25.

[28] Gupta, S. and P. Bhandari. 1999. 'An effective allocation criterion for CO2 emissions – an application to tradeable permits'. *Energy Policy* 27(12): 727-736; Höhne, N., M. den Elzen and M. Weiss. 2006. 'Common but differentiated convergence (CDC): a new conceptual approach to long-term climate policy'. *Climate Policy* 6:181-199.

[29] Bode, S. 2004. 'Equal emissions per capita over time - a proposal to combine responsibility and equity of rights for post-2012 GHG emission entitlement allocation'. *European Environment* 14: 300-316.

[30] Jacoby, H., R. Prinn and R. Schmalensee. 1998. 'Kyoto's Unfinished Business'. *Foreign Affairs* 77(4):54-66; Ringius, L., A. Torvanger and B. Holtsmark. 1998. 'Can multi-criteria rules fairly distribute climate burdens? – OECD results from three burden sharing rules'. *Energy Policy* 26(10):777-793; Babiker, M., R. Eckhaus. 2002. 'Rethinking the Kyoto targets'. *Climatic Change* 54:99-114; Lecocq, F. and R. Crassous. 2003. *International climate regime beyond 2012 – Are quota allocation rules robust to uncertainty?* Washington DC: World Bank; Blok, K., G.J.M. Phylipsen, and J.W. Bode, 1997: The Triptych Approach, Burden Sharing Differentiation of CO2 emissions reduction Among EU Member States (Utrecht University, 1997); Kartha, S., Athanasiou, T., Baer, P., Cornland, D., *Cutting the Knot: Climate Protection, Political Realism and Equity as requirements of a Post-Kyoto regime* (GD Rights, 2005); Rose et al., above n 13.

Judging the fairness of Australia's 2030 emission targets

In the absence of consensus on the best approach to setting national mitigation targets, there is no objective way of passing judgment on the fairness of Australia's 26-28% 2030 target or the Australian Labor Party's 45% target. However, the available approaches can be used to place these targets within a 'range of reasonableness'. To represent this range, we analysed what the application of population-based and cost sharing approaches imply for Australia and compared the results with the Government's and Opposition's proposed targets. For these purposes, we assume the world remains committed to the Paris Agreement's objective of keeping warming well below 2°C.

POPULATION-BASED APPROACHES AND AUSTRALIA'S 2030 TARGETS

In its 2014 and 2015 target reviews, the Climate Change Authority adopted the modified contraction and convergence approach to advise on Australia's 2025 and 2030 targets.[31] For these purposes, it suggested the use of a global emission budget of 1,700 $GtCO_2$-e for the period 2000-2050 to give a 67 percent chance of a 2°C outcome.[32] This equates to a 2011-2050 budget of approximately 1,200. This global emission budget to 2050 aligns well with the IPCC's 5th Assessment Report estimates of the cumulative CO_2 emissions that are consistent with providing a greater than 66 percent probability of keeping temperatures below 2°C. As noted above, accounting for non-CO_2 emissions and forcings, the IPCC suggested a 2°C emission budget of 1,200-1,400 $GtCO_2$-e for all time from 2011.[33] The fact the Authority's estimate is at the low end of the IPCC range is accounted for by the need for a (small) budget for the post-2050 era.

Using the modified contraction and convergence approach, the Climate Change Authority calculated Australia's share of the global emissions budget as 10.1 $GtCO_2$-e for the period 2013-2050.[34] To keep cumulative emissions within this budget, the Authority recommended a 2025 target of 30 percent below 2000 levels, and a target range for 2030 of between 40-60

[31] Climate Change Authority, *Special Review Draft Report: Australia's future emission reduction targets* (Australian Government, 2015); Climate Change Authority, *Final report on Australia's future emission reduction targets* (Australian Government, 2015); Climate Change Authority, above n 25;

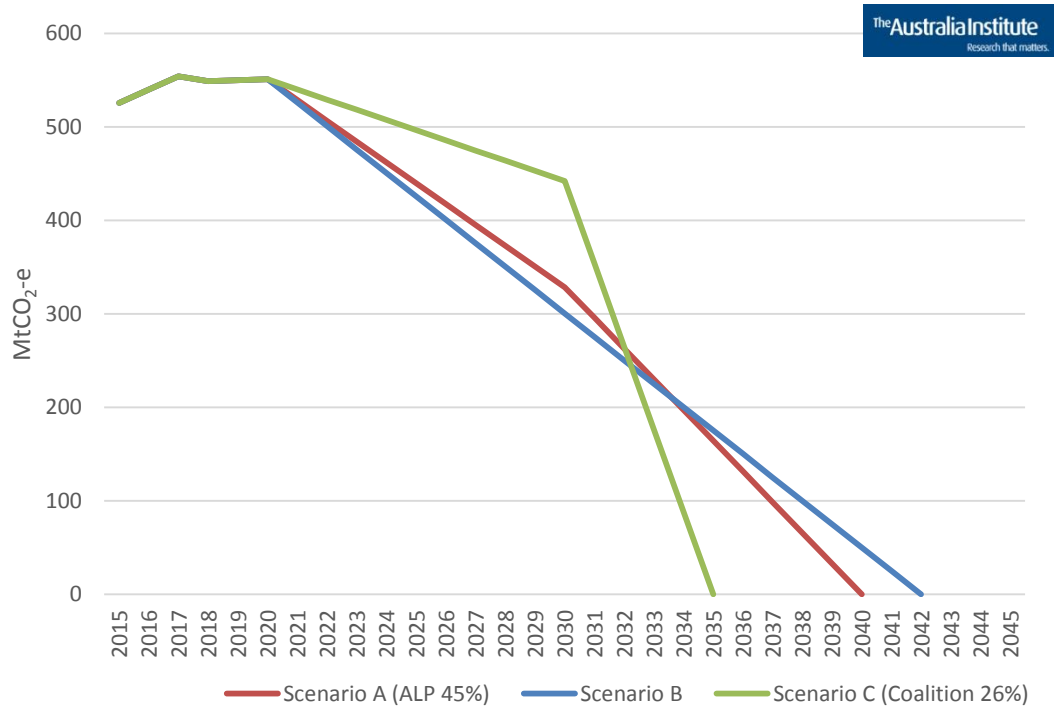
[32] The Authority also used budgets of 1,520 and 2,020 $GtCO_2$-e for the same period to give a 75 percent and 50 percent chance respectively of keeping temperatures below 2°C. For simplicity, we confine the analysis here to the 67 percent reference case.

[33] IPCC, above n 16.

[34] The full range for its scenarios was 8.5-13.1 $GtCO_2$-e. More recent emissions data suggest the budget may be slightly lower (EDGARv4.2 FT2012). We use the original estimate for simplicity.

percent below 2000 levels. The Authority's 2030 target equates to 45-63 percent below 2005 levels. Figure 1 below shows the trajectory of Australia's emissions to stay within this emissions budget calculated with the modified contraction and convergence approach. It shows a linear trajectory as well as the trajectories required under the government and opposition policies for 2030 abatement:

Figure 1: Australia's emissions under modified contraction and convergence



Source: Department of the Environment and Energy, 'Australian Greenhouse Emissions Information System (AGEIS)', available at: http://ageis.climatechange.gov.au/ (20 March 2018); Department of the Environment and Energy, *Australia's Emissions Projections 2017* (Australian Government, 2017).

Figure 1 shows that under the modified contraction and convergence approach, Australia's current target of 26 percent reduction by 2030 will then require complete decarbonisation in just five years. The difference between the Government's 26-28 percent target and the Climate Change Authority's target range equates to approximately 100-220 $MtCO_2$-e in 2030, and 550-1,200 $MtCO_2$-e cumulatively over the period 2021-2030. This is roughly 1.0-2.3 times Australia's 2015 emissions (526 $MtCO_2$-e).[35]

On its face, the Opposition's 45 percent target matches the bottom of the range recommended by the Climate Change Authority. However, the adoption of this target still involves complete decarbonisation in 2040, two years earlier than under the linear trajectory. It is important to consider that a linear trajectory may not be optimal. While large emissions

[35] Department of the Environment and Energy, 'Australian Greenhouse Emissions Information System (AGEIS)', available at: http://ageis.climatechange.gov.au/ (20 March 2018).

reductions may be possible at low cost, the final emissions reductions from industries such as manufacturing, construction and agriculture may be difficult and costly.

While the Climate Change Authority's emission budget and associated mitigation targets are ambitious, they do not reflect the least self-interested population-based approach. A simple per capita division of the remaining global emissions budget better approximates an outer marker of what some might regard as equitable. For illustration, we divided the remaining global emissions budget from 2015 on the basis of 2015 population levels. To do this, we took the IPCC's mid-range estimate for 2°C (1,300 $GtCO_2$-e) and deducted estimated emissions over the period 2012-2015 (~260 $GtCO_2$-e), leaving a budget for the remainder of the century of 1,040 $GtCO_2$-e. We then used the United Nations population estimates for 2015 to divide the budget between countries.[36] This provides Australia with a budget for the remainder of the 21st century of 3.36 $GtCO_2$-e, as shown in Table 1 below:

Table 1: Australian emissions budget under pure population approach

	Low	Medium	High
Global emissions budget from 2012 (Gt CO2-e)	1,000	1,300	1,500
Emissions 2012-15 (Gt CO2-e)	260	260	260
Remainder (Gt CO2-e)	740	1,040	1,240
Population 2015 (people)	7,349,472,000	7,349,472,000	7,349,472,000
Remaining emissions budget per person (t CO2-e)	101	142	169
Australian population (people)	23,969,000	23,969,000	23,969,000
Australia's share of emissions budget (Mt CO2-e)	2,413	3,392	4,044
Australian emissions 2015 (Mt CO2-e)	526	526	526
Years to budget	4.6	6.4	7.7

The Australia Institute
Research that matters.

Sources: IPCC (2015), UN (2015)

Table 1 shows that at current emission levels, this budget would be expended in just over six years. Assuming Australia's current climate policies remain in place until 2020, come 2021, Australia would have a little over 12 months to reach net zero emissions. While Australia could

[36] United Nations, *World Population Prospects 2017* (UN, 2017), available at: https://esa.un.org/unpd/wpp/ (20 March 2018).

not achieve cuts of such magnitude domestically, the target could potentially be achieve through the importation of foreign permits (carbon credits). Such a strategy would be dependent on the availability of international permits and extent of demand for them from other nations.

COST SHARING APPROACHES AND AUSTRALIA'S 2030 TARGETS

The application of a pure cost sharing approach to evaluate Australia's 2030 targets requires a comparison between the average economic cost of meeting the 2°C target globally and the equivalent costs for Australia, assuming emissions reductions are done in the most cost-effective (or least-cost) way possible.

The requirement for the comparison to be done on the basis of the lowest (theoretically) possible economic cost of achieving the relevant mitigation targets is important. Cost sharing approaches would have no validity if welfare loss comparisons could be made using scenarios that assume parties make policy choices that increase costs. Such an approach would mean that, the less cost-effective a country's mitigation policies, the less they would be obligated to reduce their emissions (and greater share they would receive of the remaining global emissions budget). The adoption of such an approach to target setting would create perverse incentives and work against the collective global interest of reducing emissions in the cheapest way possible.

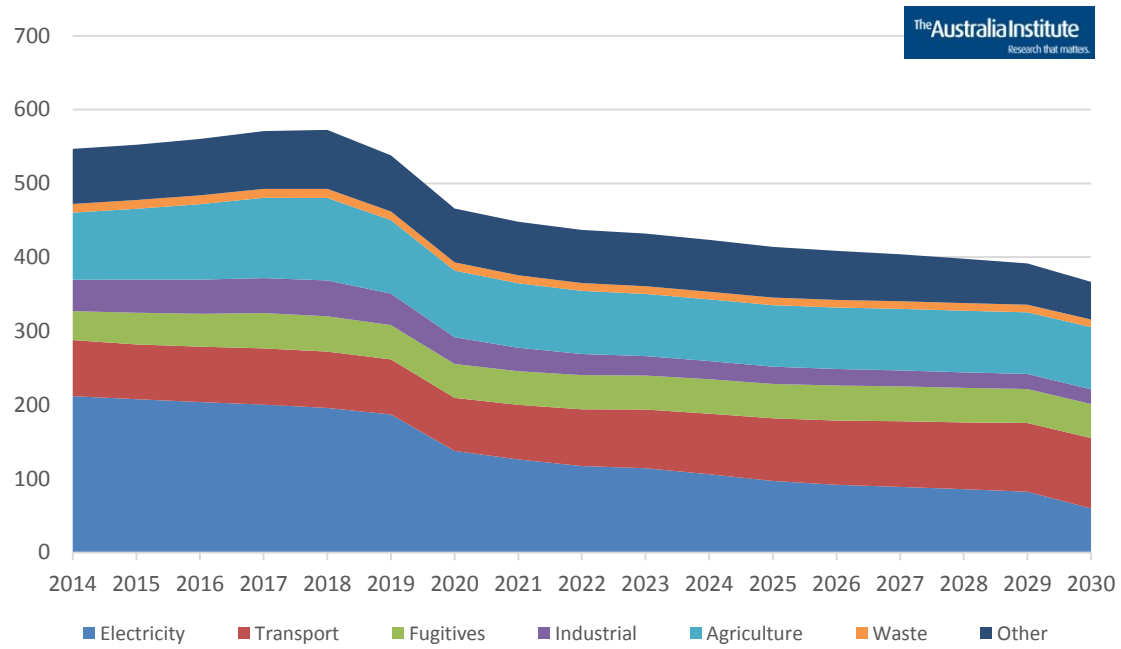
In its 5th Assessment Report, the IPCC estimated the impacts on global consumption of stabilising the atmospheric concentration of CO_2 in 2100 at 450 parts per million (ppm) (equivalent of a 2°C outcome). If done cost-effectively, consumption would continue to increase, but at a slightly lower annual growth rate. The IPCC's estimate of the difference in global consumption in 2030 was 1.7 percent lower, with a range of range 1.0-3.7 percent, relative to a reference case with no additional mitigation efforts.[37] This equates to a reduction in the average growth rate of consumption of 0.09 percent (range 0.06-0.2) over the period 2010 to 2030.

The modelling of the IPCC's assessment assumed the immediate adoption of mitigation measures in all countries and a single global carbon price. While the IPCC did not publish details of the resulting reductions in individual countries, a similar modelling exercise was undertaken by Victoria University on behalf of the Climate Change Authority in 2016 using the IPCC's 450 ppm global carbon price. The price began at $AUD33 per tonne in 2019 and increased steadily to 2050. The results suggest Australia's domestic contribution to a globally

[37] IPCC, *Climate Change 2014 Mitigation of Climate Change: Summary for Policymakers and Technical Summary* (IPCC, 2015) pp 56-60.

efficient effort to keep temperatures below 2°C would see emissions decline from 612 Mt in 2005 to 367 Mt, as shown in Figure 2 below.[38]

Figure 2: Australia's emissions under 2C scenario, IPCC cost sharing approach



Source: Adams (2016).

Figure 2 shows emissions declining by roughly 41 percent by 2030 relative to 2005 levels, significantly above the Government's 26-28 percent targets and slightly below the Opposition's 45 percent target. The largest reductions come from the electricity sector. Importantly this analysis had only partial coverage of the land sector where Australia has significant low-cost mitigation options.

A rough estimate of the economic costs associated with meeting the Government's and Opposition's 2030 targets can be derived from the modelling that was commissioned by the Government in 2015 to inform its target decision. For these purposes, the McKibbin Software Group was asked to model the economic impacts of four 2030 targets: reductions of 13, 26, 35 and 45 percent relative to 2005 levels (McKibbin Software Group 2015a; 2015b).[39] The modelling that was conducted had a number of limitations, including that the analysis did not consistently assume a cost-effective response across all countries. The analysis was also confined to CO_2 emissions in the energy sector, thereby excluding non-CO_2 emissions from energy, CO_2-e emissions from industrial processes, agriculture and waste, and CO_2-e emissions

[38] Adams, P., *Simulations of the Effects of Greenhouse Gas Mitigation Policies for the Australian Electricity Sector* (Victorian University, 2016).

[39] McKibbin Software Group, *Report 1: 2015 Economic Modelling of International Action under a New Global Climate Change Agreement* (Australian Government, 2015a); McKibbin Software Group, *Report 2: 2015 Economic Modelling of Australian Action under a New Global Climate Change Agreement* (Australian Government, 2015b).

and CO_2 removals associated with the land sector.[40] Due to these and other factors, the results were heavily caveated, with the McKibbin Software Group stressing:

> There is considerable uncertainty in the assumptions used in the modelling. Given the difficulty of predicting future economic conditions and countries' actions, all results should be understood to be an expected outcome with a relatively large band of uncertainty around the point estimates. The estimates should be treated as indicative of the orders of magnitude of policy impacts and the likely relative size of impacts across sectors and countries, and should be used with caution.[41]

Noting these modelling limitations, the findings suggest the pursuit of a 26 percent 2030 target with cost-effective domestic policies (excluding international permits) would see Australia's consumption 0.91 percent lower in 2030, relative to a base case with no additional global mitigation. Allowing international permits reduced the estimated reduction in consumption to 0.60 percent in 2030. The equivalent results for the 45 percent target scenario were a 1.47 percent reduction in 2030 with no international permits and a 0.92 percent reduction in 2030 with international permits.

For the purposes of applying a pure cost sharing approach, only the lower consumption impact estimates involving the use of international permits are relevant. As noted above, in order for cost sharing approaches to have any validity, the cost comparisons need to be made on the assumption all parties pursue least-cost policies.

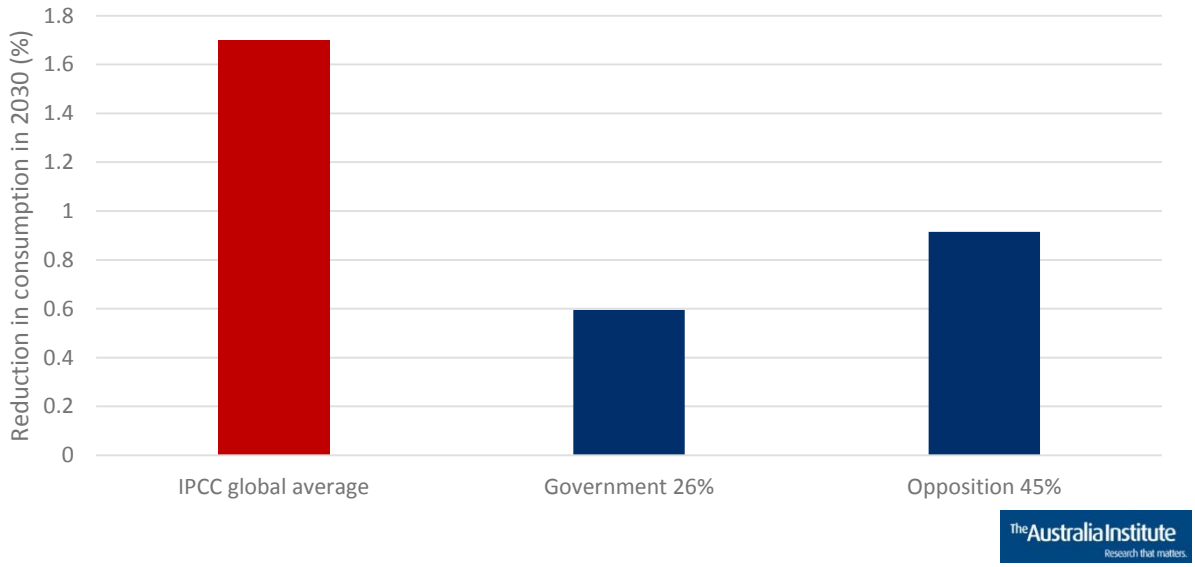
If the IPCC's estimate of the average global reduction in consumption relative to baseline growth to 2030 of 1.7 percent is used as a benchmark, it suggests the Government's 26-28 percent target is inadequate (Fig. 3).[42] The assessed reduction in consumption is less than half the global average. The Opposition's 45 percent target also falls outside of the range that might be considered consistent with a cost sharing approach. The assessed reduction in consumption in the 45% scenario, 0.92 percent in 2030, is almost 50 percent below the global average.

[40] The core target scenarios also assumed high end domestic technology costs.

[41] McKibbin Software Group, *Report 1: 2015 Economic Modelling of International Action under a New Global Climate Change Agreement* (Australian Government, 2015a) p 7. See also McKibbin Software Group, *Report 2: 2015 Economic Modelling of Australian Action under a New Global Climate Change Agreement* (Australian Government, 2015b) p 7.

[42] The estimates of impacts on other economies in the McKibbin Software Group's modelling are not directly relevant because of the limited coverage of countries, gases and sectors, and the fact they do not assume a consistent cost-effective policy response across all countries.

Figure 3: Reduction in 2030 consumption, IPCC global average, government and Labor targets



Source: McKibbin Software Group (2015a; 2015b); IPCC (2015).

COULD HYBRID MEASURES MAKE AUSTRALIA'S 2030 TARGETS APPEAR FAIRER?

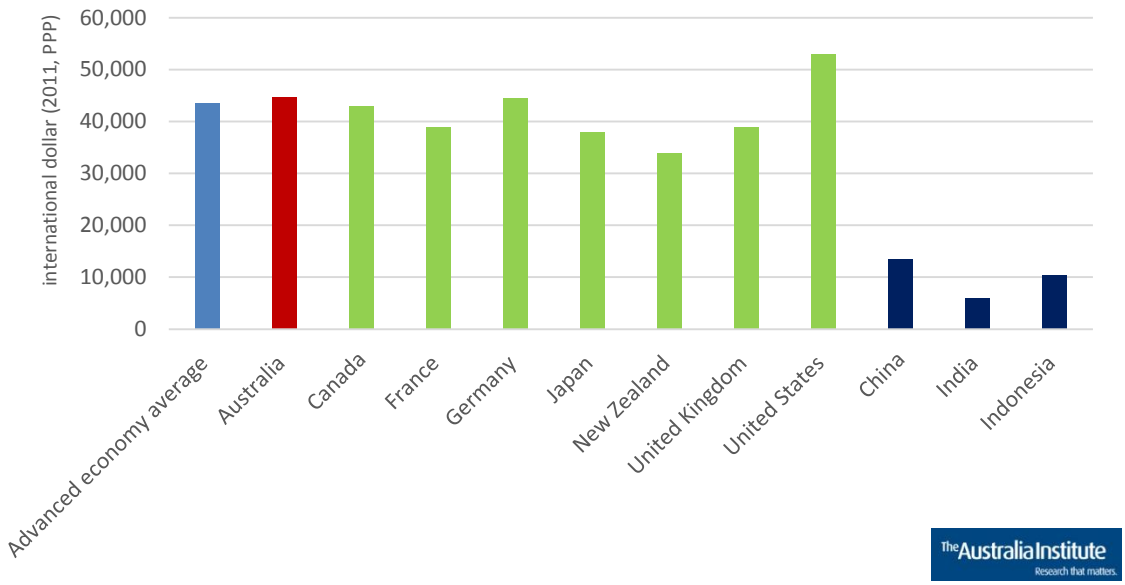
In the past, Australian Governments have presented a range of economic and emissions information to support the case its targets constitute an equitable contribution to global mitigation efforts.[43] The difficulty with this approach is that none of the recognised metrics used in hybrid models to modify the impacts of the 'pure' approaches supports Australia's position. The three most commonly employed are economic capacity, economic, human and social development, and historic emissions.

By any measure, Australia is a wealthy nation with a high economic capacity. As shown in Figure 4, Australia's GDP per capita is above the average for advanced nations, and above most other major developed countries, including the United Kingdom, Japan, Germany, France and Canada. In 2015, Australia's GDP per capita was also more than three times China's, almost eight times India's and more than four times Indonesia's.[44] The perceived fairness of Australia's 26-29 percent 2030 target, and the Opposition's 45 percent target, is not improved by the inclusion of economic capacity.

[43] See references in n 23.

[44] International Monetary Fund (IMF), 'World Economic Outlook Database' (IMF, October 2017), available at: https://www.imf.org/external/pubs/ft/weo/2017/02/weodata/index.aspx (20 March 2018).

Figure 4: Major developed and developing economies, gross domestic product per capita, constant prices, international dollar (2011)

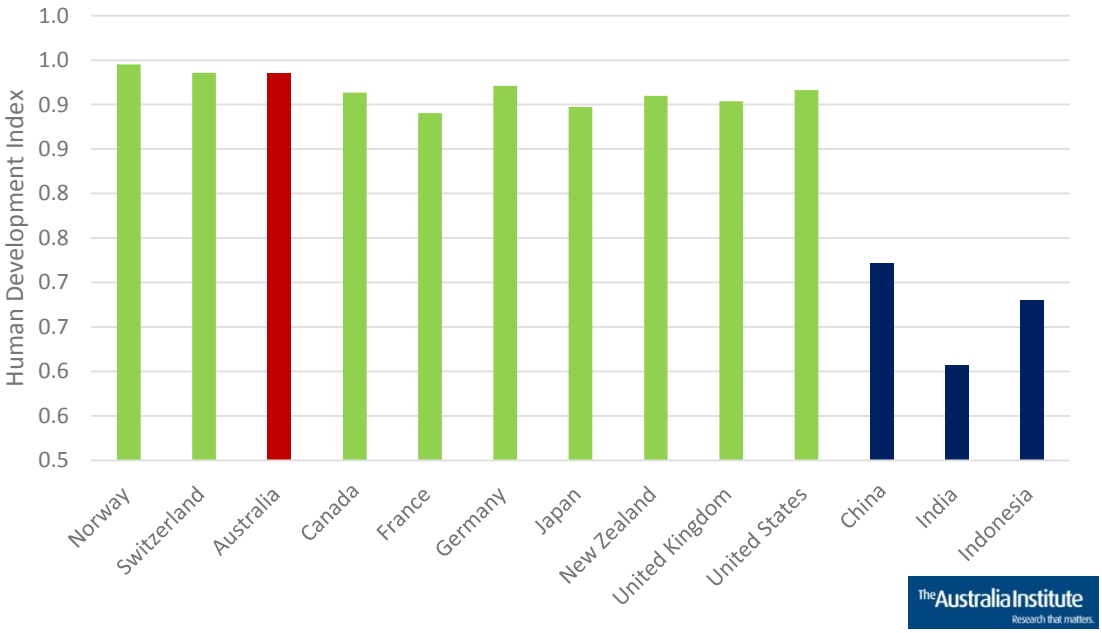


Source: International Monetary Fund (IMF), 'World Economic Outlook Database' (IMF, October 2017), available at: https://www.imf.org/external/pubs/ft/weo/2017/02/weodata/index.aspx (20 March 2018).

The use of composite measures of economic, human and social development produces a similar result. Australia has very high levels of economic, human and social development relative to other nations, suggesting it has a high capacity to mitigate emissions and make the necessary social and economic adjustments associated with the transition to a low carbon economy. The relative state of Australia's economic, human and social development is illustrated by the Human Development Index, a composite indicator that combines metrics on three dimensions: health, knowledge (education) and standard of living. The most recent HDI results (2015) place Australia second in the world behind Norway. The five year average (2011-2015) places Australia third in the world behind Norway and Switzerland, and significantly ahead of all other major developed and developing economies (Fig. 5).[45] Much like economic capacity, the perceived fairness of Australia's current targets and those proposed by the Opposition are not improved by the inclusion of composite measures of economic, human and social development.

[45] United Nations Development Programme, 'Human Development Data (19900-2015)', available at: http://hdr.undp.org/en/data (20 March 2018).

Figure 5: Average Human Development Index score for major developed and developing economies, 2011 to 2015



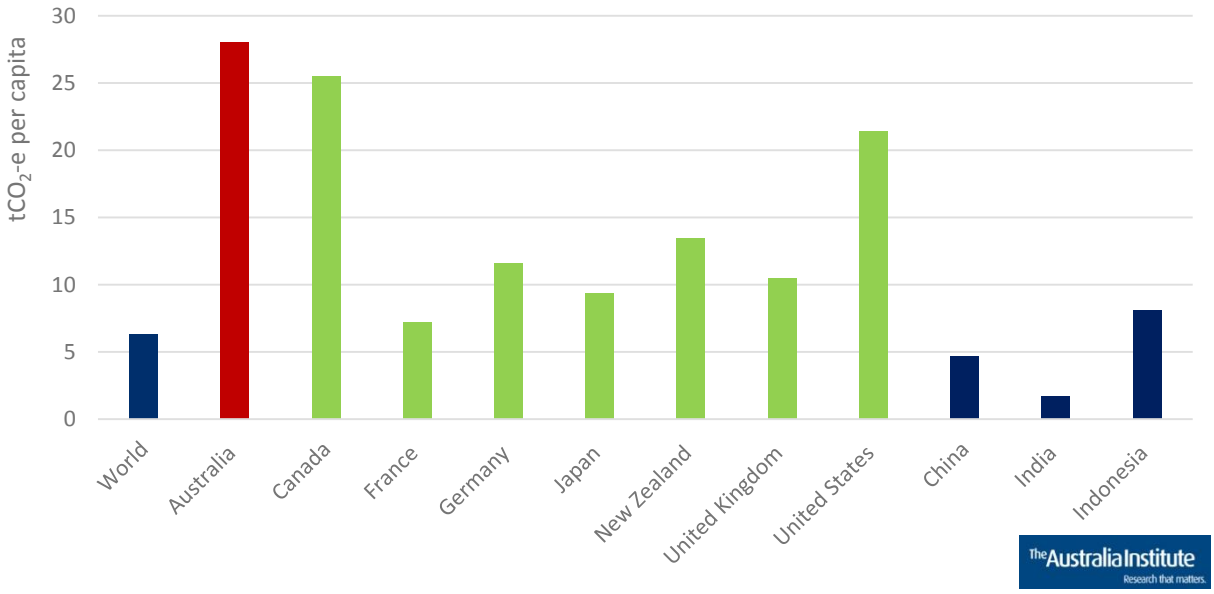
Source: United Nations Development Programme, 'Human Development Data (19900-2015)', available at: http://hdr.undp.org/en/data (20 March 2018).

The same applies to historic emissions. Over the period 1990 to 2014, Australia was responsible for approximately 1.4 percent of global greenhouse gas emissions, while having only having 0.3 percent of the world's population.[46] The extent to which Australia is disproportionately responsible for historical emissions (relative to population) is illustrated by comparing average per capita emissions over the period 1990 to 2014 (Fig. 6). Australia's average per capita emissions for this period were 28 tCO_2-e per person, compared to the global average of 6.3 tCO_2-e per person. As Figure 5 shows, Australia's per capita emissions were above all of the major developed economies, with only Canada (25.5 tCO_2-e per person) and the United States (21.4 tCO_2-e per person) being reasonably comparable. Australia's per capita emissions were almost six times China's (4.7 tCO2-e per person), 16.7 times India's (1.7 tCO2-e per person) and 3.5 times Indonesia's (8.1 tCO2-e per person).[47]

[46] It is arguable that the period for historic responsibility should extend back further, possibly to the beginning of the Industrial revolution, because of the long atmospheric lifetime of long-lived greenhouse gases. However, the post-1990 period is generally used in historical responsibility approaches because, by 1990, the nature of climate change and its causes was widely known.

[47] World Resources Institute (WRI), 'CAIT Climate Data Explorer' (WRI, 2017), available at: http://cait.wri.org (20 March 2018).

Figure 6. Major developed and developing economies, average greenhouse gas emissions (including land use change and forestry) per capita, 1990-2014



Source: World Resources Institute (WRI), 'CAIT Climate Data Explorer' (WRI, 2017), available at: http://cait.wri.org (20 March 2018).

These indicators of economic development and historical emissions show that any hybrid assessment developed is likely to show that Australia's current emissions reduction targets are not in line with our share of the global abatement task. Australia is likely to be placed under pressure, either domestically or internationally, to take on a more reasonable share of climate action.

Conclusion

In order to keep global average surface temperature increases to less than 2°C above pre-industrial levels, it is necessary for cumulative global greenhouse gas emissions to be limited to roughly 950 $GtCO_2$-e from 2018. If global emissions remain at current levels, this budget will be expended within 19 years. The only way to expand the size of the budget is through the development and deployment of one or more large-scale negative emissions technologies that remove greenhouse gases from the atmosphere.[48] While the development of such technologies is possible, it would be a high risk strategy to base global mitigation policy on the prospect of their emergence.[49] The small size of the remaining global emissions budget means all nations need to rapidly decarbonise.

Despite the apparent urgency of the situation, to date, the international community has struggled to agree on an equitable division of the global emissions budget. This is mainly attributable to the reluctance of nations to incur the short- and medium-term economic and political costs of mitigation, at least in the absence of collective action. The resolution of this impasse requires all major emitting nations to simultaneously pursue aggressive emission reductions.

In the absence of an internationally agreed method of determining each nation's contribution to this effort, this paper has sought to judge whether the Australian Government's and Opposition's 2030 mitigation targets fall within a 'range of reasonableness', judged according to the most widely used principle-based approaches to target setting. The results suggest the Australian Government's 26-28 percent target is inadequate according to any recognised principle-based approach. It falls well outside the ranges suggested by both population-based and cost sharing approaches, and its fairness is not improved by the inclusion of metrics from hybrid models.

The Opposition's target lies at the lower end of the range suggested by pure population-based approaches and outside of the range implied by cost sharing approaches. The inclusion of the main metrics used in hybrid models concerning economic capacity, economic, human and social development, and historic emissions undermines the case that the Opposition's target is fair. Given this, a 45 percent target for 2030 can be regarded as the bare minimum necessary for Australia to be considered to be making an equitable contribution to the achievement of

[48] Smith, P. et al. (2016) 'Biophysical and economic limits to negative emissions', *Nature Climate Change* 6: 42-50; Gasser, T., Guivarch, C., Tachiiri, K., Jones, C., Ciais, P. (2015) 'Negative emissions physically needed to keep global warming below 2 °C', *Nature Communications* 6: 7958; Fuss, S. et al. (2014), 'Betting on negative emissions', *Nature Climate Change* 4: 850-853; van Vuuren, D., Deetman, S., an Vliet, J., van den Berg, M., van Ruijven, B., Koelbl, B. (2013) 'The role of negative CO2 emissions for reaching 2°C—insights from integrated assessment modelling', *Climatic Change* 118: 15-27.

[49] Ibid.

the Paris Agreement's 2°C target, judged according to the main principle-based approaches to target setting.

One of the main reasons why the Australian Government's and Opposition's targets lie outside, and at the edge respectively, of what principle-based approaches suggest is reasonable is the small size of the remaining global emissions budget. With only roughly 950 $GtCO_2$-e remaining, any principle-based approach to target setting will result in highly developed, emissions-intensive nations like Australia having to pursue aggressive emissions reductions immediately and sustaining these reductions over the coming decades.

The small size of the remaining global emissions budget poses a significant challenge for the Paris Agreement's iterative structure, whereby nations are intended to progressively ramp-up mitigation efforts in 5-yearly cycles. If the global community is to succeed in keeping emissions within the 2°C budget, mitigation efforts in Australia and elsewhere need to be significantly accelerated on timescales shorter than those contained in the Paris Agreement.