

Chapter 21

Te ekenga 1.5°C me Te Ahungaroa o Aotearoa

The global 1.5°C effort and Nationally Determined Contribution for Aotearoa

Chapter 21 and 22 summaries

The global 1.5°C effort and Nationally Determined Contribution for Aotearoa and Factors relevant to setting the level of the Nationally Determined Contribution

The Minister of Climate Change asked us to review the current Nationally Determined Contribution (NDC) for Aotearoa (2021-2030). This was to determine whether the current NDC is compatible with contributing to global efforts to limit global warming to 1.5°C above pre-industrial levels.

Our assessment is that the current NDC is not compatible with contributing to global efforts to limit global warming to 1.5°C.

Aotearoa has committed to reducing net emissions to 30% below 2005 gross emissions levels, over the 2021-2030 period.

For the NDC to be compatible with the 1.5°C goal, it would need to reflect emissions reductions much more than 36% below 2005 levels by 2030.

The Climate Change Commission has not provided a specific recommendation on what the NDC should be. This is a political and ethical issue, which will require elected representatives to make decisions on the importance of factors that contribute to the 1.5°C goal. Factors include the cost Aotearoa is willing to bear, social and economic impacts, international expectations and reputation, relative comfort with climate risk, and the balance of how much we do at home versus how much we do internationally.

There is a big gap between what we can do domestically and what we must do to meet our international commitment with the NDC. This is because to meet previous climate change targets, Aotearoa has relied on offsetting through forestry and offshore carbon credits, rather than reducing total emissions. This gap will need to be bridged with offshore mitigation.

Changes in our final advice

Our assessment of the NDC has not changed, however, we have added more detail and updated some numbers.

We have provided more explanation around how we account for forests, how we have used modelling from the Intergovernmental Panel on Climate Change (IPCC) *Special Report on Global Warming of 1.5°C*, and why the current NDC is hard to meet domestically, including historical context around the use of forest offsets in Aotearoa.

In updating the numbers, we have reflected the latest Ministry for the Environment (MfE) *New Zealand's Greenhouse Gas Inventory* (published in April 2021) in our assessment of how much the current NDC allows Aotearoa to emit, and our assessment of pathways that would be compatible with 1.5°C. We have also updated our analysis to treat fluorinated greenhouse gases the same as other greenhouse gases.

Introduction

- 1 The Paris Agreement includes a collective goal to hold the increase in the global average 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.
- 2 Each country is required to set successive, and progressively more ambitious, Nationally Determined Contributions (NDCs) which outline their contribution to the global effort to limit the impacts of climate change.
- 3 In its first NDC, Aotearoa committed to reduce net greenhouse gas emissions to 30% below 2005 levels of gross emissions by 2030. This means Aotearoa can emit net emissions of no more than 596 MtCO₂e over the 2021-2030 period. Further detail on how net emissions are accounted for is set out in *2021 Supporting Evidence, Chapter 3: Rules for measuring progress*.
- 4 Under section 5k of the Climate Change Response Act (the Act), the Minister of Climate Change requested advice from the Commission on:

“whether the NDC is compatible with contributing to the global effort under the Paris Agreement to limit the global average temperature increase to 1.5°C above pre-industrial levels.”
- 5 There is no universally agreed upon approach to limit the global average temperature increase to 1.5°C above pre-industrial levels (the global 1.5°C effort).
- 6 Scientific modelling can help inform our understanding of the global emissions reductions that will be required to limit the global average temperature increase to 1.5°C above pre-industrial levels. The Intergovernmental Panel on Climate Change (IPCC) has assessed emission reduction pathways it considers would be consistent with a likely chance (50-66%) of limiting the increase on global average temperature to within 1.5°C above pre-industrial levels (the IPCC 1.5°C pathways).
- 7 However, science alone cannot determine the share Aotearoa should contribute to those global reductions. Reaching a conclusion on this also depends on social and political judgements about international equity. These should be made by the Government of the day.
- 8 This chapter responds to the Minister’s section 5k request, by:
 - setting out the modelled global reductions for each individual greenhouse gas in the IPCC 1.5°C pathways

- converting those global reductions for each individual greenhouse gas to reductions at the national level for Aotearoa
- aggregating those individual greenhouse gas reductions for Aotearoa by using the GWP₁₀₀ metric to compare with the current NDC (which uses the same metric)
- exploring the extent to which Aotearoa should contribute more or less than the global average.

Box 21.3 Feedback on our draft advice on the NDC

We received a considerable amount of feedback on our draft NDC advice. Submitters generally agreed with our advice that the current NDC was not compatible with contributing to limiting the increase in global average temperature to 1.5°C above pre-industrial levels.

Submitters' feedback generally related to three main issues:

- the level of ambition and lack of precision in our recommendation
- the use of offshore mitigation in the NDC
- the way that targets and forests are accounted for.

On the level of ambition submitters were split – some wanted much deeper emissions reductions and some wanted the country to do less on climate change overall. Few submitters engaged on the approach taken to assess compatibility with contributing to the global effort.

Some, who did, commented that scenarios with low reductions of one gas are likely to have higher reductions of other gases, and so the approach of using the lower and upper quartile reductions by gas was inappropriate. We examined the underlying data and consider the approach we are using is still appropriate. The relationship submitters described is not found in the underlying modelling data.

Some submitters wanted us to recommend a precise level that the NDC should be set to, taking account of equity considerations. These submissions generally reflected a desire from those submitters for a greater level of ambition overall.

While we can advise on the technical aspects of compatibility with limiting warming to 1.5°C, the contribution Aotearoa should make to a global effort is a question for elected decision makers. We have commented in chapter 22 on some of the factors the Government may wish to consider when making this decision.

Of the submitters who commented on the NDC, many were opposed to the use of offshore mitigation, either wanting none to be included or for its use to be minimised. Submissions cited concerns around offshore mitigation being used as an excuse to avoid reducing emissions within Aotearoa, along with environmental integrity concerns.

Consequently, many submitters said that we should meet the NDC solely through domestic action. We have considered the implications of excluding offshore mitigation from the NDC in greater detail in section 22.1 and addressed the specific concerns raised about offshore mitigation in section 22.4.

Some submitters argued that the approach used to account for forestry in targets is misleading and we should account for all emissions and removals as reported in the greenhouse gas inventory. Since our first international emissions target began in 2008 under the Kyoto Protocol *New Zealand's Greenhouse Gas Inventory* has included separate figures for reporting and for accounting.

Reporting and accounting are different purposes and separating out subsets of forest ensure that we are accurately accounting for additional action taken on climate change. This approach is also consistent with how Aotearoa has treated emissions targets since 2008 and is in line with international norms and expectations. We discuss this issue in more depth in *Section 3.4 of Chapter 3: How to measure progress in our 2021 Supporting Evidence*.

21.1 Global pathways to 1.5°C

- ⁹ The IPCC's special report on 1.5°C assesses different global greenhouse emission pathways that would be consistent with a likely (50-66%) chance of limiting warming to within 1.5°C above pre-industrial levels.
- ¹⁰ These emissions pathways are based on a range of possible future scenarios. Each scenario describes a plausible set of assumptions about economic and social development, and technological and behavioural changes between now and 2100.
- ¹¹ Some of these pathways allow the increase in global average temperature to exceed 1.5°C above pre-industrial levels before falling below that level later in the century. Climate scientists refer to this as 'overshoot'.
- ¹² Pathways with little or no overshoot are more likely to deliver the best overall social, economic, and environmental outcomes. This is because if warming exceeds 1.5°C above pre-industrial levels, more significant climate impacts and adaptation needs are likely. Pathways with significant overshoot also rely on high levels of emissions removal technologies in the future, such as carbon capture and storage, which may not be feasible.
- ¹³ In order to balance achievability with the need to limit the negative outcomes of higher overshoot, we have excluded scenarios with high overshoot (more than 0.1°C above 1.5°C) from this analysis.
- ¹⁴ In all the pathways we considered, limiting warming to 1.5°C above pre-industrial levels requires rapid emissions reductions of all greenhouse gases between now and 2030. The pathways then show somewhat slower reductions out to the end of the century.
- ¹⁵ The pathways have several other features in common:
- Emissions of carbon dioxide and other greenhouse gases peak in the 2020s and then rapidly reduce through the 2030s and 2040s.
 - Emissions of nitrous oxide have relatively smaller reductions. This reflects the fewer options to reduce this gas.
 - Emissions of methane reduce significantly over the next 20 years, but do not reach zero by 2050 or 2100. This reflects the short-lived nature of the gas, and the smaller range of mitigation options currently available.
 - Emissions of long-lived greenhouse gases reduce to be near zero by 2050.
- ¹⁶ Most of the pathways have some gross emissions remaining in 2050. These come from hard-to-abate sectors, like cement manufacturing. As a result, carbon dioxide needs to be removed from the atmosphere to make sure net emissions reach net zero and remain there.
- ¹⁷ Most of the pathways also require more significant carbon dioxide removals beyond what is required to reach net zero and stay there – carbon dioxide emissions need to be net negative. They need this to bring global average warming back below 1.5°C above pre-industrial levels after a temporary overshoot.
- ¹⁸ Table 21.1 below shows the reductions for carbon dioxide, agricultural methane, nitrous oxide emissions and fluorinated gases modelled in the IPCC pathways we considered. It shows the reductions of each of these gases or groups of gases in 2030, 2050 and 2100. Note that the IPCC pathways model agricultural methane rather than biogenic methane (which is used to specify the 2030 and 2050 methane targets in the Act). Biogenic methane also includes methane from the waste sector.

19 The table shows global emissions reductions from global pathways that limit global average warming to 1.5°C above pre-industrial levels. These figures show the ‘interquartile range’. The interquartile range represents the middle 50% of modelled reductions. That is, 25% of pathways were characterised by higher levels of emission reductions and 25% of pathways were characterised by lower reductions than the interquartile range. This gives a more conservative, but also more likely, range for the emissions reductions that are needed.

Table 21.1: Reductions in emissions, by gas, in IPCC pathways with no or limited overshoot (interquartile range)

	Percentage change relative to 2010		
	2030	2050	2100
Net carbon dioxide emissions	-40 to -58%	-94 to -107%	-121 to -136%
Agricultural methane emissions	-11 to -30%	-24 to -47%	-37 to -60%
Agricultural nitrous oxide emissions	+3 to -21%	+1 to -26%	-6 to -39%
Hydrofluorocarbon emissions	-65 to -77%	-78 to -90%	-67 to -83%
Perfluorocarbon emissions	-59 to -70%	-83 to -94%	-95 to -98%
Sulphur hexafluoride emissions	-49 to -67%	-74 to -80%	-84 to -96%

Source: IPCC, Special Report on 1.5°C, Summary for Policymakers, Table SPM.3b. Integrated Assessment Modelling Consortium data, hosted by IIASA

21.2 Applying the global 1.5°C pathways to a national level

20 Through the NDC, Aotearoa takes responsibility for emissions over the whole period 2021-2030. Figure 21.1 below illustrates how the 2030 point year NDC target is converted into a total amount of allowed emissions over the NDC period.

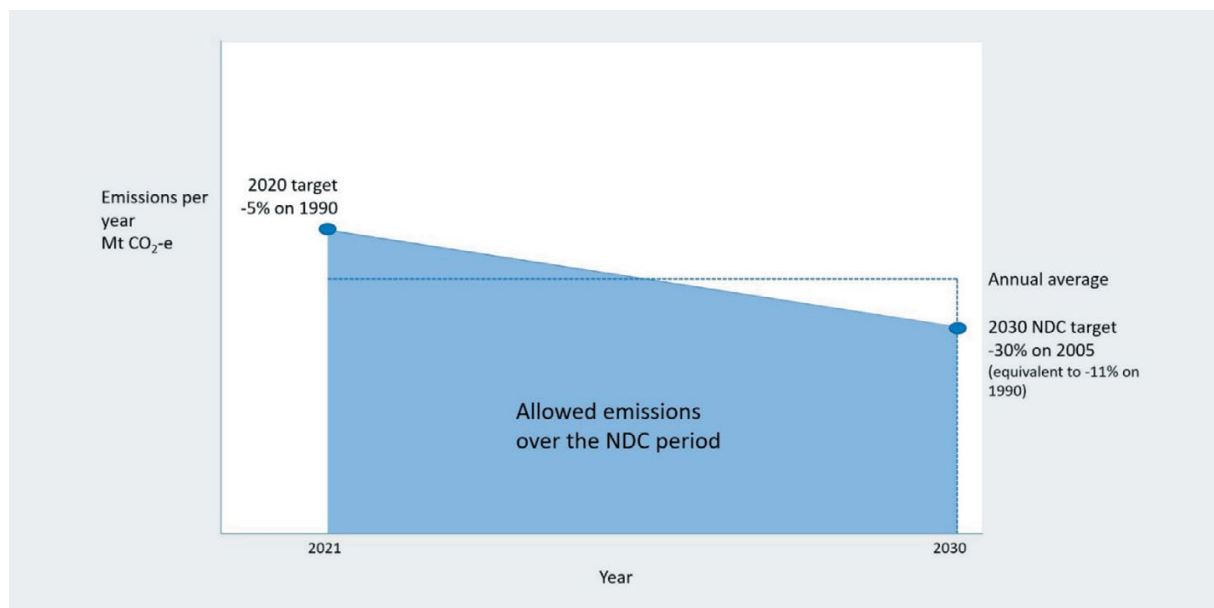


Figure 21.1: Illustration of conversion of the country's existing 2030 NDC target to an amount of allowed emissions

Note: The 2030 NDC target is to reduce emissions to 30% below 2005 levels. Here it is presented as a reduction against 1990 levels for easier comparison to the 2020 target that preceded it.

- ²¹ To provide a starting point to assess the compatibility of our NDC with the global 1.5°C effort, we convert the global reductions for each individual greenhouse gas set out in the IPCC 1.5°C pathways (see Table 21.1 above) to reductions at the national level for Aotearoa.
- ²² We note again here that this is only provided as a starting point. Other considerations should be taken into account when determining the extent to which Aotearoa should commit to greater proportional reductions than the global average. These considerations are discussed later in this chapter.

Box 21.1 Balance of modelling and qualitative judgements in assessing the NDC

The IPCC assessed emissions pathways, for different gases, that are compatible with limiting warming to 1.5°C above pre-industrial levels. However, under the Paris Agreement, emissions reduction commitments in NDCs are expressed using the GWP₁₀₀ metric to provide an equivalence (carbon dioxide equivalence, or CO₂e). See the *2021 Supporting Evidence, Chapter 1: The science of climate change* for more information on emissions metrics.

Our analysis converts the global reductions for each individual greenhouse gas (set out in the IPCC 1.5°C pathways) to reductions at the national level for Aotearoa. We then applied the GWP₁₀₀ metric to reach comparable figures in CO₂e.

The IPCC did not consider reductions for individual countries as part of the pathways it assessed. Applying global-scale modelling to Aotearoa is a blunt approach. However, it does provide a starting point, based on scientific modelling, for addressing the question of whether the NDC is compatible with contributing to the 1.5°C goal.

From this starting point, further assessment of our contribution's compatibility with 1.5°C depends on ethical and political judgements about international equity. The Commission considered some of these judgements in our analysis.

However, recommending a particular level for the NDC is beyond our mandate, and falls under the remit of the Government of the day.

21.2.1 Converting global emissions reductions to reductions at the national level for Aotearoa

- ²³ Table 21.1 shows the global emission reductions needed, by gas, in IPCC 1.5°C pathways with no or limited overshoot (interquartile range).
- ²⁴ We converted global emissions required to a national level using both upper and lower quartiles of emissions allowed in the IPCC 1.5°C pathways as shown in Table 21.2 below. There is a detailed explanation of this approach and the calculations made in *2021 Supporting evidence, Chapter 13: Requests under s5K relating to the NDC and biogenic methane – supporting evidence*.
- ²⁵ Applying this approach to the emissions profile of Aotearoa, emissions would be 527 MtCO₂e (lower quartile) to 608 (upper quartile) MtCO₂e over the 2021-2030 NDC period. This would be made up of:
- 191-225 Mt carbon dioxide
 - 10.9-12.4 Mt methane
 - 0.194-0.228 Mt nitrous oxide
 - 5.4-6.2 MtCO₂e of hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.

Table 21.2: Equivalent NDCs for Aotearoa applying the upper and lower quartile of reductions in IPCC pathways

	Allowed emissions in NDC period (Mt CO ₂ e)	Equivalent 2030 target level (% reduction on 2005)
Upper quartile IPCC pathways (higher emissions)	608	27%
Midpoint reductions of interquartile range	568	36%
Lower quartile IPCC pathways (lower emissions)	527	45%

Note: We selected the midpoint of the interquartile range in order to facilitate the assessment of the Aotearoa NDC.

²⁶ The current NDC for Aotearoa works out as an NDC budget of 596 MtCO₂e. This is equivalent to the 67th percentile, putting it towards the higher end of allowed emissions that are compatible with limiting warming to 1.5°C, using this approach.

²⁷ This approach does not account for considerations of how effort should be shared between countries. This is considered in section 21.2.3 and discussed further in the following chapter.

Box 21.2 Quantitative changes made since 2021 Draft Advice for Consultation

We have updated the calculation of the current NDC budget and the comparisons based on applying the IPCC 1.5°C pathways to Aotearoa. These figures have been adjusted to account for the methodological improvements to *New Zealand's Greenhouse Gas Inventory* published in April 2021.

The biggest changes in the new inventory were due to updated data on pasture quality and new research on organic soils. Collectively, the inventory improvements resulted in total reported emissions increasing by 1.0 - 1.7 Mt CO₂e per year in all years between 1990 and 2018.

The increase in the estimation of past emissions changes the base year emissions used to calculate the NDC budget, and the calculations we make to convert the IPCC 1.5°C pathways to a national level for Aotearoa.

In the draft advice we had applied a pathway for all synthetic fluorinated gases that was in line with the reductions required by the Kigali amendment to the Montreal Protocol. We have since elicited emissions pathways for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride from the modelling for the IPCC's 1.5°C report. We have used this data to apply a consistent methodology across all greenhouse gases. This lowers the allowed emissions under the IPCC pathways by 7.5 - 8.2 MtCO₂e over the NDC period.

21.2.2 The IPCC 1.5°C pathways reflect uncertainty about the future

²⁸ The emissions reductions in the IPCC 1.5°C pathways have a wide range. This reflects the fact that there are multiple possible emissions pathways modelled as compatible with limiting warming to 1.5°C.

29 This range reflects the difficulty of predicting exactly how future drivers of emissions, like global population, wealth, or behaviour change might affect the costs of different mitigations. There is also uncertainty in exactly how the global climate will respond to future emissions – for example, how sensitive temperature responses are to increases in carbon dioxide.

30 Because of these uncertainties, the warming outcomes of the different pathways are expressed as probabilities – how likely it is that they would limit the increase in global average temperature to 1.5°C above pre-industrial levels.

31 In its special report, the IPCC only considered emissions reduction scenarios that had a 50-66% chance of limiting warming to 1.5°C above pre-industrial levels by the end of the century. This means that even if the emissions reductions in the scenarios were achieved, there is still a 34-50% chance that warming will exceed 1.5°C.

32 More ambitious NDCs (closer to the lower quartile of emissions in IPCC pathways) are associated with pathways with larger reductions in emissions, and which are less likely to overshoot. More ambitious NDCs will be compatible with limiting the increase in global average temperatures to 1.5°C above pre-industrial levels in a greater number of plausible future scenarios. The reverse is also true.

33 And while all the pathways in the interquartile range have a 50-66% chance of limiting the increase in global average temperatures to 1.5°C above pre-industrial levels, the pathways that focus on earlier emissions reductions rely less on removing large amounts of carbon dioxide from the atmosphere in later decades.

34 The scale of carbon dioxide removals required in some pathways that focus on smaller or later reductions in emissions may not be achievable. These pathways could also have a range of negative impacts on people, communities, and economies. The IPCC notes that relying on large scale carbon dioxide removals presents a major risk that the world will not be able to limit the increase in global average temperatures to 1.5°C above pre-industrial levels.

21.2.3 Developed countries have agreed to lead the way

35 Developed countries have emitted more cumulative emissions than developing countries, for longer, and have benefited as a result.

36 Under the Paris Agreement, each country's contribution to the collective effort is determined nationally. The Paris Agreement does not specify how emission reductions are to be shared between countries.

37 However, the UN Framework Convention on Climate Change (the UNFCCC) and the Paris Agreement both make reference to developed country leadership in climate change action.

38 One of the core principles of the UNFCCC is stated in its Article 3.1 that:

“the developed country Parties should take the lead in combating climate change and the adverse effects thereof.”

39 The point is reinforced in Article 4(1) of the Paris Agreement which states:

“In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter...”

40 With a goal of limiting warming to below a certain temperature, emissions reductions are a zero-sum game. If one country reduces emissions by a smaller amount, another country must reduce emissions by more if the world is to remain on track.

41 Given that emissions in developing countries will peak later, in recognition of their development needs, emissions in developed countries must peak and reduce more quickly than the global average.

42 This obligation is on developed countries in the aggregate and does not imply specific obligations on individual countries. However, it is an important factor to consider when thinking about what a suitable contribution from Aotearoa might be.

43 We consider that if Aotearoa is to contribute to a global effort towards limiting warming to 1.5°C above pre-industrial levels, it should contribute more than the global average required. Adopting an approach that implies the same proportionate reductions of all countries is not sufficient.

21.2.4 The current NDC is not compatible with the global 1.5°C effort

44 The emissions reductions required globally to limit the increase in global average temperature to 1.5°C above pre-industrial levels likely lie within the interquartile range of the IPCC pathways.

45 The current NDC is just above the lower end of the range presented in Table 21.2 – as illustrated in Figure 21.2 below.



Figure 21.2: The current NDC and NDC targets associated with the IPCC 1.5°C interquartile range

46 As noted above (21.2.2), higher levels of emissions are associated with higher risk of overshoot. They are also more likely to rely on potentially infeasible levels of carbon dioxide removals in the latter part of the century to bring the increase in global average temperature back below 1.5°C above pre-industrial levels.

47 This means that the current NDC is aligned with a level of effort that, if adopted by all countries, carries major risks in terms of its ability to limit warming to 1.5°C. As a developed country, Aotearoa has agreed to “take the lead”. To be compatible with contributing to limiting warming to 1.5°C, the NDC needs to reflect deeper emission reductions than the global average necessary.

48 Our advice is that the NDC should reflect emissions much lower than just aligning with the middle of the IPCC interquartile range. This means emissions of much less than 568 MtCO₂e over the 2021-2030 period, or reductions of much more than 36% below 2005 levels by 2030.

49 How much stronger the NDC should be beyond this is a question for elected decision makers, given the social, political and ethical judgements involved.

Recommendation 29

Compatibility of the NDC with contributing to the global 1.5°C effort

We advise that the first NDC is not compatible with Aotearoa making a contribution to global efforts under the Paris Agreement to limit the increase in global average temperature to 1.5°C above pre-industrial levels.

Recommendation 30

Making the NDC compatible with contributing to the global 1.5°C effort

1. We recommend that to make the NDC more likely to be compatible with contributing to global efforts under the Paris Agreement to limit warming to 1.5°C above pre-industrial levels, the contribution Aotearoa makes over the NDC period should reflect a reduction to net emissions of much more than 36% below 2005 gross levels by 2030, with the likelihood of compatibility increasing as the NDC is strengthened further.
2. How much the NDC is strengthened beyond 36% should reflect the tolerance for climate and reputational risk and economic impact, and principles for effort sharing, which require political decisions. Any changes to the NDC should be developed in partnership with Iwi/Māori, to give effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi and align with the He Ara Waiora framework.