



Climate Council of Australia

Submission to: Technology Investment Roadmap  
Discussion Paper

Addressed to: Technology Investment Roadmap Taskforce  
via [consult.industry.gov.au](https://consult.industry.gov.au)

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## About the Climate Council

The Climate Council is an independent non-profit organisation funded by donations by the public. Our mission is to provide authoritative, expert advice to the Australian public on climate change.

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## 1. Recommendations

Recommendation 1. The Technology Investment Roadmap must factor in the scientific reality of the global greenhouse gas emissions budget in the 21st Century.

Recommendation 2. Remove all fossil fuel powered technological options from the roadmap, they are fundamentally at odds with effectively tackling climate change and will exceed the carbon budget allowance for limiting dangerous temperature rise.

Recommendation 3. The roadmap should exclusively support renewable, zero emissions technology options and enabling technologies that deliver net zero emissions.

## 2. Overview and context

We thank the Chief Scientist and the Taskforce for the opportunity to participate in this review.

At the Paris Conference of the Parties to the United Nations Framework Convention on Climate Change in 2015, the Australian Government agreed to the global goal of limiting global mean temperature increase to **well below** 2°C above pre-industrial temperatures, while pursuing efforts to limit global mean temperatures to 1.5°C above that same benchmark.<sup>1</sup> The Australian Government's agreement was given legal effect through formal ratification in the year following.<sup>2</sup>

In 2018, the Intergovernmental Panel on Climate Change (IPCC) demonstrated what would be required to meet both a 1.5°C global goal as well as a goal of well below 2°C, as a result of a reference from the Conference of the Parties to the United Nations Framework Convention on Climate. This reference resulted in the IPCC special report, *Global Warming of 1.5°C*.<sup>3</sup> This report showed a rapidly shrinking global emissions budget for the goal of limiting mean warming to well below 2°C above pre-industrial temperatures and an extraordinarily narrow window for limiting warming to 1.5°C above the same benchmarks.

The best available science, developed through more than a century of scientific inquiry,<sup>4</sup> indicates that global temperatures do not stabilise

until carbon dioxide concentrations in the atmosphere are held steady.<sup>5</sup> The extraordinarily long life of carbon dioxide in the atmosphere means that the only way to stop global atmospheric carbon dioxide concentrations from increasing is for the world to reach a point where the sources of carbon dioxide are balanced by sinks, meaning that additional carbon dioxide is no longer being added to the global atmosphere each year.<sup>6</sup> This point is also known as the point of 'net zero emissions'.<sup>7</sup>

Reaching this point is vital, but even if the global community were to drastically reorient toward net zero emissions today, the reality is that the 1.5°C goal outlined in the Paris Agreement is now very likely out of reach.<sup>8</sup> A global mean temperature increase of 1.5°C represents very large additional risks over where global mean temperatures are today—about 1.1°C above the 1850-1900 average.<sup>9</sup>

While global average temperatures are meaningful, these also tend to hide the full extent of the climate impact in any given region. The mean temperature for 2019 was already more than 1.5°C above the average temperature of 1961-1990, let alone preindustrial temperatures.<sup>10</sup> The ten hottest years on record for Australia have all occurred since 1998, and recent analysis has shown that by 2100, Australia's average temperature could be expected to increase by 7°C if long-term emissions reduction goals outlined in the Paris Agreement are not met.<sup>11</sup>

Meeting the global temperature goals outlined in the Paris Agreement are crucial for a country as exposed to climate impacts as Australia. In the past 12 months, this country has seen drought of unprecedented scale—exacerbated by climate change<sup>12</sup>—the Black Summer fires—exacerbated by climate change<sup>13</sup>—and the third mass bleaching of the Great Barrier Reef in five years—exacerbated by climate change.<sup>14</sup> These events have occurred against a background warming of 1.1°C above the average temperature in the second half of the nineteenth century.<sup>15</sup>

Average annual rainfall in southwestern Western Australia has plummeted from 710 millimetres per year in 1911–1920 to 621 millimetres per year in 2011–2018.<sup>16</sup> This is a total reduction in rainfall of 12.5% across the region, with far greater change to come.<sup>17</sup>

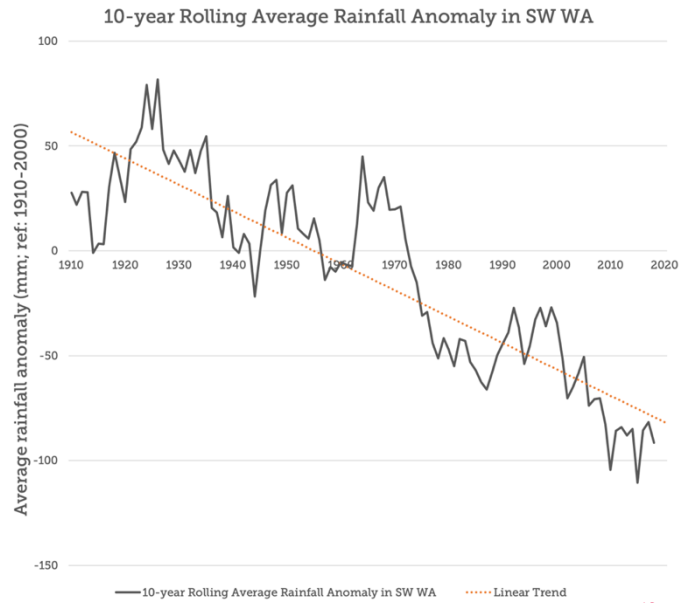


Figure 1. Data source: Bureau of Meteorology (2020).<sup>18</sup>

These changes in rainfall are a core driver of the collapse in streamflows in Perth-area dams highlighted below in Figure 2.

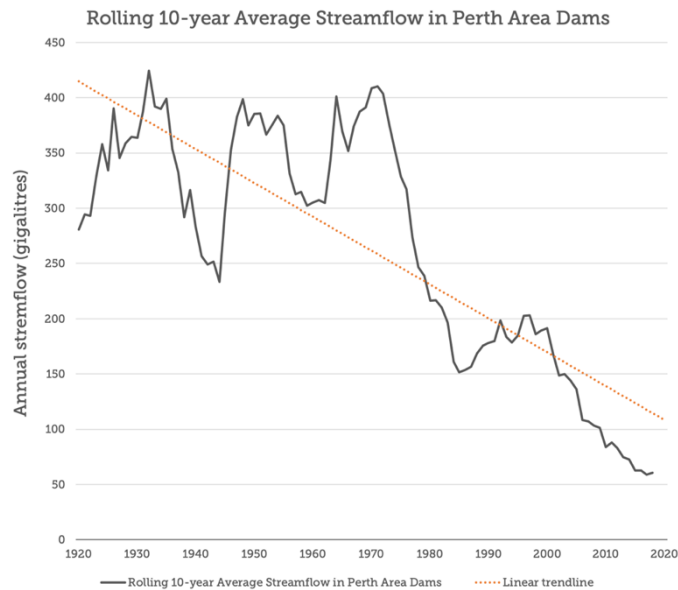


Figure 2. Data source: Water Corporation of WA (2019).<sup>19</sup>

This can be partnered with a more general trend towards reduced cool season rainfall in Australia's significant agricultural regions; cool season rainfall has also been declining across southern Australia over recent decades. In the southeast of the country, April-October rainfall has decreased by around 11 percent since the 1990s.<sup>20</sup> (CSIRO and BoM 2018).

### 3. An equitable share of the global emissions budget

If the Technology Investment Roadmap is to have any legitimacy or to create a realistic vision of Australian prosperity, it must face up to the reality of the global greenhouse gas emissions budget, which Australia is a significant influencer over. As will be shown below, the window of opportunity to hold mean warming to levels that enable Australians to have relatively productive—and relatively safe—lives and livelihoods is rapidly shrinking.

In *Global Warming of 1.5°C*, the IPCC outlined clearly what is required to meet the globally agreed temperature goals by linking the amount of additional global carbon dioxide emissions occurring after 1 December 2018 to a relative probability of holding global temperatures to a given temperature goal.<sup>21</sup> The numbers given define the remaining global carbon budget for a given temperature goal.

The remaining global carbon budget can be allocated among countries or states to determine the emissions budget for that region.<sup>22</sup> This same process was undertaken as part of the Climate Change Authority's 2014, *Targets and Progress Review*.<sup>23</sup> There are several means of allocating the global emissions budget, depending on competing visions of fairness, and several assumptions that must be made relating to emissions from non-CO<sub>2</sub> greenhouse gases and other matters.

Australia is an extraordinarily large emitter of fossil fuels in both absolute and relative terms<sup>23</sup>. As the 14<sup>th</sup> highest emitter Australia emits more than 181 of the world's 195 nations.<sup>24</sup> Of all developed nations, Australia is the highest per person emitter as well, emitting more per individual than all but a handful of very small, very emissions-intensive countries such as Qatar and Kuwait.<sup>25</sup> This is even before considering that Australia is an extraordinarily large exporter of fossil fuels.<sup>26</sup> It is the world's largest liquefied gas exporter, the world's largest metallurgical coal exporter, and the world's second largest thermal coal exporter.<sup>27</sup>

As a result of this, even using neutral assumptions, and an extraordinarily generous allocation of the global emissions budget, Australia's share of the remaining emissions budget is vanishingly small.

This analysis makes the following assumptions in line with the IPCC's special report:<sup>28</sup>

- Emissions from non-CO<sub>2</sub> gases will overall have a neutral effect—that is, the warming effect from methane, nitrous oxide and the variety of lesser greenhouse gases will be offset by the cooling effect of aerosols.
- The melting of Arctic permafrost will see 100 GtCO<sub>2</sub> added to the atmosphere as temperatures rise.

- Anthropogenic emissions of greenhouse gas between the beginning of the industrial revolution in the 18<sup>th</sup> Century and the IPCC reference period (the mean temperature over 1850-1900) were sufficient to warm the planet by 0.05°C.

Alongside this, based on research not available at the time the special report was released,<sup>29</sup> a further 198 GtCO<sub>2</sub> is deducted from the global emissions budget as a result of forest dieback. As temperatures increase, so too does the emission of carbon from burnt and decaying forests. This is proved most vividly by the fact that, on the Federal Government's own numbers, the Black Summer fires saw 830 MtCO<sub>2</sub> released into the atmosphere.<sup>30</sup> There is significant doubt around whether this carbon will ever be recovered in full.<sup>31</sup>

The resulting global budget was allocated to Australia using the same method of contraction and convergence as was relied on by the climate change Authority in its 2014 review.<sup>32</sup> This is the most generous form of equitable allocation that is compliant with the principle of 'common but differentiated responsibilities and respective capabilities' which permeates multilateral climate governance.<sup>33</sup> This results in an extraordinarily large allocation of the global emissions budget being allocated to Australia. The Authority's allocation results in 0.97% of the global emissions budget being passed to Australia—a country with 0.33% of the global population. This results in the allocations shown below in Table 1.

Table 1: Equitable allocation of the remaining global emissions budget for Australia against given temperature goals and probabilities from 1 January 2018. The calculations here are based on the IPCC's special report, *Global Warming of 1.5°C* and Steffen (2018). Assumptions and methodology detailed in text.

		Probability of meeting temperature goal		
		67%	50%	33%
Temperature goal	1.5°C	310 Mt CO <sub>2</sub> -e	1,862 Mt CO <sub>2</sub> -e	4,384 Mt CO <sub>2</sub> -e
	1.6°C	1,765 Mt CO <sub>2</sub> -e	3,705 Mt CO <sub>2</sub> -e	6,712 Mt CO <sub>2</sub> -e
	1.7°C	3,220 Mt CO <sub>2</sub> -e	5,500 Mt CO <sub>2</sub> -e	8,895 Mt CO <sub>2</sub> -e
	1.8°C	4,675 Mt CO <sub>2</sub> -e	7,246 Mt CO <sub>2</sub> -e	11,223 Mt CO <sub>2</sub> -e
	1.9°C	6,130 Mt CO <sub>2</sub> -e	8,992 Mt CO <sub>2</sub> -e	13,551 Mt CO <sub>2</sub> -e
	2.0°C	7,585 Mt CO <sub>2</sub> -e	10,786 Mt CO <sub>2</sub> -e	15,927 Mt CO <sub>2</sub> -e

In the 2018 calendar year, Australia emitted 537.4 million tonnes of carbon dioxide-equivalent greenhouse gas as a result of human

activity.<sup>34</sup> This means that Australia's allocation of the global emissions budget for the world being more likely than not to limit global temperatures to 1.5°C by 2100 was exhausted part way through the same year.

The upper end of the range for the Paris Agreement's global temperature goal, as noted above, is to limit mean warming to well below 2°C above pre-industrial temperatures by 2100. Noting the considerable extra risk the flows from 2°C warming,<sup>35</sup> here 'well below' 2°C is interpreted as a goal to emit no more than what the current range of models indicate is capable of offering a 67% chance of limiting global temperatures to 1.8°C above pre-industrial temperatures.

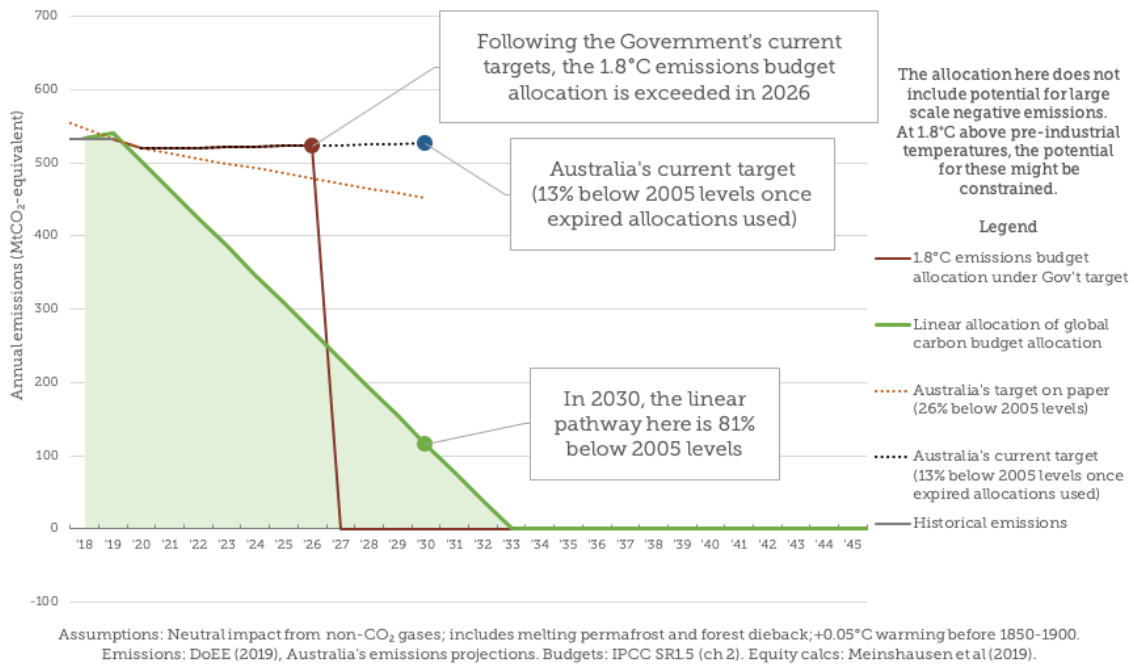
This means, with neutral assumptions and an exceedingly generous allocation of the global emissions budget, Australia can emit a total of 4,675 Mt CO<sub>2</sub>-e between 1 January 2018 and the point of net zero. The combined emissions from the 2018 and 2019 calendar years, according to official government data,<sup>36</sup> were 1,070 MtCO<sub>2</sub>-e, meaning that from 1 January 2020, only 3,605 Mt. This is small enough that the allocation is exhausted partway through 2026. To put that into context, see Figure 3 below.

The reality is that Australia and the International community have had decades to act on climate change, based on decades of scientific warnings of the escalating climate risks. Yet the gap between what science says is necessary to tackle the climate crisis and the policy response has grown ever wider.<sup>37</sup> The current Government target, while notionally a 26% to 28% reduction on 2005 levels by 2030 is intended to be met through the use of expired allocations from Kyoto commitment periods.<sup>38</sup> This makes the Federal Government's 2030 goal a de facto stabilisation of emissions at current levels.

Notwithstanding that the use of these allocations against the Paris goal is entirely invalid and runs counter to the spirit of the Paris climate agreement,<sup>39</sup> following that trajectory would see Australia's entire allocation exhausted in 2026, six years from today. Following such a path would require a rethink of who the sunniest and windiest inhabited continent on the planet is, and could be, in a zero emissions world.<sup>40</sup>



Figure 3: Australia's share of the global greenhouse gas emissions budget for a 67% chance of limiting mean warming to 1.8°C above pre-industrial temperatures using contraction and convergence allocation and Federal Government targets.



Unfortunately, it seems that the Technology Investment Roadmap is incapable of leading such a rethink as currently conceived. As such, the work is incapable of accurately reflecting the risks and opportunities for Australia.

Until its research is based on the reality facing this country, and the rest of the world as we move further into the 21<sup>st</sup> Century, it is difficult to see any benefit that might come from this exercise.

**Recommendation 1.** The Technology Investment Roadmap must factor in the scientific reality of the global greenhouse gas emissions budget in the 21<sup>st</sup> Century.

**Recommendation 2.** Remove all fossil fuel powered technological options from the roadmap, they are fundamentally at odds with effectively tackling climate change and will exceed the carbon budget allowance for limiting dangerous temperature rise.

**Recommendation 3.** The roadmap should exclusively support renewable, zero emissions technology options and enabling technologies that deliver net zero emissions.

## Endnotes

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<sup>2</sup> United Nations Treaty Collection, "Paris Agreement," United Nations, accessed June 19, 2020,

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