IN THE HIGH COURT OF NEW ZEALAND
WELLINGTON REGISTRY

I TE KŌTI MATUA O AOTEAROA
TE WHANGANUI-Ā-TARA

CIV-2021-485-000341

UNDER	Judicial Review Procedure Act 2016 and part 30 of the High Court Rules 2016
IN THE MATTER OF	an application for judicial review
BETWEEN	**LAWYERS FOR CLIMATE ACTION NZ INCORPORATED** Applicant
AND	**THE CLIMATE CHANGE COMMISSION** First Respondent
AND	**MINISTER FOR CLIMATE CHANGE** Second Respondent

AFFIDAVIT OF MATTHEW JAMES SMITH

(Climate Change Commission - NDC advice)

Affirmed: 10 December 2021

Counsel acting: Victoria Casey QC
Clifton Chambers

Luke Cunningham Clere
Barristers & Solicitors
PO Box 10-357
WELLINGTON

I, Matthew James Smith, Principal Analyst, of Wellington, affirm–

INTRODUCTION

1. My full name is Matthew James Smith. I am a Principal Analyst in the Budgets, Adaptation and Markets team at He Pou a Rangi Climate Change Commission.

2. I was the lead analyst for the Commission's work in response to the request from the Minister of Climate Change, Hon James Shaw, to provide a report on the compatibility of New Zealand's nationally determined contribution under the Paris Agreement with contributing to the global effort to limit the global average temperature increase to 1.5°C above pre-industrial levels.

QUALIFICATIONS AND EXPERIENCE

3. I have been in my role as Principal Analyst at the Commission since May 2020.

4. Prior to joining the Commission, I held the following roles:

   4.1 Ministry for the Environment, January 2007 – December 2015. I worked at the Ministry for the Environment initially as a Graduate Analyst and then as a Senior Analyst. I had several different roles in that time, with a focus on emissions reporting and accounting. Key roles included:

   (a) 2009. Project lead for the development of the Fifth National Communication under the United Nations Framework Convention on Climate Change (UNFCCC). The National Communications were a reporting requirement under the UNFCCC. They were required to be collated every four years and describe all of a country's efforts on many aspects of climate change including up-to-date emissions data and projections, estimates of the effect of climate policies on emissions, descriptions of work on adapting to the effects of climate change, support provided to developing countries, education training and public awareness, and research and scientific data collection. I led the project and managed and edited the contributions of approximately 30 people.

   (b) 2011 – 2013. New Zealand lead for national emissions projections. In this role I was responsible for the production of New Zealand's

projections of total and net emissions used for a variety of purposes. In particular, the projections under target accounting were used to quantify the government's potential liability or asset under the Kyoto Protocol.[1] Other uses included informing government on future target choices, such as the 2020 target. I coordinated the subject matter modellers across multiple departments, ensured that the overall results met QA/QC standards and were fit for purpose. This also included forecasting flows of units within the emissions trading scheme (ETS) and reconciling differences between ETS and national projections.

(c) 2013 – 2015. Private Secretary to the Minister for Climate Change Issues. From 2013 – 2015 I was seconded into the office of Hon Tim Groser, the then Minister for Climate Change Issues. I was the key liaison point between the Minister and government agencies. I advised the Minister on technical matters within my expertise, and supported him through the international negotiation process up to, and including, the confirmation of New Zealand's Intended Nationally Determined Contribution (INDC) and the negotiation of the Paris Agreement. It was part of my role to assist the Minister's understanding of the technical papers and advice he received, so it was essential that I understood the detail of the targets decisions being taken.

4.2 PwC, January 2016 – December 2017 (Senior Analyst) and January – September 2018 (Manager). After the conclusion of the Paris Agreement, I worked at PwC as in the Finance and Economics team. I undertook a range of policy reviews for predominantly government clients, including the Energy Efficiency and Conservation Authority, New Zealand Transport Agency, Ministry for Business, Innovation and Employment and Department of Conservation. I also led a series of land-use sustainability and data projects alongside AgResearch as part of the Our Land and Water National Science

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1 As the Kyoto Protocol was a binding target and the government could trade any overachievement to other countries, and was liable to purchase units to meet any underachievement, the forecast of future emissions against the target level represented an asset or liability on the scale of hundreds of millions of dollars that needed to be accounted for under the Public Finance Act 1989.

Challenge. The publications arising out of this work are included in my CV, which is included in the CBD.[2]

4.3 Ministry for the Environment, October 2018 – April 2020, Senior Analyst. In October 2018 I re-joined the Ministry for the Environment, as a Senior Analyst in the Transition Hub – a team established to develop evidence and give advice on how New Zealand could transition to a low emissions economy. Here I provided technical analysis on detailed policies (particularly energy and transport policies) as well as leading advice on overall strategic direction of policies, and on how the NDC could feasibly be met. I also led work on responding to the Productivity Commission's report *Low Emissions Economy*, which laid out 77 recommendations for the government.

5. I have particular expertise in the following areas:

5.1 Emissions reporting and accounting. I worked for six years in the team that managed New Zealand's reporting and accounting obligations, ensuring that we were meeting international obligations under the UNFCCC, and the Kyoto Protocol, and accurately accounting for targets. I led our projections of future emissions for several years, during which new targets were assessed and decided by the government. Having a clear understanding of the differences between different emissions accounting methods, and the reasons for them, is an essential element of this role.

5.2 Relating changes in emissions back to the real world implications. Because of my experience working with production of the New Zealand Greenhouse Gas Inventory I am intimately familiar with New Zealand's sources and sinks of emissions, and how these compare internationally. This means that in advising on targets the numbers are not abstract concepts to me: I am always aware of what they mean 'on the ground' in New Zealand's particular circumstances.

5.3 Mitigation policy – via my work on policy reviews at PwC and through the Transition Hub I am familiar with the key policy mechanisms that can be used to reduce greenhouse gas emissions, the ways in which they interact, and the types of problems more suited to one policy response versus another.

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2 CBD at [•].

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6. In 2006 I completed an LLB at Victoria University of Wellington. In 2010 I completed a BSc with majors in mathematics and environmental studies. In 2012 I was admitted to the bar as an enrolled barrister and solicitor.

7. My CV is at [•] of the CBD.

SCOPE OF MY EVIDENCE

8. The Commission's Advice to the New Zealand Government is set out in *Ināia tonu nei: a low emissions future for Aotearoa*, released on 21 June 2021, and its Supporting Volumes. The advice relating specifically to the NDC is set out in Chapters 21 and 22 of the Advice,[3] although the general Chapters are also relevant, including especially Chapters 2 to 4,[4] and 9 and 10[5]. Of the Supporting Volumes published with the Advice, Chapter 13 is addressed to this issue, and Chapters 1 to 3 are also particularly relevant.

9. The purpose of my evidence is to address the specific criticisms of the Commission's Advice relating to the NDC raised by the Lawyers for Climate Action New Zealand Inc (LCANZ) in this judicial review proceeding, and to respond to the evidence filed on behalf of LCANZ. While the Commission was aware of LCANZ' views prior to finalising the Advice, and the Advice includes a very high level response, a much deeper level of detail is required to respond in full to the allegations raised in this proceeding. In particular, LCANZ' allegations relating to the NDC appear to be based on a fundamental misunderstanding of climate change accounting principles, which in turn requires a much more detailed explanation of those principles and how they have been applied in this context than the Commission considered necessary to present in its Advice.

10. I am authorised to provide this evidence on behalf of the Commission.

11. To the extent that my evidence includes matters of expert opinion, I confirm that I have read and agree to comply with the Code of Conduct for expert witnesses in Schedule 4 of the High Court Rules, and I confirm that the evidence I give is within the area of my expertise.

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3 Climate Change Commission *Ināia tonu nei: a low emissions future for Aotearoa* (June 2021), Advice Bundle at 365 – 374 and 375 – 391.

4 Advice Bundle at 35 – 50, 51 – 61 and 63 – 75.

5 Advice Bundle at 200 – 210 and 211 – 223.

12. In terms of the structure of my evidence, I first outline the relevant context:

12.1 The Paris Agreement, New Zealand's first NDC, the Minister's request for advice, a summary of the advice that the Commission gave to the government on the (then current) NDC, and the government's subsequent communication of a revised NDC.

12.2 A brief outline of the basic concepts of 'gross' and 'net' emissions in climate change accounting, LULUCF (land use, land use change and forestry) and the concepts of gross-net accounting.

13. I then outline the methodology adopted by the Commission to assess the compatibility of the (then current) NDC with the goal of contributing to the global effort under the Paris Agreement to limit the global average temperature increase to 1.5°C above pre-industrial levels.

14. I then address the evidence that has been filed on behalf of LCANZ in this proceeding in relation to this issue.

15. I confirm that there has been no 'mathematical' or 'logical' error in the preparation of the Commission's Advice on the NDC. The so called 'error' or 'mistake' alleged by LCANZ represents a deliberate and informed choice of approach by the Commission. We were aware from communications with LCANZ, and in particular its submissions on the Commission's draft Advice, that LCANZ takes a different view on how the Commission should have approached its task. We have considered their views carefully, but in the end we did not agree with them.

DOCUMENTS

16. In my evidence I refer to a number of documents. I understand that some of these have already been provided to the Court by LCANZ, and others will be collated with material referred to by other witnesses for the Commission into a paginated supplementary bundle. References in this affidavit will accordingly be to:

16.1 The Commission's Advice and Support Volumes, referred to as "Advice Bundle" with the relevant page reference. The page references I will give will be to the page number at the top of each page (not the original page numbers, as these were not continuous in the original volumes);

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16.2 LCANZ' bundle of documents, referred to as "LBD" with the relevant page reference;

16.3 Commission's supplementary bundle of documents, referred to as "CBD" with the relevant page reference.

CONTEXT

The Paris Agreement, the NDC and the Commission's advice

17. The Paris Agreement[6] was adopted by 196 Parties at the 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) in Paris in December 2015.[7] New Zealand signed the Paris Agreement on 22 April 2016 and ratified the Agreement on 4 October 2016.

18. One of the objectives of the Paris Agreement is the collective goal of holding the increase in 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 (Article 2.1(a)).[8]

19. The Paris Agreement places a requirement on each state Party to prepare, communicate and maintain successive nationally determined contributions (NDCs) that it intends to achieve to contribute to the global effort to limit the impacts of climate change (Article 4.2).[9] Each successive NDC set by a Party must represent progression beyond the previous one and reflect the Party's highest possible ambition, reflecting its common but differentiated responsibilities and respective capabilities, in light of different national circumstances (Article 4.3).[10]

20. New Zealand communicated its intended first NDC (for the period 2021 – 2030) to the UNFCCC secretariat on 7 July 2015, pending the Paris Agreement entering into force. New Zealand committed to reduce greenhouse gas emissions to 30 percent below

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6 Paris Agreement (opened for signature 22 April 2016, entered into force 4 November 2016).

7 United Nations Framework Convention on Climate Change 1771 UNTS 107 (opened for signature 4 June 1992, entered into force 21 March 1994). New Zealand signed the Convention on 4 June 1992 and ratified the Convention on 16 September 1993.

8 CBD at [•].

9 CBD at [•].

10 CBD at [•].

2005 levels by 2030, corresponding to a reduction of 11 percent from 1990 levels.[11] New Zealand lodged an addendum on 25 November 2015 addressing its intended approach to accounting for emissions and removals from forestry and other land use.[12] New Zealand formally confirmed its first NDC on 5 October 2016.[13]

21. New Zealand's NDC commitments are set by Cabinet, on the advice of the relevant Minister, and informed by advice from a range of departments including the Ministry for the Environment, the Ministry for Primary Industries, the Ministry of Foreign Affairs and Trade and Treasury. The Commission has no role under the Climate Change Response Act in relation to the NDC unless the Minister of Climate Change formally requests a report from the Commission under section 5K of the Climate Change Response Act.

22. On 20 April 2020 the Minister made a request to the Commission under section 5K. The Minister requested that the Commission provide advice to the government on New Zealand's first NDC.[14] The Minister requested that the Commission's advice on the NDC be provided alongside the Commission's advice on the first three emissions budgets.[15]

23. The Terms of Reference asked for:[16]

> 2) a report on New Zealand's first Nationally Determined Contribution (NDC), including:
>
> a. advice 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° Celsius above pre-industrial levels; and
>
> b. recommendations on any changes to the NDC required to ensure it is compatible with global efforts under the Paris Agreement to limit the global average temperature increase to 1.5° Celsius above pre-industrial levels.

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11 New Zealand *Submission to the ADP: New Zealand's Intended Nationally Determined Contribution* (7 July 2015), LBD at 1 – 5.

12 New Zealand *Submission to the ADP: Addendum to New Zealand's Intended Nationally Determined Contribution* (25 November 2015), LBD at 6 – 7.

13 New Zealand *Submission under the Paris Agreement: New Zealand's Nationally Determined Contribution* (October 2016), LBD at 8 – 10.

14 Hon James Shaw *Letter requesting advice under s 5 K* (20 April 2020), CBD at [•].

15 CBD at [•].

16 Hon James Shaw *Terms of Reference*, CBD at [•]. The Minister also asked for advice related to biogenic methane, which was item (1) in the terms of reference. The Commission's advice on that issue is at Chapter 23, Advice Bundle at 392 – 407.

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24. New Zealand presented an addendum to its NDC on 22 April 2020, reaffirming that New Zealand is committed to ambitious national and global climate action to achieve the aims of the Paris Agreement, and providing information on the enactment of the Climate Change Response (Zero Carbon) Amendment Act 2019, the setting of the 2050 domestic targets, the establishment of the Commission and this request for advice.[17]

25. The Commission developed its advice in tandem with its advice to the government on the first three emissions budgets and direction for the emissions reduction plan 2022 – 2025. This included the same stakeholder engagement and public consultation process.[18] The Commission released its draft Advice on 31 January 2021 and received a wide range of submissions, including submissions from LCANZ identifying the same alleged 'error' raised in this proceeding.[19]

26. The Commission's final Advice of 21 June 2021 was in substantially the same terms as the draft Advice in relation to the NDC.[20] The Commission's advice was that New Zealand's NDC was not compatible with contributing to global efforts to limit global warming to 1.5°C above pre-industrial levels, and that in order for the NDC to be compatible the contribution New Zealand makes over the NDC period should reflect a reduction to net emissions of "much more than" 36 percent below 2005 gross levels by 2030.[21]

27. The Commission did <u>not</u> set a specific figure for the recommended NDC. The Commission considered that the question of how much the NDC should be strengthened beyond 36 percent involved matters that required decisions to be made by elected representatives. The Commission however also advised on the factors that would be relevant for the government to consider in setting the level of the NDC, and

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17 New Zealand *Submission under the Paris Agreement: Communication and Update of New Zealand's Nationally Determined Contribution* (22 April 2020), LBD at 11 – 12.

18 This process is outlined in the Advice in Chapter 2: Advice Bundle at 35 – 50.

19 LCANZ *Submission to the Climate Change Commission*, LBD at 685 – 734. The Commission were also in contact with and met directly with LCANZ representatives on a number of occasions to discuss their views. The nature of this correspondence and these meetings is discussed in more detail in the affidavit of Joanna Hendy and the Commission's correspondence with LCANZ is provided in CBD at [•].

20 Other than in terms of actual numbers: as the Commission outlines in its Advice, the Advice was updated to reflect the latest Greenhouse Gas Inventory published in April 2021: Advice Bundle at 366. The Advice was also adjusted to treat fluorinated greenhouse gases in the same manner as other greenhouse gases.

21 Advice Bundle at 373 and 374.

advised that any changes to the NDC should be developed in partnership with Iwi/Māori.[22]

28. On 4 November 2021 the New Zealand government communicated an updated NDC for the period 2021 – 2030 to the UNFCCC.[23] Under the updated NDC, New Zealand committed to reduce its net greenhouse gas emissions to 50 percent below gross 2005 levels by 2030.

The basic concepts of 'gross' and 'net' emissions, LULUCF, and gross-net accounting

29. Climate change accounting is a highly specialised area and its terminology can be confusing to those who are not familiar with it.

30. Dr Stephen Gale, for example, in his affidavit for LCANZ states at paragraph 8 that he understands: "net carbon dioxide to refer to gross carbon dioxide emissions (for example from fossil fuel combustion) less carbon dioxide removals (for example, from forestry)". This is incorrect and demonstrates a fundamental error. Gross and net are not used in climate change accounting in the ordinary sense that economists or financial accountants or members of the general public are used to seeing those terms (for example, where gross income means income before tax is deducted, and net income is post tax, and so on).[24]

31. In climate change accounting gross and net do <u>not</u> refer to a basic equation of:

Gross = all emissions

Net = all emissions minus all removals

32. Nor is it expected that net emissions will always be lower than gross emissions. On the contrary, for many countries (including the most significant emitters globally) net emissions will generally be *higher* than gross emissions.

33. In climate change accounting, following the Kyoto Protocol, gross and net have very specific meanings. The terms refer to particular *sectors* of emissions and removals,

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22 Advice Bundle at 365, 366, 367 and 374.

23 New Zealand *Submission under the Paris Agreement: New Zealand's first Nationally Determine Contribution Updated 4 November 2021* (4 November 2021), CBD at [•].

24 These concepts are discussed in the Commissions Supporting Volumes: Climate Change Commission *2021 Supporting Evidence: Chapter 3*, Advice Bundle at 488 – 489.

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and are globally understood and accepted (and reflected in the definitions in the Climate Change Response Act) to mean:

> Gross emissions = emissions from all sectors *except* the land sector (LULUCF)
>
> Net emissions = emissions and removals from all sectors *including* the land sector (LULUCF)

34. By sectors, we mean the broad categories of activities that contribute to greenhouse gas emissions and removals.[25] In New Zealand the sectors we consider in gross emissions are:

    34.1 agriculture (including biological emissions produced by farmed animals);

    34.2 energy (including transport energy, and industrial energy use);

    34.3 industrial processes that directly produce emissions (for example, cement production, aluminium production and the use of solvents); and

    34.4 waste (emissions from the decomposition of waste and organic material).

35. In theory, removals from any of these sectors could also be included in gross emissions. For example, carbon capture and storage technology diverts emissions from the energy or industrial sectors, captures them, and stores them in geologic formations underground where they will not be released to the atmosphere. Use of this technology could reduce energy or industrial emissions and be included within the gross emissions category.

36. The *only* difference between gross and net emissions in this context is whether the land sector (LULUCF) is taken into account or not. LULUCF refers to 'land use, land-use change, and forestry'. 'Land use' here does not refer to direct emissions from

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25 These categories were developed by the IPCC in the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, and refined in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*:

- IPCC *Revised 1996 IPCC Guidelines for National Greenhouse Inventories* (1996), available at <https://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html>.
- IPCC *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (2006), available at <https://www.ipcc-nggip.iges.or.jp/public/2006gl/>.

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agriculture, such as fertiliser or livestock – rather it refers to land uses such as cropland, grassland, wetlands etc. Forests are a type of 'land use' but are separated out in the LULUCF acronym because of their significance in emission removals. 'Land-use change' refers to the emissions and removals associated with changes in use between different categories of land-uses. For example an area of grassland being converted to forestland or vice versa. Land-use change is separated out because changes in land use between categories tends to be associated with more significant emissions and removals than land use within a category. Both land use and land-use change can be sources of emissions or removals. However, in relative terms in New Zealand non-forest 'land use' and 'land-use change' are not significant sources of either emissions or removals. In New Zealand by far the biggest component of LULUCF is forestry.

37. So in highly simplified terms, in New Zealand when we refer to gross and net the difference is:

Gross emissions = excludes forestry

Net emissions = includes forestry

38. It is important to understand that forestry can either remove carbon from the atmosphere (that is, be a sink) or be a source of emissions (a source). The Indonesian rainforest for example, was for a long time a net source of emissions while deforestation rates were high.[26]

39. In terms of New Zealand's forestry plantations, each forest varies in whether it is an emissions source or a sink (and the relative quantity of each), depending on where the forest is in the cycle of planting, growth, maturity or harvesting. I am aware that other witnesses for the Commission will explain this in more detail, but in basic terms, New Zealand has a very 'lumpy' profile in terms of our forestry because of the timing of exotic (mainly pine) forestry planting over the past decades. As the planting of forest was lumpy over previous decades, large areas of forest will reach maturity and be harvested at around the same time. This means we have very pronounced cycles

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26 Indonesia's most recent Greenhouse Gas Inventory provides data for the year 2000. In 2000 the LULUCF sector was a net emitter of 821 Mt CO_2e – two to three times as much as all of Indonesia's gross emissions: see UNFCC *Greenhouse Gas Inventory Data – Detailed data by Party* <https://di.unfccc.int/detailed_data_by_party>.

where the level of removals from forestry swings up and down on a cyclical basis over a period of about 28 years.[27]

40. This is an unusual situation in global terms: many countries where forestry is a significant factor in their climate change accounting have a much smoother profile, reflecting the fact that forests will have been planted at different times, so the harvesting and replanting cycles will average out across the whole country. In New Zealand, largely as a result of various government policy initiatives in previous decades, a large portion of our forests are on the same cycle. To give a sense of the scale of this, in 1990 New Zealand's forests were at their peak growth rate, harvesting was at an all-time low, and forestry was sequestering around 24 million tonnes of CO_2 per year, about a third of all our emissions at the time. By 2030 we expect that figure to drop to 10 – 14 Mt per year.[28]

41. If we took the ongoing removals and emissions from the forests planted before 1990 (that is, adopted a net-net approach), then simply by the inevitable change in our forestry cycle from 1990, even if we had *no change at all* in gross emissions since 1990, by 2030 we would have increased our net emissions from around 40 Mt CO_2-e to around 51 - 55 Mt CO_2e. The only way we could avoid that under a net-net approach would be to endlessly keep extending the area of our forest plantations, to keep that sink at its peak 1990 level – and we would have had to have started that process decades earlier.[29] Any actual reduction in domestic emissions (which is what the Kyoto Protocol and the Paris Agreement are designed to measure and incentivise) would have been drowned out by the cyclical swing of the forest harvests and replanting.

42. It is also important to understand that there are a range of different (but valid) approaches to assessing the elements of net emissions focussed on how the complex aspects of the land sector are assessed. Extensive international guidance and protocols exist to assist countries in the appropriate ways to approach these issues that are suitable for different countries' circumstances. So, for example, in its national

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27 The trend in UNFCCC net removals oscillates at a level that is consistently a net removal, because a portion of the emissions that would otherwise occur at harvest instead go into long-lived products (such as construction materials). These do return to the atmosphere as emissions but over a much longer timeframe (up to 80 – 100 years). This keeps the emissions at harvest in the UNFCCC figures consistently lower than the associated removals from growth.

28 These figures are drawn from the June 2021 Ministry for Primary Industries projections.

29 This is discussed in the Commission's Supporting Volumes: see Advice Bundle at 919.

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inventory reports to the UNFCCC, New Zealand treats its land emissions and removals differently than it does for its target accounting under the Kyoto Protocol and for its NDC under the Paris Agreement.[30] In New Zealand and other similar countries, these approaches have different purposes and are not interchangeable (this is an issue with the evidence filed by LCANZ in this proceeding, where some of its witnesses do not appear to understand that distinction).

43. The other important point to understand is that New Zealand has always (since reporting under the UNFCCC commenced) been in an overall position where our forestry (or LULUCF) is a *sink* – our LULUCF removals have always exceeded our LULUCF emissions, although the relative levels swing hugely over the 28 year cycle. Other countries (for example, two of the largest emitters globally, Brazil and Indonesia) are in the reverse position: their LULUCF is generally an overall *source* of emissions. At a global scale as well, LULUCF is a source of emissions.

44. This difference between LULUCF as a source or a sink has a major significance under the Kyoto Protocol that has been carried through to the government's approach to setting New Zealand's NDC. Under the accounting rules for the Kyoto Protocol, countries whose LULUCF in the base year (generally 1990) was a *source* of emissions were required to adopt a net-net approach to their accounting. In very simplified terms this meant that they were required to account for the comparison between:

> Net emissions as at 1990 = all emissions including emissions from LULUCF (ie the higher figure between gross and net)[31]
>
> with
>
> Net emissions in the target year[32] = all emissions including emissions and removals from LULUCF

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30 The National Greenhouse Gas Inventory Report contains separate chapters for reporting LULUCF emissions and removals under the UNFCCC (Chapter 6: Land Use, Land-Use Change and forestry), and for presenting accounting figures under the Kyoto Protocol (Chapter 11: KP-LULUCF): see LBD at 1254 – 1362 and 1464 – 1491.

31 Under the Kyoto Protocol, if emissions from LULUCF were greater than removals, then just the emissions from deforestation were added in calculating the target (that is, removals were not 'netted' off the target baseline).

32 New Zealand's targets use an emissions budget approach. Here the target in the end year is used to define an emissions trajectory for each year in the period, and the government is accountable for limiting emissions in the whole period, although emissions in any particular year may exceed the trajectory. The emissions budget approach is considered to be more

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45. In contrast, countries whose LULUCF were a *sink* in the base year of 1990 were required to adopt a gross-net accounting approach.[33] Again in very simplified terms, this means that New Zealand's accounting under the Kyoto Protocol compares:

> Gross emissions as at 1990 = all emissions (from the energy, agriculture, industry and waste sectors) but ignoring any emissions and removals from forestry planted up to 1989 (ie the higher figure between gross and net)
>
> with
>
> Net emissions in the target year = all emissions but allowing for emissions and removals from *changes* in forestry since 1990 (that is, deforestation and afforestation – not forests that have simply been harvested and replanted: cyclical harvesting and replanting of the same pre-1990 forest areas remains excluded from the assessment).

46. Under this accounting approach, both gross and net measures exclude the impact of pre-1990 forestry, and they are therefore directly comparable. What they measure is change in human activity – in basic terms, new land put into forestry planted after 1989 counts for removals, and permanent deforestation of land that was in forest as at 1990 counts as emissions.

47. The technical elements that explain and make up this accounting approach are complex. Some of the reasons for it are described briefly in the Commission's Advice in Chapter 10 and in Chapter 3 of the Supporting Volumes,[34] and other witnesses for the Commission will also address this.

48. Overall, however, by excluding the cyclical emissions and removals of forests planted before its base year of 1990, accounting under the Kyoto Protocol aims to reflect the

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stringent and robust than simply accounting for the final target year. Details of this approach are described in Chapter 13 of the Supporting Volumes: see Advice Bundle at 914 – 919.

33 The requirement to use gross-net accounting is within the text of the Kyoto Protocol itself. Article 3.7 requires that targets be set on the basis of the emissions categories listed in Annex B, which lists the categories of gross emissions (for countries whose LULUCF sector was a net sink in the base year). Article 3.3 says that emissions and removals from specified forestry activities shall be used to meet the targets. The requirement for gross-net accounting is also discussed in more detail in the Commission's Supporting Volumes: see Advice Bundle at 488 – 489.

34 Advice Bundle at 215 – 216 and 484 – 486.

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changes that a country achieves in its emissions and removals *as a result of changes in human action going forward*, rather than allowing credit or imposing penalties for what is simply an ongoing consequence of the growth and harvesting cycles that were set in motion in earlier decades. That is the point of the international effort: countries commit to *changing their behaviour*, and that is what the accounting principles under Kyoto and Paris seek to measure. 'Target accounting' of this kind is deliberately different from the UNFCCC national inventory reporting approach of 'what the atmosphere sees', because it is directed at this purpose of measuring and thus incentivising change in human behaviour.

49. New Zealand's NDC under the Paris Agreement is similarly set on the same gross-net basis with the same 1990 base year (or 'activity start year') used for forestry, providing continuity of approach from the accounting used under the Kyoto Protocol.

50. Many other countries (and the European Union) have also adopted a similar gross-net approach to their NDCs under the Paris Agreement, generally consistent with the approach they have taken under Kyoto accounting rules and guidance.[35] This is sound accounting practice and supported by the international guidance.

51. Finally, it is important to understand that while New Zealand's NDC refers to 2005 as the year against which our progress will be assessed (30 percent below 2005 levels by 2030 for the first communication, 50 percent below 2005 levels by 2030 for the updated NDC), in terms of the gross-net accounting the base year (or 'activity start year') for forestry remains 1990.[36]

52. Again, the technical accounting rules that will be applied here are complex and in some areas still evolving. To give a very broad sense, and emphasising that this is hugely simplified, under the Paris Agreement New Zealand will essentially compare:

> Gross emissions as at 2005 = all the emissions as at 2005 but excluding any emissions or removals from forests
>
> with

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35 Most notably, the European Union. See: Germany and the European Union *The update of the nationally determined contribution of the European Union and its Member States* for example (17 December 2020) at 16, available at: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/European%20Union%20First/EU_NDC_Submission_December%202020.pdf>.

36 See, in particular, the updated NDC as communicated in November 2021: CBD at [•].

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Net emissions as at 2030 = all gross emissions but allowing for emissions and removals from *changes* in forestry since 1990 (that is, deforestation and afforestation, as above)

53. The choice of 2005 as the base year is really just a choice about how we express the target (this is discussed in more detail in Paul Young's evidence for the Commission), and 2005 is a useful choice for the NDC as it makes it easier to compare New Zealand's NDC with other countries that also use the 2005 reference.

54. There is a simple mathematical relationship between how we express the same target for different reference years.[37] So, for example, the previous NDC (that the Commission advised on) was often expressed as a 30 percent reduction by 2030 on 2005 gross levels, equivalent to an 11 percent reduction on 1990 gross levels. Whichever year is used for comparison, the amount of emissions in the target is the same.

55. In meeting the target, the same as under the first Kyoto Protocol target, forests planted before 1990 that remain in forest are treated as background activity and are factored out of both the baseline and the measure of net emissions used to meet the target, so long as they continue to be replanted after harvest.[38] Only new forests planted after 1990 are counted as removals towards the target.

THE COMMISSION'S MODELLING TO ASSESS THE COMPATIBILITY OF THE NDC

56. I now turn to explain the modelling that the Commission adopted to produce its advice on the NDC in response to the Minister's request. This modelling is detailed in Chapter 21 of the Commission's Advice "Te ekenga 1.5°C me Te Ahungaroa o Aotearoa

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37 30 percent below 2005 gross emissions = (1-0.3) *82.5 Mt = 57.75 Mt. This can be expressed as a percentage reduction against a different year by the formula:
Equivalent reduction % = (1 - 57.75Mt/ (Gross emissions in reference year)) * 100
The precise figures will change slightly over time as future inventories update the time series with more accurate emissions data.

38 Accounting for some components of the emissions and removals from pre-1990 forests was mandatory for the second commitment period under the Kyoto Protocol, and New Zealand included this in its target from 2013-2020. It is not all emissions and removals however – only those above or below a specified reference level. This is elaborated further in the affidavit of Renee (Eva) Murray.

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| The global 1.5°C effort and Nationally Determined Contribution for Aotearoa"[39] and Chapter 13 of the Supporting Volumes that was published along with the Advice.[40]

57. The Minister's request was to for the Commission to report on whether the then current NDC commitment (to reduce net greenhouse gas emissions to 30 percent below 2005 gross levels by 2030, corresponding to a reduction of 11 percent from 1990 levels) was compatible with contributing to the global 1.5°C effort under the Paris Agreement.

58. In responding to this question we were aware that the assessments of New Zealand's contribution to a 1.5°C pathway by other organisations – principally that of Climate Action Tracker and the Paris Equity Check, indicated that New Zealand's NDC was not compatible. These organisations presented a range of possible targets based on different judgements about how effort would be shared internationally, and New Zealand's NDC was compatible with only the weakest approach to international effort sharing. This approach contemplated equal proportional reductions in emissions from all countries, but the Paris Agreement requires developed countries such as New Zealand to peak and start reducing their emissions before developing countries, so an equal approach was not going to be appropriate.

59. As I have already said, the Commission was of the view that the final assessment of New Zealand's appropriate contribution under the Paris Agreement required decisions that could only be made by elected representatives. While there is a scientific component to the question of the reductions that an individual country needs to commit to in order to be making a sufficient contribution to the 1.5°C goal, there is also a significant political and ethical component to determining what constitutes a fair contribution for a country such as New Zealand to make towards the global cut in emissions, taking into account New Zealand's obligation under the Paris Agreement to set an NDC that reflects the country's "highest possible ambition, reflecting its common but differentiated responsibilities and respective capabilities, in light of the different national circumstances" (Article 4.3).

60. While declining to recommend a particular figure, the Commission provided advice set out in Chapter 22 on the range of factors that the government should consider in

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39 Advice Bundle at 365 – 374.

40 Advice Bundle at 911 – 932.

setting the level of the NDC, but I understand that LCANZ does not challenge that part of the Commission's Advice.

61. This part of my evidence is addressed only to the Commission's approach to undertaking the element of that assessment where scientific modelling can assist. That is, a comparison between the NDC commitment as against an estimated approximation of the required global reductions in greenhouse gases that would be needed to reach the 1.5°C goal.

62. The starting point, which requires some emphasis, is that there was and is no ready-made methodology or guidance the Commission could adopt to make this assessment. Indeed, there were many and various challenges associated with developing such a methodology, including:

    62.1 There is no universally agreed upon approach to determine the actual global emissions reductions over any particular time frame that are needed to limit the global average temperature increase to 1.5°C above pre-industrial levels.

    62.2 Even once the Commission determined an approach to approximating required global emission reductions over time, there was no established methodology or approach for then apportioning those *global* emissions reductions to an individual country, in order to establish the reductions that New Zealand ought to commit to over a specific time period to be making a sufficient contribution to the 1.5°C goal.

63. Those (and a range of other) challenges meant that there were a number of judgements and choices to be made by the Commission in producing the advice on the NDC requested by the Minister.

64. In very basic terms, the Commission decided to approach its modelling task as follows (I discuss these steps in more detail below):

    64.1 First, we looked to develop a methodology that would provide a defensible approximation of the global reductions in greenhouse gas emissions over time that would be compatible with the 1.5°C goal. The Commission opted to adopt a conservative selection of pathways for individual greenhouse gases set out in

the Intergovernmental Panel on Climate Change's 2018 *Special Report on Global Warming of 1.5°C* (the 2018 Special Report).[41]

64.2 Second, we developed a methodology that would enable an approximate comparison between those *global* reduction pathways for individual greenhouse gases (that is, split-gas pathways) to the New Zealand-specific 'all gas' NDC commitment. The Commission essentially converted the IPCC split-gas pathways for key gases into percentage reductions and combined or aggregated them together to develop a number of all-gas 'NDC comparator budgets'.

64.3 Third, the Commission compared the then current NDC with the 'comparator' NDCs to provide and anchor the range of how far the scientific component of the assessment would take us. The Commission used this range to provide a reference point for its recommendations on how much the NDC would need to change to be compatible with contributing to the global 1.5°C effort. It did not on its own however address the question of what New Zealand's share should be, as I have outlined. If our advice was accepted, it would then be a matter for government to assess what the final commitment ought to be.[42]

65. It must be emphasised that this whole process was a matter of modelling to provide a level of informed guidance, involving many judgements, compromises and approximations. The point of these methodologies was not to provide a precise mathematical answer, which would have been quite impossible in this context. Rather, we were using these methodologies to provide a foundation and a guide for an overall assessment of likely compatibility.

66. The Commission's approach to this modelling exercise is set out in more detail in the Advice. It involved a number of complex analytical steps most of which I will not canvass here, given what I understand to be the limited scope of LCANZ' challenge to our approach.

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41 IPCC *Global warming of 1.5°C: An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* (2018), LBD at 13 – 642.

42 Advice Bundle at 375.

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Step 1: adapting pathways from the Intergovernmental Panel on Climate Change's *Special Report on Global Warming of 1.5°C* (2018)

67. The Commission determined that it would be guided by the Intergovernmental Panel on Climate Change's 2018 *Special Report on Global Warming of 1.5°C* (the 2018 Special Report) for its approach to modelling global emissions reductions consistent with the 1.5°C effort.

68. In the 2018 Special Report, the IPCC set out possible 'pathways' of future global greenhouse gas emissions that it considered would be consistent with a likely chance (50 – 66 percent) of limiting the increase of global average temperatures to within 1.5°C above pre-industrial levels.

69. The emissions pathways set out in the 2018 Special Report are based on a range of possible future scenarios. Each scenario aims to describe a plausible set of assumptions about economic and social development, and technological and behavioural changes between now and 2100, and how those parameters may affect the emissions profile of each type of greenhouse gas.[43] It is important to make clear that the pathways in the 2018 Special Report are not forecasts of what will happen with global emissions, but instead present a wide range of scenarios of plausible futures in which global average warming is likely to be limited to 1.5°C.

70. Separate pathways were outlined for each greenhouse gas (such as carbon dioxide, agricultural methane, nitrous oxide and fluorinated gases). This reflects the different parameters that affect the likely future pathways for each different type of greenhouse gas. The IPCC did not put forward a combined 'all gas' series of pathways.

71. The Commission was alert to the limitations and challenges of using the IPCC's global modelling as a basis to assess New Zealand's national NDC. These included the following:

    71.1 *Purpose: the purpose of the IPCC pathways was to address cost-effective global pathways, not to set national targets*[44]. The IPCC's pathways were

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43 Advice Bundle at 368.

44 The modelling that informed the Special Report on 1.5 degrees was not done by the IPCC authors themselves, but by a wide range of scientific modellers around the world. The IPCC assessed the peer reviewed modelling in developing the Special Report on 1.5 degrees. Here I refer to the modelling done as "the global modelling" and to the outputs of this modelling

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global, and the modelling did not consider or address pathways or reductions for individual countries. The modelling was also focussed on finding and prioritising the options that would be most cost-effective at a global level to keep the world on track to limit warming to 1.5°C. This means that the modellers had to consider the systems of emissions at a global scale, across national borders. The underlying activities modelled for the globe may not apply directly to the circumstances of any particular country.[45]

71.2 For example, the global modellers found that rapid reductions in emissions from coal fired electricity were both necessary and cost-effective. So for the global pathways, large emissions reductions in CO_2 would come from replacing coal fired electricity with renewable generation, and the IPCC pathways therefore modelled significant percentage reductions in CO_2 emissions on that basis. But in New Zealand most of our electricity is renewable already, and we only have one coal power plant remaining which is already in the process of shutting down. When you look at the activity, we have already done it. To try to 'apply' the proposed percentage reduction in CO_2 emissions from the global pathways directly to New Zealand ignores whether the underlying mitigation opportunity the IPCC modelled actually exists in New Zealand or whether it's already been done (meaning the proposed percentage drop would be unreal and unachievable).

71.3 *Difference between the global emissions profile and New Zealand's emissions profile.* There are other limitations of applying global modelling to New Zealand, because New Zealand's emissions profile differs quite significantly from the overall global emissions profile. In particular, a much higher proportion of New Zealand's emissions come from methane and biogenic methane than the global average, and a much lower proportion from fossil fuels than the global average. Also, as I have already outlined, New Zealand's land sector (LULUCF) is a sink, whereas globally the overall position is that LULUCF acts as an emission source.

(particularly the percentage reductions of particular gases), as collated and described in the Special Report on 1.5 degrees as "the IPCC emissions pathways".

45 The Commission referred to the "blunt" nature of applying global modelling domestically in the Advice. See: Advice Bundle at 270 and 370, in particular at Box 21.1.

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71.4 *Split-gas vs all gas.* As I have noted, the IPCC's pathways are on a split-gas basis. That is, the IPCC's pathways split up the emissions reductions on the basis of the different gases: net carbon dioxide emissions, agricultural methane emissions, agricultural nitrous oxide emissions, hydrofluorocarbon emissions, perfluorocarbon carbon emissions and sulphur hexafluoride emissions. New Zealand's NDC however is set on an "all-gas basis", which aggregates all the different types of emissions into what is called "carbon dioxide equivalent". Consequently the NDC could be met with a range of different reductions of different gases whereas the IPCC pathways specified reductions for each gas. This created a challenge in comparing the global pathways against New Zealand's all-gas NDC.[46]

71.5 *Net-net vs gross-net.* The 2018 Special Report refers to net CO_2 emissions in its modelled pathways, reflecting the fact that globally, LULUCF is an overall source of emissions. A net approach in those circumstances is consistent with the objective or reducing or offsetting all sources of emissions – this is reflected in the Kyoto Protocol's accounting approach. The IPCC pathways also use 2010 as the base year. That is, potential future net emissions reductions are measured against the global net emissions in 2010. In contrast, New Zealand's NDC is set by government on a gross-net basis (that is, net emissions in the target year 2030, compared to gross emissions in 2005).[47]

72. We were alert to these issues, and the Commission recognised in its Advice that using the IPCC global-scale split-gas net-net modelling as the basis for comparison for Aotearoa's country specific, all-gas gross-net NDC target is a blunt approach.[48] But in the absence of any better alternative, the Commission considered this was still the best method available to provide an evidential foundation to inform the advice requested by the Minister.

73. We also saw that using the IPCC emissions pathways had a number of benefits over other options:

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46 The Advice touched on the matter of the modelling that supported the 2018 Special Report being on a split-gas basis: Advice Bundle at 207.

47 This is addressed in the Supporting Volumes: Advice Bundle at 919.

48 Advice Bundle at 370, in particular at Box 21.1. The point is also made that the use of the IPCC emissions pathways was only intended as a starting point.

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73.1 The modelling that supported the 2018 Special Report is the most targeted dataset to one of the main aspects of the specific question we had been tasked with – what is needed to limit warming to 1.5°C? The IPCC's reports are the most reputable body of scientific work on climate change. There would not be a more authoritative set of modelling on the question.

73.2 The specifics of the gas-by-gas pathways could help to mitigate the issue that New Zealand's emissions profile is so different from many other developed countries. By applying specific reductions by gas, we could account for New Zealand's national circumstances given the high proportion of agricultural emissions in our emissions profile.

Step 2: developing the comparator NDCs

Choice of pathways

74. The first decision that had to be made by the Commission in developing comparator NDCs was which pathways from the 2018 Special Report the Commission would be considered.

75. For each model there are three different categories of pathways for each gas included in the 2018 Special Report:[49]

75.1 pathways with no overshoot (that is, pathways under which at all times global average temperature increase stays below 1.5°C);

75.2 pathways with limited overshoot (that is, pathways which allow the increase in global temperature to exceed 1.5°C above preindustrial levels by no more than 0.1°C, before falling below that level later in the century); and

75.3 pathways with high overshoot (that is, pathways which allow the increase in global temperature to exceed 1.5°C above preindustrial levels by more than 0.1°C, before falling below that level later in the century).

76. The Commission decided that it would use the pathways from the 2018 Special Report with no overshoot and pathways with limited overshoot in its analysis, but exclude pathways with high overshoot.[50]

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49 The three types of pathways are discussed in the Advice: Advice Bundle at 368.

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77. This was on the basis that pathways with little or no overshoot are more likely to deliver the best overall social, economic, and environmental outcomes, while pathways with high overshoot will result in more significant climate impacts and result in more significant adaptation needs. Further, pathways with high overshoot rely on high levels of emissions removal technologies in the future, such as carbon capture and storage, which may not be feasible.[51]

78. The exclusion of high overshoot pathways left the Commission with 42 pathways to consider in its analysis.

Use of the interquartile range

79. The next step the Commission took was to model the "interquartile range" of these 42 pathways. The interquartile range represents the middle 50 percent of modelled reductions.

80. There were a number of reasons for using the interquartile range of the IPCC emissions pathways. These include:

    80.1 As compared to using the entire range: the interquartile range gave the Commission a more conservative, but also more likely, range for the global emissions reductions that will be required to keep average global warming below 1.5°C than relying on the entire range of the global modelling.[52]

    80.2 As compared to relying on individual pathways: there would be a number of challenges in the Commission relying on particular pathways, as it would require the Commission to predict the "most likely" futures on which to place reliance, which the Commission (and the IPCC) was in no position to do. Further, use of the interquartile range to some extent "neutralises" the issue of the global modelling having been developed on a split-gas basis, as compared to New Zealand's NDC which is set on an all-gas basis, which I discuss further below.

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50 Advice Bundle at 368.

51 Advice Bundle at 368.

52 The Commission's decision to adopt the interquartile range is explained in the Advice and the Supporting Volumes: Advice Bundle at 369 and 919.

Aggregating the individual gas pathways to create 'all-gas' comparator NDCs

81. Once the Commission had established the interquartile range of the IPCC global pathways with limited or no overshoot, which gave the Commission a picture of a realistic likely range for the global emissions reductions for each individual greenhouse gas that would keep average global warming below 1.5°C, the Commission then had to decide how to approach comparing this global modelling to New Zealand's NDC commitment.

82. The challenges and limitations of using the global modelling on an individual country basis meant that there was no one right or easy way to compare the modelling to New Zealand's NDC target. A number of judgement calls were made, to try to ensure that the comparators were as useful and informative as possible for the task we had been asked to undertake.

83. We decided to develop two "comparator NDC budgets": a lower quartile comparator NDC (that is, the bottom of the interquartile range of reductions – less effort) and an upper quartile comparator NDC (that is, the top of the interquartile range of reductions – more effort).

84. In order to create the lower and upper quartile comparators NDCs, the Commission took the following approach:[53]

    84.1 The Commission created individual 'budgets' for each gas/group of gases, for both the lower quartile and upper quartile modelled reductions.

    84.2 The Commission treated the lower quartile and upper quartile of percentage reductions for each of the main greenhouse gases from the IPCC emissions pathways as if they were individual percentage reduction targets for each of the gases (with hydrofluorocarbon emissions, perfluorocarbon emissions and sulphur hexafluoride emissions treated as one category each).

    84.3 These estimated percentage reductions for each gas were then converted into emission trajectories over the NDC period. This allowed us to work out what the overall target for New Zealand would be if the target for each particular

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53 See the Commission's discussion of the approach taken in the Supporting Volumes: Advice Bundle at 914 – 922.

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gas was the percentage reduction we had derived from the selected IPCC pathways. While we knew that for each individual gas the percentage reduction was unlikely to be directly appropriate for New Zealand's circumstances, we assessed that at an aggregate level these issues would be likely to largely balance out, at least sufficiently for our purposes.

84.4 In applying the percentage reductions to carbon dioxide we deliberately applied them to the gross emissions figures, to approximate the gross-net approach of the NDC (carbon dioxide being the gas sequestered by growing forests, and emitted on harvesting and deforestation). This wasn't necessary for the other gases as the gross – net distinction (that is, with or without forestry) wasn't relevant for those gases.

84.5 The Commission then aggregated the emissions figures over the whole NDC period, using the GWP_{100} metric from the IPCC *Fourth Assessment Report,* to create two "all-gas" gross-net NDC comparators for New Zealand: a lower quartile NDC comparator and an upper quartile NDC comparator.

85. Applying this approach gave us an approximate total for all greenhouse gas emissions measured in metric tonnes of 'carbon equivalent' emissions (this measure is signified by the unit $MtCO_2e$[54]):[55]

85.1 the lower quartile NDC comparator for New Zealand was a 527 $MtCO_2e$ total emissions budget over 2021 – 2030; and

85.2 the upper quartile comparator NDC was a 608 $MtCO_2e$ total emissions budget over 2021 – 2030.

86. As I have already explained, and I hope is clear from this discussion, these figures are far from precise. They are at most an informed 'best guess' based on rough

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54 Carbon dioxide equivalent (CO_2e) is a measure used to aggregate the effects of different greenhouse gases with different warming properties. It does this by applying a conversion factor to describe the emissions of a particular gas – say methane – in terms of the equivalent amount of carbon dioxide that would produce that warming effect. The GWP_{100} metric is what has been mandated for use in emission reporting under the UNFCCC and Kyoto Protocol. For example, under GWP_{100}, 1 tonne of methane emitted is equivalent to 25 tonnes of carbon dioxide equivalent (using the values from the IPCC's Fourth Assessment Report).

55 Advice Bundle at 370 – 371.

approximations and inexact modelling, and formed only a starting point and a general guide for the Commission's overall assessment of whether the then current NDC was compatible with the 1.5°C goal.

Step 3: comparison of the comparator NDCs with New Zealand's NDC

87. The Commission separately calculated the total emissions budget contemplated by the target set in the then current NDC, as the comparison point to these lower and upper quartile NDC comparators.[56] The Commission assessed that the then current NDC allowed for net emissions of no more than 596 $MtCO_2e$ over the 2021-2030 period.

88. This assessment demonstrated that New Zealand's NDC was equivalent to the 67th percentile of the interquartile range of the comparator NDCs, putting it towards the higher end of total emissions that we'd assess as likely to be compatible with limiting warming to 1.5°C using this approach. This is demonstrated by Figure 21.2 from the Commission's Advice:[57]

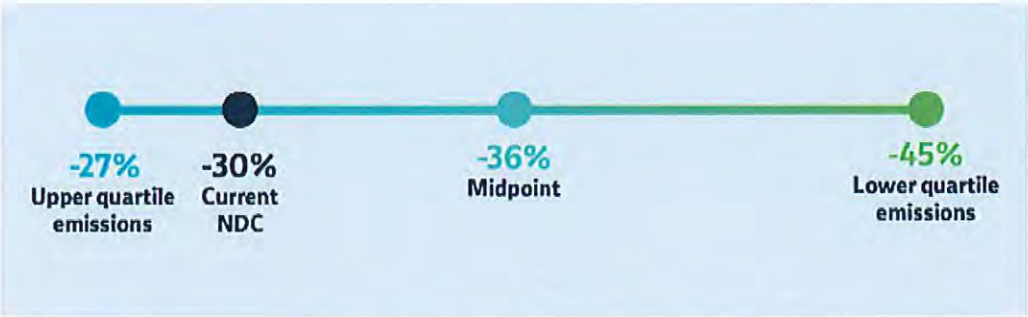

Figure 21.2: The current NDC and NDC targets associated with the IPCC 1.5°C interquartile range

89. The Commission then undertook an overall assessment of whether an NDC of 596 $MtCO_2e$ over the 2021-2030 period, equivalent to the 67th percentile of the interquartile range of the IPCC's modelled emissions reductions, was compatible with New Zealand contributing to the global effort under the Paris Agreement to limit the global average temperature increase to 1.5°C above pre-industrial levels. The Commission concluded that it was not.

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56 The process the Commission took to calculate the total emissions budget contemplated by the target is explained briefly in the Advice, and in more detail in the Supporting Volumes: Advice Bundle at 369 and 914 - 919. I understand that there is no challenge to this aspect of the Commission's analysis so I do not go into any detail on this part of the analytical approach.

57 Advice Bundle at 373.

89.1 First, as I have already noted, in the 2018 Special Report the IPCC only considered emissions reduction scenarios that had a 50 – 66 percent 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 percent chance that warming will exceed 1.5°C. More ambitious NDCs (that is, 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.[58]

89.2 Second, the Commission recognised that in committing to the UNFCCC and the Paris Agreement New Zealand had agreed with the principle that developed countries should take the lead in emissions reductions, in recognition of the fact that developed countries have emitted more cumulative emissions than developing countries, for longer, and have benefited as a result. Accordingly, the Commission considered that if New Zealand was to contribute to a global effort towards limiting warming to 1.5°C above pre-industrial levels, it should contribute *more* than what the modelling indicated the global average required. Adopting an approach that implies the same proportionate reductions for all countries would not be sufficient.[59]

90. The Commission concluded in its Advice that:[60]

> ... 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.
>
> Our advice is that the NDC should reflect emissions much lower than just aligning with the middle of the interquartile range. This means emissions of much less than 568 $MtCO_2e$ over the 2021 – 2030 period, or reductions of much more than 36 percent below 2005 levels by 2030.

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58 Advice Bundle at 371 – 372.

59 Advice Bundle at 372 – 373.

60 Advice Bundle at 373.

91. As I have already noted, the Commission did not set or recommend an actual figure for the NDC, it only advised that the to be compatible, the NDC needed to represent a reduction of *much more than* 36 percent below 2005 levels by 2030.

92. In the first place, the Commission's modelling was nowhere near robust enough to give an accurate figure for an NDC target, even in terms of what would be an 'average' contribution towards the global goal.

93. More importantly, though, the Commission recognised that on the question of *how much* stronger the NDC should be, scientific modelling did not provide the answer. How much stronger the NDC should be is a matter for elected representatives, given the social, political and ethical judgements involved.[61] The Commission considered that these judgments as to the potential social and economic impacts of extending the NDC, the expectations of other countries and their governments, tolerance for climate risks and the relative importance of investing in greater levels of climate change action compared to other domestic or international priorities were all matters beyond the Commission's remit, to be made by the government of the day.[62]

94. The Commission did however detail further advice in chapter 22 "Ngā herenga matua kia tika ai te ekenga a Te Ahungaroa o Aotearoa | Factors relevant to setting the level of the Nationally Determined Contribution" to assist government in making these assessments, setting out the range of different factors that the Commission considered government should consider in deciding the level of the NDC.

95. In particular, Chapter 22.5 of the Commission's Advice outlined the key principles and approaches to inform decisions about what a fair contribution would look like.[63]

LCANZ' EVIDENCE CHALLENGING THE CREATION OF GROSS-NET COMPARATORS

96. LCANZ in this judicial review proceeding challenges the Commission's approach to using modelling based on the IPCC net emissions pathways as a basis for creating gross-net comparator NDCs, to allow comparison with the NDC which is set on a gross-net basis.

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61 Advice Bundle at 375.
62 Advice Bundle at 375.
63 Advice Bundle at 387 – 389.

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97. As I have already outlined, the net emissions basis of the IPCC split gas pathways was only one of a number of differences and complexities the Commission had to address in using the IPCC pathways in its modelling. We were aware that this – along with many other factors including those I have already referred to – reduced the direct applicability of the IPCC pathways for our purpose. This was not considered to be a fatal problem, however: the modelling was always only an approximate tool, to provide guidance. The different parameters of the IPCC pathways and the NDC (such as one being set on a net emissions basis and the other on a gross-net basis) simply meant that we must recognise that the models are not exactly aligned, and approach the comparison exercise with an appropriate degree of caution. This is what we did.

98. If we had been engaging an a purely arithmetical or mathematical exercise, trying to 'apply' the IPCC pathways directly to New Zealand's emissions, as LCANZ appears to assume, then the fact that the parameters of the IPCC pathways did not exactly match the parameters of the NDC would be a significant problem, since you could not directly apply one to the other.

99. Put in more colloquial terms, we knew we were comparing an orange (the NDC) with a range of apples (the IPCC pathways), and not only because of the net and gross-net issue. We undertook a considerable amount of work and engagement to satisfy ourselves that it was an appropriate approach in the circumstances. We recognise that others may disagree with the judgement calls the Commission made in developing and applying our modelling, but we are very clear that there is no 'mistake' or 'logical error' in our approach: the choices the Commission made were deliberate, considered and well-informed.

LCANZ' raised the 'maths error' in its submissions on the draft Advice

100. LCANZ raised this same claim that we had made a 'maths error' in its submission in response to the Commission's draft Advice.[64]

101. Two of LCANZ' witnesses also made submissions on the Commission's draft advice: Professor Ralph Sims[65] and Dr Ivo Bertram.[66] Neither of them identified this alleged 'maths error'.

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64 LBD at 713 – 715.

65 Professor Ralph Sims *Submission to the Climate Change Commission*, CBD at [•].

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LCANZ argument that the Commission should have 'converted' the NDC to a net-net NDC

102. I understand that LCANZ' position is that the Commission was correct to adopt the IPCC pathways as a useful model, but erred in then using these net emissions pathways as a basis for comparison with the gross-net NDC.

103. LCANZ seem to be approaching this as an abstract exercise in arithmetic, combined with Dr Stephen Gale's fundamental misunderstanding of what 'gross' and 'net' mean in this context. As I understand their evidence, LCANZ is essentially saying that the Commission basically (by analogy) is comparing pre-tax income (gross income) with post-tax income (net income) and hence has made a simple error.

104. I understand LCANZ' position is that instead of creating gross-net comparator NDCs, the Commission should have created net-net comparator NDCs, and then 'converted' the actual NDC to be on a net-net basis, to allow a 'true' comparison. I wish to respond to this first in general terms, and then I will turn to address the specific evidence put forward on this issue on behalf of LCANZ.

105. LCANZ appear to be saying that since the IPCC pathways model of net emissions, what is required and all that is needed is to simply convert the NDC to a net-net basis. In other words, that the Commission should convert the orange (a gross-net NDC) to an apple (a net-net NDC) so that it can be directly compared to the other apples (the net emissions IPCC pathways).

106. This is incorrect at many levels.

107. First, as I have already outlined above, it is based on a basic and fundamental misunderstanding of what 'gross' and 'net' mean in the context of climate change accounting following Kyoto.

108. Second, it appears to be a direct attack on the core concept of gross-net accounting itself (at least as it presented by Dr Gale and a number of other LCANZ witnesses). That is also fundamentally misconceived. As I have explained, the Kyoto Protocol not only endorses gross-net accounting, it actually required this for countries such as New Zealand whose land sector acted as a sink in the 1990 base year. New Zealand and many other countries have used gross-net accounting for many years under both

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66 Dr Ivo Bertram *Submission to the Climate Change* Commission, CBD at [•].

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the Kyoto Protocol and now under the Paris Agreement. As the Commission records in its Supporting Volumes, New Zealand's emissions reporting and accounting is reviewed annually by international experts for compliance with these rules, and no issues of compliance with accounting approaches have been raised.[67]

109. Finally, the NDC was *set by the government* on a gross-net basis, in accordance with the accounting approach adopted by New Zealand under the Kyoto Protocol and for many good reasons, some of which I have already touched on. This is not an issue of arithmetic: it would make an enormous difference to New Zealand to 'switch' its NDC to a net-net accounting basis, given both the international directives to maintain consistency of accounting approach, and the overwhelming cyclical impact on our overall emissions of the pre-1990 forestry plantations.

110. To make this switch simply for the purposes of aligning the NDC with what is acknowledged to be an indirect comparator would also be pointless: the Commission would be providing advice about a hypothetical NDC that doesn't exist, and doesn't reflect the NDC actually set by the government. All that the Commission would be then saying to government is that *if* the government had opted to set a net-net NDC, which it hadn't, then a net-net NDC should be at a level below X. What the Commission in fact advised government is that our best assessment against the imperfect comparators based on the IPCC pathways was that a gross-net NDC ought to be much more than 36 percent below 2005 gross levels by 2030.

111. There are also are a range of technical problems with LCANZ overly simplistic suggested 'conversion' of the NDC from gross-net to net-net, especially as outlined by Dr Bertram, who addresses this for LCANZ in the most detail. For example, LCANZ appear to adopt 'net' figures taken from New Zealand's national inventory reporting under the UNFCCC (LCANZ refer to this as 'GHGI accounting'). As I have mentioned, however, New Zealand's national inventory reporting under the UNFCCC has different parameters than those adopted for either its target accounting under Kyoto (which the NDC intends to be consistent with) and from the IPCC pathways. One notable difference is in the approach to accounting for land use.[68]

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67 Advice Bundle at 923.

68 For New Zealand, net emissions under the UNFCCC includes additional categories of emissions and removals beyond our accounting approach. In some cases these categories are not included in the accounting because they are highly uncertain (such as non-forest

112. This means that in important areas the national inventory reporting and the IPCC pathways are not aligned and are not directly comparable. In other words, adopting a net-net NDC based on national inventory reporting would not only not meet the government's intention, it would also not be a direct comparator to the IPCC net emissions pathways anyway. LCANZ' proposed approach merely throws up different issues that would need to be addressed in the modelling. In other words, even on LCANZ' approach there would still not be a straight 'apples for apples' comparison.

113. I now turn to address some more specific issues with the evidence filed by LCANZ in support of this ground of review relating to the NDC.

Dr Stephen Gale (NZ)

114. I have already addressed the fundamental error made by Dr Gale at paragraph 8 of his affidavit, and the reasons why his 'mathematical' approach to the NDC comparator modelling exercise set out at paragraphs 14 to 16 is wrong. In addition, I note the following points in reply to his evidence:

114.1 It is not apparent that Dr Gale has any experience or expertise in climate change accounting at all. His misunderstanding of 'gross' and 'net' in this context indicate that he does not. As does his statement at paragraph 22 to the effect that he does not understand – and is not aware of international accounting guidance that would assist him to understand – why a 'gross emissions baseline' is consistent with target accounting (Dr Gale appears to be unaware that a gross-net approach was a requirement under the Kyoto Protocol, and unaware of the Kyoto Reference Manual, the wide range of UNFCCC technical papers and COP decisions providing accounting guidance).

114.2 In paragraph 13 Dr Gale incorrectly compares net emissions from the national inventory reporting to net emissions assessed under the Kyoto Protocol accounting approach. As I have already outlined above, the two are set on a different basis and for different purposes, and are not directly comparable.

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land-uses), and in others because they do not represent real additions or removals of carbon from the atmosphere that should be accounted for (such as native forest and pre-1990 planted forests).

114.3 Dr Gale's remaining criticisms at paragraphs 17 to 23 appear to be directed to the core concept of gross-net accounting, and are misconceived, as already outlined. These criticisms also appear to be contrary to Professor Forster's evidence for LCANZ, which I refer to later.

Dr Joeri Rogelj (UK)

115. Dr Rogelj is a recognised expert in his field, based in the UK, but I am not aware that this extends to a detailed understanding of climate change accounting for national targets. I note for example that he does not identify the errors in Dr Gale's opinion at paragraphs 8, 13 and 22.

116. I also note that the question LCANZ asked of Dr Rogelj, set out at paragraph 6 of his affidavit, is not the question that the Commission was asked to address by the Minister. If Dr Rogelj was considering only that question, of a comparison between the IPCC pathways and what they would require *if they could be directly applied* to New Zealand with no other constraints, then applying a net-net approach to a net-net outcome would appear to be logical. That was not of course the task the Commission was working on, which was to find a way to assess a gross-net NDC (without changing its fundamental character) from modelling based on the IPCC pathways net emissions pathways.

117. It is not clear that Dr Rogelj is familiar with New Zealand's national circumstances, nor that the NDC the Commission was asked to advise on is set on a gross-net basis.

118. It also appears that Dr Rogelj may not have read the Commission's Advice, or at least not read it thoroughly. He refers only to reading Dr Gale's affidavit, but more importantly at paragraph 12 he criticises the Commission for what he assumes is our approach of directly applying global emissions pathways to an individual country, referring to international climate equity perspectives. The Commission's advice however is clear that for very similar reasons we have not taken that approach.

119. On this basis, it seems that Dr Rogelj's agreement with Dr Gale on the 'maths error' may be based on an incomplete understanding of what the Commission was asked to do, what it did and the reasons for it.

Professor Donald Wuebbles (Illinois)

120. Professor Wuebbles is based in Illinois but appears to have at least a basic understanding of New Zealand's general emissions profile.

121. However, his reference at paragraph 11 to New Zealand's historical LULUCF becoming "less negative over time" appears to reflect a misunderstanding of both what is happening in New Zealand and why, and how this aligns with the IPCC pathways and our target measures. Under UNFCCC national inventory reporting, net removals from forests have not decreased since 1990. In 1990 net removals from LULUCF were 24 Mt CO_2e, and in 2019 net removals were 27.4 Mt CO_2e – that is, LULUCF emissions had become *more* negative in that time. Official forecasts show LULUCF emissions will become significantly less negative over the period to 2030 (due to cyclical harvesting emissions), but that has not yet occurred.

122. Professor Wuebbles' expertise in climate change matters appears to be extensive, but it is not clear whether he has any particular specialist expertise in climate change accounting. His broad claim at paragraph 12 that "every country on our planet" needs to adopt net-net accounting, and his general criticism of gross-net accounting (including his claim at paragraph 8 that using gross emissions 'makes no sense'), appears to disregard the Kyoto Protocol and the extensive guidance produced for target accounting, perhaps indicating that his expertise does not extend particularly far into this area. His position here also appears to be contrary to Professor Forster's evidence, discussed below.

123. Professor Wuebbles' criticism that "if New Zealand applies that 40 to 58% reduction range to its gross carbon dioxide emissions from 2010, then it will be doing less than the global average because its 2030 net carbon dioxide emissions will be too high" is a good illustration of the validity of Dr Rogelj's (and others') warnings against attempting a direct application of global figures to a national level. At a global level deforestation is a major source of carbon dioxide emissions, and the IPCC pathways require this to reduce dramatically. To apply that same dramatic reduction to New Zealand where there is no major deforestation and our land sector acts as a sink already is not sensible. In addition, Professor Wuebbles looks to be applying a percentage reduction based on figures that exclude harvesting and replanting, to New Zealand figures that include harvesting and replanting. No sound conclusions can be drawn from that comparison.

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124. I note again that the question Professor Wuebbles has been asked by LCANZ (described at paragraph 6) does not reflect the question that the Commission was addressing, and Professor Wuebbles makes no reference to the exercise actually carried out by the Commission. Nor is it apparent that he had read the Commission's Advice in any detail.

125. It appears that Professor Wuebbles' views are expressed on an incomplete understanding of what the Commission was asked to do, what it did and the reasons for it.

126. Even on that basis, however, I note that he does not express any agreement with Dr Gale's view on the 'maths error': rather his evidence is a more general explanation of the importance of accounting for human caused emissions, which is a basic principle of target accounting. How that is achieved in any particular context is the more complex issue, and possibly because of the limited nature of the question he was asked, Professor Wuebbles does not seem to have engaged with what the Commission actually did in that regard.

Professor Piers Forster (UK)

127. Professor Forster is a well-recognised expert in his field, and was in fact a co-author for advice requested by the Commission in the development of its Advice on the request made to the Commission by the Minister under s 5K on reductions in biogenic methane.[69]

128. Unlike Dr Gale, Dr Rogelj and Professor Wuebbles, Professor Forster does actually engage with the Commission's advice in his evidence. At paragraphs 6 and 7, contrary to most of LCANZ' other witnesses, he endorses the adoption of gross-net accounting as well justified and reasonable. However, he refers to this as the Commission's decision, rather than the government's continuation of an accounting approach initially required under Kyoto Protocol, perhaps indicating a lack of detailed familiarity with target accounting for countries where the land sector is a sink rather than a source. Professor Forster's reference here to 'standard accounting practice' would be

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[69] Piers Forster, Richard Miller and Jan Fuglestvedt *Climate science considerations of global mitigation pathways and implications for New Zealand mitigation pathways* (14 January 2021), CBD at [•].

standard in the UK, given the UK's emissions profile, but not 'standard' in countries with a different type of emissions profile.

129. This possible lack of detailed understanding of the implications of an emissions profile such as New Zealand's may be why the Professor considered that he could agree with Dr Gale that an 'error of mathematical logic' had occurred in the Commission's modelling. For the reasons set out above, the Commission disagrees with this view, but without discussing this in detail with him I am not clear whether the Professor would maintain this position once he was fully informed of the context.

130. It may be however that Professor Forster is approaching this only from the question Dr Gale was asked (which is the same limited question as was asked of Dr Rogelj and Professor Wuebbles, although for reasons that are not explained, not of Professor Forster). If he was considering only that question (which was not the Commission's task), then as I have noted, applying a net-net approach to a net-net outcome would make logical sense. I would be interested in hearing the Professor's views on how he would have approached the task that the Commission was actually undertaking here (to find a way to assess a gross-net NDC from modelling based on IPCC net emissions pathways), if he were given a required parameter that the NDC could not be 'converted' into a net-net NDC (unless both it and its comparators were then converted back to being gross-net, of course).

131. Turning to paragraph 9 of Professor Forster's evidence, if I understand this correctly the Professor appears to accept NDC gross-net accounting as legitimate but argues that because the level of net removals under NDC accounting will decrease from 2010 levels out to 2030, New Zealand should make up for that decrease with an equivalent amount of extra gross CO_2 emissions reductions. While not clearly stated, this argument and the compatibility test he has designed are equivalent to applying a net-net approach under NDC accounting: that is, applying the range of IPCC cuts to the NDC accounting net CO_2 emissions in 2010. This approach may appear logical at face value, but would perversely penalise New Zealand for the large area of new forests planted in the 1990s – that is, prior to the beginning of the IPCC's assessment timeframe.

132. The level of net removals under NDC accounting is weakening from 2010 because the large area of forests planted in the 1990s are reaching maturity. In Figure 3.2 cited by the Professor, the level of removals (under NDC accounting) declines from 14.0 Mt CO_2

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in 2010 to 5.8 Mt CO_2 in 2023, before increasing again due to the impact of projected new forest planting to 10.1 Mt CO_2 in 2030. Without this new (post-2009) forest planting, we have calculated that the level of removals would in fact fall to 2.0 Mt CO_2 in 2030.

133. Under Professor Forster's approach to compatibility, New Zealand would have to work much harder than the global average in reducing gross CO_2 emissions from 2010 to 2030 because we planted a lot of forests in the 1990s – harder than if we had *not* planted those forests. Under this same approach, a country that had instead deforested a large amount of land in the 1990s but then replanted some of it in the late 2000s would be allowed to reduce gross emissions by less than the global average, because its net removals would increase from 2010 to 2030.

134. These perverse outcomes from using net CO_2 emissions as the starting point for the compatibility assessment arise because of the legacy effects of land use decisions undertaken before the reference year (in this case 2010). These legacy effects are one of the reasons that Kyoto Protocol rules stipulated that countries whose land sectors were a sink in the base year should use a gross-net approach to setting targets. As I have noted, it may be that the Professor does not have an in depth understanding of the issues facing countries in this position, and the accounting approaches developed to address that, which could explain why he did not realise the implications of his proposed approach.

135. Turning to paragraphs 10 to 15 of the Professor's evidence, Professor Forster raises a question about the 2010 base year, specifically on the basis that the forest sink in the Commission's 2030 target seems to be estimated from a 1990 baseline, but a gross emission 2010 baseline is chosen for quantifying 2030 net targets. Accordingly, Professor Forster says that this means that the Commission seems to count the NDC forest sink prior to 2010 in the 2030 emission target but not in the 2010 baseline.

136. Professor Forster has touched on a valid issue. The Commission used a 2010 base year for the development of its comparator NDCs because this was the base year in the IPCC's analysis, meaning the pathways only started from that year. However, because New Zealand's NDC accounting will continue to use a 1990 base year for forestry, CO_2 removals from forests planted after 1990 and before 2010 will be credited towards meeting the 2030 target.

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137. This was not something that the Commission discussed directly in the Chapters addressing the NDC advice. However, the Commission was aware of this inconsistency and referred to it in the context of assessing the compatibility of the Commission's demonstration path in the emissions budget advice with contributing to the 1.5°C effort.[70] We undertook some analysis to determine the scale of the problem, and found that the impact was small due to the averaging approach taken under NDC accounting. Hence, contrary to Professor Forster's assumption that this would mean that "a large fraction" of the emission reduction is already met, and that the target requires "far less significant reduction in emissions" as a result, the reality is that only a relatively small portion of removals in 2030 will be from pre-2010 forests. In the context of our modelling exercise for the NDC advice, this is not a significant factor.

138. I note also that the Professor's suggested net-net approach set out in paragraphs 13 and 14 seems to overlook the fact that the NDC is *already set* on a gross-net basis, and equally overlooks one of the primary reasons for that – being to exclude the obscuring impact of the major cyclical changes in forestry emissions and removals that are a major (and unusual) feature of New Zealand's emission's profile. His suggested approach might be appropriate if New Zealand's national circumstances were different.

139. Finally, I am concerned with Professor Forster's conclusion at paragraph 16. The Professor states: "Adopting the Commission's proposed framework and their proposed emission reduction target would give New Zealand an unambitious 2030 target that does not align to meeting global ambitions of holding global temperature rise to 1.5C."

140. The Professor appears to have inexplicably conflated accounting standards with the ambition of the target itself. Decisions on an accounting approach are not be made with reference to the ambition of the target. Rather, appropriate accounting approaches are assessed against whether they actually measure and incentivise real change, through accuracy, fairness, transparency, and comparability. The accounting standard must be good or bad on its own merits, not retrospectively judged on the basis of whether one agrees with the outcome it produces – that would invalidate the purpose of the standard entirely. The Professor also appears to have overlooked a key aspect of the Commission's advice, being that it is for government to set the level of

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70 Advice Bundle at 209.

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ambition, with the Commission's modelling providing only guidance as to the minimum level of commitment required to be compatible with the 1.5°C goal. I note that the Commission's advice in this regard was consistent with the expert advice co-authored by Professor Forster at the Commission's request.

Dr Ivo Bertram (New Zealand)

141. As with Dr Gale, it is not apparent that Dr Bertram has any expertise or experience in climate change accounting. Rather, his experience appears to be economics and finance, including research on international trade dimensions of climate taxes and emissions trading schemes. These are quite different areas to climate change accounting.

142. As I have mentioned, Dr Bertram made a submission on the Commission's draft Advice.[71] That submission did not raise any issue about a 'maths error', but it did make it clear that Dr Bertram has very strong views about gross-net accounting in general, describing it as "a key tool for misinformation" by government Ministers, who in his view have engaged in "opportunistic data manipulation".[72] He refers to the Commission's discussion of this accounting approach as "specious" and its resulting analysis as "obviously untrue".[73]

143. Dr Bertram claims in his submission on the Commission's draft Advice that through the use of gross-net accounting all the government's commitments under Kyoto and Paris do not in fact involve any reduction at all in New Zealand's greenhouse gas emissions. He acknowledges that the 2050 target set in the Climate Change Response Act would require a reduction, but refers to that as "pie in the sky".[74] On that basis he claims that the government has made "no actual commitment to reduce this country's emissions <u>at all</u> before 2030".[75]

144. Dr Bertram's views are clearly sincerely held, but they unfortunately reflect a lack of understanding of the fundamental principles of climate change accounting.

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71 CBD at [•].
72 CBD at [•].
73 CBD at [•].
74 CBD at [•].
75 CBD at [•].

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145. Dr Bertram's evidence in this proceeding appears to be basically a repetition of this policy campaign, that the government should move away from gross-net accounting and instead adopt for all purposes the measures used in the national inventory reporting under the UNFCCC, and that the Commission should be instrumental in that change. For reasons I have already touched on, the Commission does not agree with his position.

146. There are also a number of mistakes in Dr Bertram's evidence.

147. For example, at paragraphs 26 and 28 Dr Bertram refers to the Common Reporting Format (CRF) and describes this as "the authoritative CRF guidelines issued by the IPCC." The CRF are not guidelines, and are not issued by the IPCC. The CRF is the set of reporting tables that are to be completed by each Party as part of their national inventory reporting under the UNFCCC. It is essentially a database tool developed by the UNFCCC secretariat reflecting the latest guidelines for reporting national greenhouse gas inventories as agreed to by Parties under the UNFCCC and Kyoto Protocol. The IPCC has issued guidance on how to report and estimate emissions for reporting, but that is separate from the CRF reporter software itself or the CRF tables it produces

148. A more major issue arises with paragraph 30 where Dr Bertram states that the IPCC 2018 Special Report based its modelled projections on the national inventory reporting: "these exercises are done in terms of global GHGI net emissions as defined in the Common Reporting Framework". Unless Dr Bertram has access to information about the IPCC processes that is not generally available, this appears to be an incorrect assertion. The 2018 Special Report does not state this, and it seems almost certain that the IPCC could not have used national inventory data as the basis for its global emissions estimates. This is because the 2018 Special Report needed to work with data for the whole world, and that data had to be consistent for them to be able to model with it.

149. Under the UNFCCC reporting there has been a strong bifurcation in responsibilities between developed and developing countries. Developed countries have had stringent reporting obligations including national reporting of annual greenhouse gas inventories, but these only apply to the 42 Annex 1 countries. Developing countries (that is, the majority) on the other hand are encouraged to publish greenhouse gas inventories when they can, but they are in general much less frequent. The most

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recent year that China has submitted a greenhouse gas inventory for is 2014. China, Brazil, India, South Africa are responsible for 40 percent of global CO_2 emissions in 2020 according to Our World in Data, and they are all considered developing countries with more relaxed reporting obligations.[76] A data source that excludes that much of world emissions is not useful for global emissions modelling: while it seems likely that national inventory reports would have been taken into account, they cannot have been the basis for the modelling overall.

150. In paragraph 42 Dr Bertram claims that: "... the CRF tables submitted to the UNFCCC by the New Zealand Government are the internationally-authoritative gross and net emissions measures under Articles 4 and 12 of the Convention. Those tables do not include the New Zealand Government's gross-net target calculations related to Protocol compliance, which are incorporated into the annual greenhouse gas inventory reports as separate sections of text which have no counterpart in the CRF inventory tables." While this is more relevant to LCANZ' third ground of review, it again demonstrates a basic error by Dr Bertram: the statement is simply wrong. There are specific CRF tables for the Kyoto Protocol data. The Kyoto Protocol figures that are reported separately in the inventory report itself, are also included in the CRF data.

151. At paragraph 43 Dr Bertram incorrectly describes New Zealand's adoption of the mandatory Kyoto Protocol requirement of a gross-net approach as the New Zealand government developing "its own bespoke measure of so-called 'target emissions'". All Kyoto Protocol Annex 1 countries were required to develop these so called bespoke measures, and 34 of the 45 Annex 1 countries were in the same position as New Zealand, with their land sector as a sink in the base year of 1990, and hence adopted the same gross-net approach.

152. Dr Bertram's subsequent criticisms appear to be directed at this basic Kyoto target accounting approach, and the fact that it has been followed by the government in setting the NDC. Other witnesses for the Commission will address this wider issue of 'what the atmosphere sees' versus how to account for (and incentivise) changes in human activity that contribute to or reduce emissions, but as a basic observation,

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76 That is changing now, but has not yet changed, and the 2018 Special Report was done in 2018 before reporting obligations on developing countries came into force.

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when considering how best to measure New Zealand's progress towards a target, target accounting is usually the better option as that is what it is designed to do.

153. Dr Bertram addresses the NDC advice at paragraphs 75 onwards.

154. I disagree with his claim at paragraph 76 that the Commission's advice "entirely overlooks" the issue he refers to here. This was not overlooked, the Commission simply approached the issue differently to the way that Dr Bertram appears to prefer. Dr Bertram appears to apply "share of effort" by weighting the percentage reductions the IPCC described on a gas by gas basis, on the basis of average world emissions, and then applying that as an average to each country as their share. In other words, Dr Bertram's view appears to be that all countries must meet the average set by the globe's profile of emissions, ignoring national circumstances, and ignoring the specifics of what the IPCC said about particular gas reductions. I do not agree that this is a sensible way of assessing fair share.

155. In paragraph 77 Dr Bertram similarly appears to conflate the IPCC global pathways with an assessment of fair share. The modelled emissions pathways in the 2018 Special Report said nothing about what a fair share from any country would be. Expert advice we commissioned in preparing the advice (co-authored by Professor Piers Forster, that I have already referred to[77]) has equally confirmed that fair share is more complex than just taking a percentage of a global pathway, and confirmed our view that the overall assessment of what the contribution from Aotearoa should be to the global effort is not a scientific (or mathematical) question, but one driven by fairness and equity principles.

156. That same expert advice also confirms the dangers of making judgements based on overly simplistic approach to these issues, noting for example in its conclusion:[78]

> As New Zealand's starting position in terms of sectoral emissions is different from other nations, a high ambition emission reduction trajectory might look quite different to a high ambition pathway from another country. In particular, many countries are expected to rapidly decarbonise their power sector out to 2030, leading to large national emission reductions in the 2020s. In countries such as New Zealand (and the UK) where the power sector is already mostly decarbonised, urgent actions are needed on other sectors such as agriculture, buildings and transport for mitigation compatible with Paris Agreement ambitions. Policy actions in these areas might take longer to manifest themselves in emissions trends.

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77 CBD at [•].

78 CBD at [•].

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Dr Bertram's preferred approach allows for no such nuances, and would not be useful to inform policy decisions going forward.

157. Dr Bertram does not appear to hold the same view as Dr Gale that the Commission has made a simple mathematical error: rather at paragraph 82 he argues that we have "erroneously conflated target accounting with the mathematical application of the 2018 Special Report". However, the same response applies: the Commission was not engaged in a "mathematical application of the 2018 Special Report", rather it was engaged in developing what was acknowledged to be imperfect comparators for the purpose of forming a view and providing advice on the gross-net NDC set by the government.

158. Dr Bertram's criticisms of the 2010 base year in the IPCC pathways in paragraphs 83 and 84 is odd. For the purposes of our modelling, we of course adopted the 2010 base year for the IPCC pathways as the IPCC pathways only begin in 2010, and we are not comparing this to a Kyoto Protocol target, so there is no question of "unilaterally declaring" a variation to Kyoto. Also, converting between base years is easy to adjust for, as I have already mentioned. The NDC the Commission was advising on for example is often expressed as 30 percent reduction on 2005 or an 11 percent reduction on 1990. It is a simple percentage calculation.

159. Dr Bertram appears to have made a mathematical error at paragraphs 87 and 88, by drawing a straight line for the CO_2 component of the NDC from the gross start point to a net end point. This indicates to me that Dr Bertram has not understood the significance of the selection of the appropriate start point for this type of analysis.

160. Much of what follows in Dr Bertram's evidence appears to be continuing criticisms of New Zealand's use of gross-net accounting generally, and does not reflect either what the Commission was advising on, or the reasons for our advice. For example, at paragraph 98 Dr Bertram claims: "The Advice is evidently concerned about how onerous a 2030 net-net target would be for New Zealand, and is in effect pleading for New Zealand to be a special case because we have relied on forestry to meet our international commitments in the past". No such 'special pleading' is reflected in the Commission's advice, but more importantly, Dr Bertram here can only be referring to the NDC itself – *which had already been set* by government on a gross-net basis. Dr Bertram is also apparently unaware of the number of other countries who have

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adopted a similar approach to setting a gross-net NDC following the Kyoto accounting principles.

161. Dr Bertram's core position on this issue is also contrary to Professor Forster's more informed view at paragraphs 6 and 7 of his evidence that the adoption of a gross-net method with a 1990 baseline is well justified and reasonable.

162. Dr Bertram then progresses from paragraph 102 to set out his own personal analysis of "how a 1.5° consistent emissions budget might be validly constructed." There are many problems with Dr Bertram's proposal, which perhaps illustrate the dangers of approaching a complex and specialist area with an underlying assumption that it is (or should be) straightforward and intuitive. Some of the reasons why Dr Bertram's proposals would not be suitable for New Zealand's budgets include:

162.1 The reductions needed at a global level are based on the global emissions profile which is overwhelmingly CO_2. New Zealand's emissions are mostly methane and nitrous oxide. Dr Bertram overstates the contribution we need to make in reducing CO_2, which is not useful to inform policy decisions or the formulation of New Zealand's climate response plan.

162.2 It adopts a net-net approach that is inconsistent with New Zealand's target accounting approach under Kyoto.

162.3 Dr Bertram appears to be debiting New Zealand with the upswing of emissions in the forestry harvest cycle, but ignoring that New Zealand took no credit for the sequestration that occurred while those forests were growing. He is therefore putting forestry on only one side of the ledger for New Zealand – which is poor accounting.

162.4 Dr Bertram is weighting the target by proportion of emissions – this grandfathers in existing emissions as the status quo, unfairly punishing developing countries with low starting emissions, and unfairly benefiting countries like New Zealand.[79]

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79 The Commission discussed the different approaches to considering fair share in the Advice: see Advice Bundle at 387 – 389.

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162.5 Dr Bertram makes a fundamental assumption that net figures in the national inventory reporting under the UNFCCC are equivalent to target accounting and are useful for that purpose, which misunderstands how both of those are measured, and how forestry works in New Zealand's targets. It is not appropriate to use national inventory net emissions as a starting point to set a target from, because the effect of cyclical harvesting that is net neutral to the climate in the long-term will obscure any real emissions changes in either direction. This is not useful for informing policy decisions on appropriate response plans.

163. Dr Bertram makes a number of criticisms about whether casual readers or members of the public could readily understand the complexities involved in aspects of the Commission's Advice. While I agree that good communication and transparency are important, it is also important to bear in mind that these *are* complex matters, and climate change accounting is a complex and specialised area. We do not expect lay people to intuitively understand the detailed ins and outs of complex financial accounting principles, but we don't discount those principles as misleading and obscuring because of that. The Commission's advice responding to the Minister's request involved highly complex modelling to support an informed assessment: the Commission's duty was to exercise its expertise to provide the best possible advice, and that would not be assisted by ignoring genuine complexity and simplifying matters at the cost of robust analysis.

Dr William Taylor (New Zealand)

164. Dr Taylor is a consultant economist working with NERA. He does not claim to have expertise in climate matters, let alone climate change accounting. Dr Taylor's judgements and assessments reflect this lack of knowledge and experience.

165. Dr Taylor adopts a similar approach to Dr Gale, and asserts that there is a "simple mathematical error".[80] I have addressed this claim already.

166. Dr Taylor's analysis also appears to be based on the misapprehension that the Commission was 'applying' the IPCC pathways directly to New Zealand's emissions, as a direct mathematical equation to give a clear percentage figure of required

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80 Affidavit of Dr William Taylor, Appended Report at [8] and [91].

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reductions. As I have already outlined, and as is clear from the Advice and Supporting Volumes, this is exactly what the Commission was *not* doing.

167. Dr Taylor, like Dr Bertram, also falls into the error at paragraph 13 of treating the national inventory reporting measure for land use as if it were an appropriate accounting quantity. It is not, for the reasons I have already outlined. Other witnesses for the Commission will explain in more detail the importance of excluding long term cyclical variations that do not reflect changes in human action or government response, but basically, in accounting terms comparing the net national inventory reporting measures (which includes the cyclical swings of pre 1990 forests) will not give a useful picture of government action going forward. Right now it makes New Zealand's emissions profile (and the government) look 'bad', simply because of where we are at in the forestry cycle. But in future decades it will make our profile (and the government) look very good, again, simply because of where New Zealand is on its forestry cycle. Both the bad and the good are unjustified and should be removed from the accounting system as cyclical variation. More importantly, these cyclical swings – that reflect no long term net change for the environment - drown out what we are actually trying to measure with these targets: how much has New Zealand actually *changed its behaviour* and what new actions are we taking improve our emissions going forward.

168. Our net emissions/removals from forestry will go up and down over decades for reasons that have nothing to do with the measured action of governments. Getting a true representation of what additional action the government should be held accountable for requires that the variability of forests that are net-neutral over long time periods be factored out.

169. Dr Taylor refers in section 3.4 of his report to a graphic developed and published by Stats NZ which attempts to show a direct comparison between the IPCC split-gas pathways and New Zealand's net emissions reported in its national inventory. Dr Taylor says at paragraph 96 that Stats NZ have taken the same approach as he proposes, although he acknowledges that the Stats NZ figures are out of date.

170. For the reasons that I have touched on already about how the IPCC pathways cannot be directly applied in this way, the Commission has significant concerns with the Stats NZ graphic, which is not analytically robust. The Stats NZ graphic makes the gas-by-gas pathway ranges appear like they are appropriate targets for New Zealand

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when that is not what they are and not what they can be used for: Dr Rogelj's evidence for LCANZ confirms that, as does the advice the Commission received from its external experts, including Professor Forster. Once we became aware of the comparison on Stats NZ website, we raised these issues with Stats NZ.

Emeritus Professor Ralph Sims (NZ)

171. Professor Sims is the only LCANZ witness who does not refer to the alleged 'math error' and it appears he was not asked to give evidence on this issue, despite having much more extensive experience in climate change matters than Dr Gale, Dr Bertram or Dr Taylor (although I note Professor Sims does not claim any expertise in climate change accounting).

172. As I have already mentioned, Professor Sims made a submission on the Commission's draft advice.[81] Professor Sims' submission was focussed on whether the Commission had adequately emphasised the degree of urgency now needed, given the growing risks of climate change impact and the possible costs of inaction becoming more clearly relevant. He also talked about the importance of behavioural change in order to reach net-zero carbon emissions by 2050 and made a number of useful observations and suggestions which were given full consideration.

173. In his submission on the draft Advice Professor Sims did not raise any issues with a 'maths error', or with the Commission's approach to advising on the compatibility of the NDC, or with the accounting decisions more generally.

174. The Commission does not disagree with the general points expressed by Professor Sims in his submission to the draft Advice, nor with the broad theme of his evidence in this proceeding, as the Advice reflects. Budgets and commitments are only words and numbers, and worth very little if they are not accompanied by action, and the action required will absolutely need widespread societal commitment and behavioural change to be effective. This is a strong focus of the Commission's Advice. The Commission in its Advice also reiterates that New Zealand is not on track to meet its targets and elected officials need to move fast to implement a comprehensive plan.[82]

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81 CBD at [•].

82 Advice Bundle at 28.

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175. On a more minor point, Professor Sims also refers to the Stats NZ figure I have discussed above, and my response is the same here.[83] I also note that Stats NZ should not be used as a source of national inventory reporting figures as its website is out of date.

176. Finally, if the sense of Professor Sims' evidence is that the urgency for an effective global response should drive New Zealand towards reducing its own emissions faster, without regard to any other considerations, I would not agree. New Zealand reducing emissions faster will not change the global impacts of climate change to any material degree. We are ≈0.17 percent of global emissions, and no matter how fast we cut our emissions, we will not change the impacts felt. We must reduce our emissions for many good reasons, including to contribute to a global collective action problem and to motivate other countries to also contribute, but there is no causal link between the speed in which we reduce emissions and the impacts of climate change felt by us or by anyone else.

Affirmed

Matthew James Smith

At Wellington this 10th day of December 2021

before me:

Hana Khan
Solicitor, Wellington

A Solicitor of the High Court of New Zealand

[83] CBD at [•].