

In the High Court of New Zealand
Wellington Registry

CIV 2021-485-341

I Te Kōti Matua O Aotearoa
Te Whanganui-ā-Tara Rohe

Between **Lawyers for Climate Action NZ
Incorporated**

Applicant

And **The Climate Change Commission**

First respondent

And **Minister for Climate Change**

Second respondent

AFFIDAVIT IN REPLY OF DR IVO GEOFFREY BERTRAM

Sworn 17 January 2022

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AFFIDAVIT IN REPLY OF DR IVO GEOFFREY BERTRAM

I, Dr Ivo Geoffrey Bertram, Economist of Wellington, swear:

1. I am a Senior Associate at the Institute of Governance and Policy Studies at Victoria University of Wellington. I have previously given an affidavit in this proceeding, dated 22 September 2021. This affidavit sets out my reply to the certain matters raised by the affidavits of the witnesses for the Climate Change Commission and the Minister and responds to their main comments on my previous evidence.

The mathematical error in the Commission's application of the Special Report

2. One of the central issues in this case is whether the Climate Change Commission has erred by applying the percentage emission reductions required from 2010 net CO₂ in the IPCC Special Report's modelled 1.5°C pathways, to New Zealand's 2010 gross CO₂ emissions.
3. I consider that for any comparison between New Zealand's Nationally Determined Contribution (NDC), which is expressed in gross-net terms, and the Special Report's pathways, which are net-net, to be valid, the comparison must be carried out on a like-for-like basis.
4. In terms of the calculations in question, this means that the Special Report's 40% to 58% reductions in the global rate of net CO₂ emissions from 2010 to 2030 should have been applied to New Zealand's 2010 net CO₂ emissions to be mathematically valid, not to its 2010 gross CO₂ emissions. The outcome of this calculation could then be compared to the commitments in New Zealand's NDC to test whether it was in line with the Special Report. The Commission's witnesses claim that applying like-with-like is not necessary.
5. The Commission's approach involves making a direct comparison between, as Mr Smith aptly puts it at his paragraph 99, "an orange" and "an apple". Mr Young in his paragraph 88.2 captures precisely the issue of gross-net versus net-net: "Differences in how something is calculated and recorded of course gives [*sic*] a different number, and trying to compare one directly against the other is meaningless. Numbers *within* each series can be compared, but not *between* the series, unless you first convert the data to a comparable accounting basis" [emphasis added]. I agree with this statement, which concisely summarises the nature of the error into which the Commission has fallen in directly comparing gross-net NDC numbers with the net-net Special Report ones. This is a fundamental error. The Commission has also committed the same error in table 9.1 in chapter 9 of

the Advice in comparing its proposed emissions budgets with the Special Report pathways: the percentage carbon dioxide reductions under the Commission's demonstration path in this table are based on a 2010 gross starting point, not a 2010 net starting point.

6. In his paragraphs 102-106 Mr Smith dismisses as "an abstract exercise in arithmetic" the conversion calculation that would be required to make a like-with-like comparison possible, and alleges that this arithmetical conversion would be "incorrect on many levels".
7. Those "many levels" turn out to be three, outlined by Mr Smith in his paragraphs 107-109.
8. First he alleges (paragraph 107) some "misunderstanding of what 'gross' and 'net' mean in the context of climate change accounting following Kyoto". I do not agree that any misunderstanding arises: apples are apples, and oranges are oranges, and directly comparing them is (in Mr Young's words) meaningless unless an appropriate conversion exercise has been undertaken. Mr Smith's extensive description (in his paragraphs 33-55) of the difference between gross and net, and of the reasons why the Protocol provided for the use of gross-net accounting in setting and monitoring country commitments, leaves untouched the fact that directly comparing gross-net with net-net numbers is not a like-with-like exercise.
9. As I explained in my first affidavit at [22]-[23], the Special Report uses the gross/net terminology to distinguish between human-caused greenhouse gas emissions (gross) and the balance of human-caused greenhouse gas emissions minus human-caused removals of greenhouse gas emissions (net). This is the same as the terminology used by Dr Gale.
10. Second, Mr Smith says in his paragraph 108 that to require conversion of the NDC into net-net terms is a "direct attack on the core concept of gross-net accounting itself". No such direct attack is involved in saying that direct comparison of gross-net with net-net requires conversion into a common metric. One simply has to be aware that an orange is not an apple.
11. A number of the respondents' witnesses¹ make the point that the accounting format used to express an emissions target does not determine the level of ambition, which is a political decision separate from the choice of accounting methodology - any given level of ambition can be expressed in whatever format is chosen. I agree, and add two points. First, a set of

¹ For example Mr Smith at paragraph 140; Dr Reisinger at paragraphs 43, 58-59 and 68; Ms Plume at paragraph 73; and Mr Young at paragraphs 29, 54-55, 76 and 88.3.

conversion factors needs to be calculated to enable the given degree of ambition to be expressed in alternative formats, so that (for example) an NDC expressed in gross-net terms can be re-expressed as net-net. Then, for purposes of comparison with the Special Report, the appropriate metric (net-net) can be applied. Thus the Special Report's 40 to 58% reduction figure should have been applied to 2010 net CO₂, to produce a net-net "starting point" for a target for 2030 emissions. The final target adopted could then be converted to gross-net terms with a 2005 starting year to match New Zealand's NDC and re-expressed in those terms, as Dr Taylor does in section 3.5 of his first affidavit. Getting the maths right does not imply having to abandon gross-net.

12. Third, Mr Smith says in his paragraph 109 that the New Zealand Government has set its NDC in gross-net terms and that it would be difficult and costly to change it to net-net. This is irrelevant to the issue at stake here, which is whether gross-net and net-net can be directly compared for analytical purposes. In order to answer the question posed by the Minister – whether the NDC was consistent with the 1.5° global target – the Commission ought to have begun by deriving the net-net implications of the NDC and could then have undertaken their arithmetical calculations on a correct basis, regardless of the NDC being expressed in gross-net terms.
13. I further disagree with Mr Smith when he alleges in his paragraph 110 that such a comparison would be "pointless" and that to carry out the comparison on a like-for-like basis would involve "a hypothetical NDC that doesn't exist, and doesn't reflect the NDC actually set by the government". The opposite is the case: a proper calculation would compare the scientific modelling in the Special Report of the required reductions in net CO₂ against the actual NDC as set by the New Zealand Government but expressed in net-net terms. Dr Reisinger in his paragraph 80 agrees that this "would have been a valid approach".
14. Such a calculation would have properly converted "the global reductions for each individual greenhouse gas (set out in the IPCC 1.5°C pathways) to reductions at the national level for Aotearoa" and produced the "starting point, based on scientific modelling" that the Commission was seeking (Advice, box 21.1, p 354).
15. I also do not agree with Mr Smith's suggestion in his paragraph 163 that doing the comparison correctly would amount to "ignoring genuine complexity and simplifying matters at the cost of robust analysis." I do, however, agree with Mr Smith when he notes in his paragraph 111 that the required mathematical exercise is not trivial and involves a number of

technical issues – including the fact (not contested) that “the national inventory reporting and the IPCC pathways are not aligned and are not directly comparable”. This is the sort of work for which the Commission was established and which it is fully equipped to undertake. Both I and Dr Taylor, without the resources available to the Commission, have undertaken calculations to show how a correct approach could proceed. Neither of these is a perfect substitute for a fully-resourced exercise by the Commission’s staff, who are familiar with the differences among various data sets and well able to make any appropriate adjustments. But such adjustments are an order of magnitude less important than the error of applying the required global rate of net carbon dioxide emissions reductions to our 2010 gross CO₂ emissions.

16. As I point out in paragraph 54 below, in undertaking my own calculations I took the IPCC pathways as being sufficiently close to CRF inventory values to justify proceeding without entering into a fruitless quest for absolute precision. In other words I consider the IPCC pathway numbers to be sufficiently “aligned and comparable” with the GHGI inventory series to enable valid conclusions to be drawn. Statistics New Zealand evidently takes the same view². The NDC gross-net numbers, in contrast, are neither aligned with, nor comparable with, the IPCC pathways. I therefore disagree with Dr Glade’s paragraph 23 where she appears to argue the contrary.
17. Mr Young in his paragraph 91 alleges that my approach to the calculation of consistency between the NDC and the IPCC pathways consists of “trying to directly compare figures derived under these two different accounting approaches when they are not comparable”. In fact my approach, in common with other witnesses for the applicants, is to reject making any such direct comparison without undertaking conversion of the gross-net target to net-net terms. It is the Commission, not the applicants’ witnesses, that has made the error identified by Mr Young.

The limited domain of application of gross-net and MAB accounting

18. A number of witnesses for the Commission have focused their evidence on an issue which is not, as I understand it, contested between the parties, namely whether the use of gross-net accounting to set New Zealand’s NDC is allowed under the UNFCCC. It clearly is.
19. Equally, I understand that there is no dispute over whether MAB accounting is consistent with the UNFCCC rules (which is a different issue

² <https://www.stats.govt.nz/indicators/new-zealands-greenhouse-gas-emissions> plots the Special Report’s emission ranges for 1.5° alongside CRF emissions data from which the IPCC ranges have been calculated.

from that raised by LCANZI - whether the Act permits MAB accounting to be used for setting emissions budgets). But MAB accounting is only one of several approaches that could have been used, with equal legitimacy, by the New Zealand Government in setting its NDC. The merits of expressing the NDC in gross-net terms, and of the use of MAB to measure net emissions for NDC purposes, may be debated, but it is not contested that the UNFCCC rules allow both.

20. Therefore, the section of Dr Glade's evidence headed "second issue", at paragraphs 67 – 94, comprising a detailed exposition of MAB accounting, is beside the point. While Dr Glade describes it as a response to the affidavits of myself and Dr Taylor, I did not deny that New Zealand is entitled to adopt this method if it chooses to do so. I have cast doubt on the wisdom of the choice, but not on its legitimacy in terms of the detailed rules and decisions of the UNFCCC for the purpose of setting commitments³. For better or worse, New Zealand has specified its commitments through to the year 2030 in gross-net terms, and intends to account for compliance using MAB accounting. The domain of application for that procedure is linked tightly to the commitment/compliance nexus under the UNFCCC, and my first affidavit nowhere denied this; on the contrary I said (paragraph 45) that gross-net accounting is appropriate when used to test compliance with gross-net commitments, but that outside that domain of application, gross-net accounting does not serve.
21. Gross-net accounting numbers, in short, are appropriate for reporting on New Zealand's compliance with commitments made in gross-net terms. However, gross-net accounting cannot reasonably be used in the way the Commission has done to evaluate the consistency of the NDC with the Special Report. What Dr Taylor and I have said in our evidence is that the gross-net accounting procedure, in its MAB form or any other, is not appropriate for the purpose of comparing the NDC with the IPCC pathways. I do not agree that either myself or Dr Taylor have "misunderstood the purpose of activity-based accounting and how it works" (Dr Glade's paragraph 94).

My submission on the draft report

22. At several points in their evidence Mr Smith and Mr Young make reference to a submission made by me on the Commission's draft report. Mr Smith at paragraph 145, for example, says that "Dr Bertram's evidence in this proceeding appears to be basically a repetition of this policy campaign".

³ Dr Brandon at paragraph 25 has suggested that the applicant considers net-net accounting "the only correct approach" for setting the NDC; this is clearly a misinterpretation or misunderstanding of the position.

This has led them to read into my evidence a number of statements that are not there.

23. They are correct in saying that I have from the outset been personally opposed to the New Zealand Government's adoption of gross-net accounting, on the grounds that it allowed New Zealand policymakers to defer serious action on this country's gross emissions throughout the period 2008-2020. As an academic economist attached to an institution (the University) that has a statutory duty to act as critic and conscience, I have been a consistent and sometimes vigorous participant in policy debates over climate change issues since 1989. I have from the outset criticised gross-net accounting as providing cover for lack of ambition. In my submission on the draft report I urged the Commission not to use gross-net data when laying out the historical record of New Zealand's performance under the UNFCCC to date. I do not resile from any of those views, but I would note that they were expressed in a different forum for a different purpose. In my role as an expert witness, I seek to assist the Court, not to advance any policy agenda.
24. Mr Smith comments in his paragraphs 101 and 142 that I did not identify the alleged "maths error" in my submission. In fact, my submission criticized the Commission's across-the-board adoption of gross-net accounting, urged the Commission to "re-work its spreadsheets, charts and tables using the UNFCCC inventory numbers and methodology for net emissions as the basis", and commented that "an important effect of re-working the numbers would probably be to tighten the 2022-25 and 2025-30 budgets quite significantly".
25. In terms of the specific issue of how the Commission's draft report laid out its analysis of consistency with the Special Report pathways, it should be noted that the draft report's presentation of this part of its analysis was obscure in the extreme. Table 10.2 in Chapter 10 of the draft Evidence Report⁴ explicitly stated that all numbers in the top row were for "net carbon dioxide", with no explanation at any point in the chapter that the 2010 entry in that row was in fact gross CO₂ emissions. When the Commission's recommended emission paths were compared with the Special Report paths in Figure 4.4 of the draft report, the comparison was done in terms of index numbers, with the result that the incorrect 2010 base for CO₂ was not apparent, and the underlying data for that Figure

⁴ <https://ccc-production-media.s3.ap-southeast-2.amazonaws.com/public/evidence/advice-report-DRAFT-1ST-FEB/Evidence-CH-10-S5K-requests-methane-and-NDC-26-Jan-2021.pdf> .

4.4⁵ did not show the actual emission numbers used to calculate the indices. To have engaged in detail with every specific detail of the draft report's calculations lay beyond the scope of my submission, but I take this opportunity to support the LCANZI submission⁶ which correctly identified the error in Table 10.2 of the Commission's draft Evidence Report.

Alleged mathematical error in my calculations at paragraphs 87-88

26. Mr Smith says at paragraph 159 of his affidavit that I have made a mathematical error in my calculations at paragraphs 87-88 of my affidavit "by drawing a straight line for the CO₂ component of the NDC from the gross start point to the net end point".
27. In paragraphs 85-91 of my first affidavit I undertook calculations that reproduced the Commission's tables 13.4 and 13.5 in the Advice's Evidence Chapter 13, apart from just one single change - the 2030 target for CO₂. The reason for undertaking this exercise was (as paragraphs 85 and 86 of my evidence stated) to confirm the derivation of some numbers laid out in the Statement of Claim paragraphs 88b and 90b.
28. The Statement of Claim says that for consistency with the Special Report's 1.5° pathways, the IPCC's 48% - 58% net-net reduction in CO₂ emissions relative to 2010 would imply a 2030 target for New Zealand's CO₂ emissions of between 2.120Mt and 3.029 Mt.
29. I confirmed, and I repeat here, that this is correct. Net CO₂ emissions in 2010 were indeed 5.038Mt (as per the Statement of Claim paragraph 85b), and a reduction of 40-58% would imply a 2030 target of between 2.120 and 3.029Mt (as per Statement of Claim paragraph 90a). I accordingly inserted those revised 2030 numbers for CO₂ into the Commission's Tables 13.4 and 13.5 and re-calculated the implied NDC budget.
30. Apart from this single change, I left untouched the Commission's other numbers. The point made in the Statement of Claim, and confirmed in my paragraphs 87 and 88, that application of the IPCC's net-net approach dramatically reduces the budget available to achieve consistency with the Special Report's 1.5° modelled pathways, can be well established with just this single change in the Commission's tables, leaving everything else untouched. In particular I made no change to the Commission's 2020 starting numbers in Tables 13.4 and 13.5. Given that the actual GHGI

⁵ <https://ccc-production-media.s3.ap-southeast-2.amazonaws.com/public/2021-Draft-Advice-Report-charts-and-data-v3.xlsx>, Tab "Chapter 4".

⁶ <https://static1.squarespace.com/static/5cf3039126905000011c02b0/t/60582ad62998f4194f095ad7/1616390878157/2021-03-22+LCANZI+Submission.pdf>.

inventory data for 2020 were not yet available, in the absence of that data I saw no point in trying to estimate alternative 2020 emissions values for insertion into the Commission's Tables 13.4 and 13.5. To have done so would have just complicated the issue.

31. Whether (as Dr Reisinger suggests in his paragraph 86) the Commission's own 2020 figure for CO₂ should be read as "the previous 2020 emissions target" or (as Mr Smith alleges in his paragraph 159) some point on "a straight line for the CO₂ component of the NDC from the gross start point to a net end point" is immaterial. I simply took as given the Commission's own 2020 starting number, for the purpose of demonstrating the implications of setting a net-net rather than gross-net target for 2030. No "mathematical error" is involved, and Dr Reisinger in his paragraph 86 states that he has "confirmed the calculation".
32. I note that the MfE paper *Consistency of NDC1 with efforts to limit global warming to 1.5°C*, appended as "AR-2" to the affidavit of Dr Reisinger, undertakes at paragraphs 82-83 what appears to be the same calculation as that undertaken in my paragraphs 87-88, and arrives at the same total budget number – 484Mt – as I recorded in my paragraph 89, corresponding to paragraph 90b of the Statement of Claim (inadvertently mis-labelled in my first affidavit's paragraph 89 as "Statement of Defence"). Mr Smith's suggestion in his paragraph 159 of a "mathematical error" is not well founded.

My expertise

33. Mr Smith at his paragraph 141 challenges my expertise on the grounds that "it is not apparent that Dr Bertram has any expertise or experience in climate change accounting". One possible interpretation of this is that in Mr Smith's view, only those who are actively engaged in the production of the emission accounts are entitled to engage in discussion of their implications. If indeed this is Mr Smith's position, I disagree. As an economist for the past five decades I have worked with a myriad of statistical series produced by official agencies around the world, and I have never heard any suggestion that merely because I had not produced the statistics myself I was not entitled to use them. One major reason for the production and publication of statistics is precisely to enable professional analysts, including economists, to get on with their own specialised work while relying upon published official statistics.
34. If instead Mr Smith was suggesting that I lacked experience in the use and analysis of emission accounting statistics, I would simply make the point that I have been engaged in climate-change-related research for thirty-four years and my published work includes a book on New Zealand climate

policy which made extensive use of the emission statistics being produced under the Kyoto Protocol.

35. Close acquaintance with the complex detail of gross-net accounting is not required to answer the simple question: should the Special Report net-net pathway for net CO₂ be applied to New Zealand's 2010 gross CO₂ or 2010 net CO₂ to produce a target for 2030? Commonsense, logic, and science all say net CO₂. No amount of detailed exposition of the highly technical accounting procedures behind the gross-net numbers can overcome that simple logic.

The CRF tables

36. In paragraph 42 of my evidence, referring to the gross-net total emissions series used by the New Zealand Government to measure compliance with its commitments, I said that the authoritative CRF 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."
37. Mr Smith in his paragraph 150 responds that "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." Similarly Dr Brandon at paragraph 65 quotes my paragraph 42 and says flatly "this is incorrect". As I explain below, their comments are based on a misreading of my evidence, which nevertheless requires some clarification.
38. Mr Young, in his paragraph 25, incorrectly accuses me of saying that "while the Greenhouse Gas Inventory reports land emissions under the Kyoto Protocol accounting approach, this is not included in the CRF tables", and in his paragraph 26 presents the following incorrect summary of my paragraph 42: "Dr Bertram, at paragraph 42 of his affidavit, says that the Common Reporting Framework tables submitted to the UNFCCC include only the datasets for the national inventory reporting approach (used for reporting under the UNFCCC), and do not include the datasets for New Zealand's target accounting reporting under the Kyoto Protocol."
39. I refer the Court to my paragraph 42 which contains no such statements. What I said was that the CRF tables do not include the calculation of the aggregate gross-net target emissions series used by the New Zealand Government to demonstrate compliance with its commitments. The gross-net target emissions appearing in Figure 5.3 of the Advice, and in Figures 1 and 2 of my first affidavit, have been calculated using data drawn from

the CRF tables, but are not themselves presented in those tables. The CRF tables provide, in other words, inputs to the gross-net target calculation, but not the output.

40. The CRF tables certainly do include detailed country data on LULUCF, separating out pre-1990 and post-1989 forestry (Tables 4.A – 4.C) and (for years from 2013 on) a set of tables (Tables 4(KP) – “accounting”) showing the numbers for KP-LULUCF activities under Articles 3.3 and 3.4 of the Protocol (where KP is used to designate the subset of LULUCF activities under the Kyoto Protocol). Those numbers from the detailed CRF tables are then, as Dr Brandon says at paragraph 14.1 [emphasis added], “used for accounting for New Zealand’s targets”, in what my paragraph 42 described as “the New Zealand Government’s gross-net calculations related to Protocol compliance”.
41. My paragraph 42 could be read as saying that the calculated timeseries for target emissions, derived by subtracting particular elements of LULUCF emissions from total gross emissions, themselves appear in the NIR. In fact they do not. Instead, in May of each year the Ministry for the Environment puts on its website an “Update on New Zealand’s Net Position” containing a table in which truncated timeseries are presented for gross emissions and for those forestry-related LULUCF emissions used for target accounting. Multi-year totals of those two timeseries are then presented to show the net position for the commitment period under review. Only the most recent “Update” is available on the Ministry’s website⁷, containing numbers that do not reconcile with the Advice’s target emissions in its Figure 5.3 which were evidently drawn from an earlier Update⁸.
42. It is in fact no simple matter to locate the New Zealand Government’s gross-net “target emissions” numbers in the form of a complete timeseries from 1990 forward. As Dr Brandon notes in her paragraph 19, “each successive annual inventory submission recalculates the timeseries back to 1990 to reflect improvements in data and methodologies, and therefore replaces all previous submissions”. A basic requirement for transparency would then have been to publish the entire target-accounted timeseries for all years from 1990 in each inventory report. However, reference to the latest National Inventory Report at Vol.1 p.16 Table ES5.1(b) and p.463

⁷ The latest update, dated April 2021, is at <https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/emissions-reduction-targets/latest-update-on-new-zealands-2020-net-position/> (downloaded 12 January 2022).

⁸ <https://ccc-production-media.s3.ap-southeast-2.amazonaws.com/public/Inaia-tonu-nei-a-low-emissions-future-for-Aotearoa/Modelling-files/Charts-and-data-for-2021-final-advice.xlsx> downloaded 8 September 2021.

Table 11.1.1 reveals no such series - only a truncated (2013-2019) timeseries for just the "accounting quantity" of LULUCF removals. That accounting quantity still has to be subtracted from gross emissions to derive total target emissions, but the actual calculation is not undertaken in the NIR, and there is no table in the NIR showing total target emissions year by year from 1990.

43. New Zealand's fourth *Biennial Report* at <https://unfccc.int/documents/266364>, published in December 2019 but updated in November 2020, shows only the years 2013-2019 in its Table 3.1 on page 44, does not explicitly derive year-by-year target emissions (only a five-year total for 2013-2020 including three years of projected data), and has no timeseries for target emissions in the appendices. Indeed, until the Commission published the Ministry for the Environment's complete 1990-2019 target-accounting series in the data tables for its Advice, there was to my knowledge no published official source to which outside researchers could turn for a complete series of target emissions 1990-2019.

Contents of the CRF tables

44. The CRF country tables in their current format comprise, for each year, 95 individual spreadsheets. Of these, the first 56 contain detailed sectoral emissions data for the six UNFCCC categories: agriculture, energy, industrial processes and product use, waste and LULUCF. Then come 13 spreadsheets covering methodology and other background information, and six (making up Table 10) that set out annual time-series data from 1990 forward for gross and net emissions as generally understood (what my first affidavit described as "GHGI-gross" and "GHGI-net emissions"). There are then four tables laying out detail on land-use and forestry activities.
45. The last 20 tables set out the fine detail of KP-LULUCF activities that are to be subtracted from Parties' Assigned Amounts under the Protocol for the purpose of measuring compliance with commitments made under the Protocol. The final one of these 20 tables, labelled "accounting", adds up the various categories of KP-LULUCF removals which the relevant Party has opted to have subtracted from its Assigned Amount.
46. This Kyoto information is "incorporated in [the] annual inventory"⁹ to provide "the necessary supplementary information for the purposes of ensuring compliance"¹⁰ with each country's commitments. It is the

⁹ Protocol Article 7.1.

¹⁰ Ibid.

remainder of the UNFCCC tables that represent the “inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases”¹¹ as distinct from “information necessary to track progress in implementing and achieving [the] nationally determined commitment”¹². The Kyoto target information in the CRF tables relates only to LULUCF (and not the five other sectors), and KP-LULUCF is a subset of the full measured LULUCF emissions and removals.

47. It should be noted that because New Zealand opted not to make any commitment under Commitment Period 2 of the Protocol, it has no Assigned Amount for the period 2013-2020. The Government’s target accounting exercise for 2013-2020 involves subtraction of KP removals - as recorded in the “accounting” CRF spreadsheet - from gross emissions as recorded in CRF Table 10, followed by comparison of the result with a self-declared “carbon budget” that is not an Assigned Amount under the Protocol¹³. Similarly, New Zealand’s NDC under the Paris Agreement has no Assigned Amount, and the MAB target accounting exercise consists simply of subtracting removals figures based on forestry emissions averaged over harvest cycles, from GHGI-gross emissions. Neither of these calculations precisely fits the Protocol-based design of the CRF tables.
48. Because the CRF tables do not include Parties’ Assigned Amounts, they do not proceed beyond recording the limited set of LULUCF removals to be set against Assigned Amounts in deriving gross-net totals. In strong contrast, the full record of LULUCF emissions reported in CRF Tables 4-4Gs2 are used in CRF Table 10 to calculate GHGI net emissions (“including LULUCF”). The absence of gross-net total emission data from the CRF tables reflects the fact that production of country-specific gross-net emissions series, subtracting the “accounting” removal data from Assigned Amounts, is a matter for Party governments, and the target-accounted results of that calculation are reported under Articles 4(1)(b), 12(1)(b) and 12(1)(c) of the Convention and Article 13.7(b) of the Paris Agreement – not in the “national inventory” tables under Articles 4(1)(a) and 12(1)(a) of the Convention, Article 7.1 of the Protocol, and Article 13.7(a) of the Paris Agreement.

¹¹ Kyoto Protocol, Article 7.1 and Article 13.7(a) of the Paris Agreement.

¹² Paris Agreement Article 13.7(b). The Paris Agreement here echoes Articles 4 and 12 of the Convention, in explicitly splitting the reporting obligation into: (a) a national inventory report of anthropogenic emissions by sources and removals by sinks; and (b) information necessary to track progress against each country’s NDC.

¹³ For the latest version of this calculation see <https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/emissions-reduction-targets/latest-update-on-new-zealands-2020-net-position/>.

49. I note that the UNFCCC versions of gross and net emissions are the only ones reported in Statistics NZ's *Statistics of New Zealand Emissions*¹⁴ and are the only ones for which time-series data is presented in the Ministry for the Environment publication *Our Atmosphere and Climate*¹⁵. Neither of those two publications provides year-by-year data on gross-net target emissions. The only time target emissions make an appearance (with no explanation of the radical difference between target emissions and the UNFCCC emissions) is in a brief paragraph on page 60 of the second publication, forecasting target-accounted emissions in total over the decade 2021-2030.

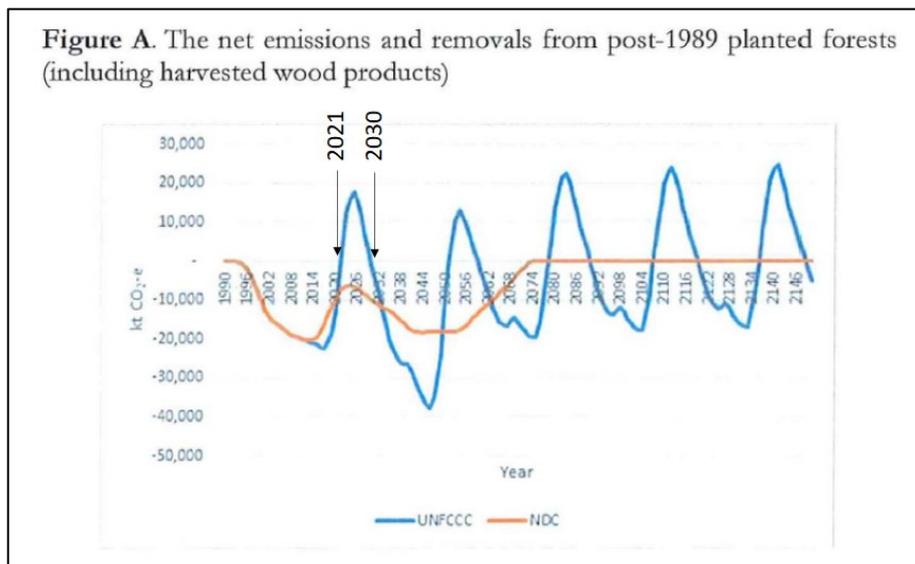
The switch to MAB accounting

50. The New Zealand Government's reporting of target-accounted emissions to date has been obscure and not widely understood. Clarity and transparency will be further diminished if the Commission's recommended use of MAB accounting (Chapter 10 of the Advice) is accepted as being consistent with the Act's definition of net accounting emissions. Adoption of MAB target accounting, with its procedure of averaging forestry sequestration over harvest cycles, means that an independent analyst will not be able to derive from the UNFCCC's CRF tables an estimate of New Zealand's target-accounted emissions, because those tables do not include the detailed age-classes of individual forest stands that are to be used in the averaging calculations¹⁶.
51. The main innovation of MAB accounting is to change the timing of when forestry removals are recorded. Figure A in paragraph 59.1 of the affidavit of Dr Brandon, reproduced below, shows how removals from post-1989 forests under MAB differ from those recorded in the KP-4 CRF tables for years from 2013 on. Close inspection of the graph for the years 2021-2030, corresponding to the NDC's first two periods, dramatically illustrates the way that abandoning GHGI inventory figures and adopting MAB will slash the target-accounting figure for forestry net emissions over the decade, making it much easier to meet the NDC commitment by claiming falling net emissions, when in fact GHGI net emissions will be rising.

¹⁴ <https://www.stats.govt.nz/indicators/new-zealands-greenhouse-gas-emissions> accessed 15 January 2022.

¹⁵ <https://environment.govt.nz/assets/Publications/Files/our-atmosphere-and-climate-2020.pdf> downloaded 15 January 2022.

¹⁶ See Advice page 199, paragraph 24 of Chapter 10, which makes clear that the MAB approach used in the NDC is different from the approach "used in the GHG Inventory for UNFCCC reporting".



52. The switch to MAB accounting at this point in the harvest cycle looks opportunistic, as it lowers the stringency of the NDC for the coming decade (as shown in the diagram above) and effectively writing-off forestry removals that are already above their long-term average even where we have relied on these excessive removals for Kyoto compliance purposes under the previous target-accounting methodology. The point was forcefully made in a 2016 report by the Morgan Foundation as follows:¹⁷

The existing rules track the cycle of carbon stored in the forest; a country receives credits as a new forest grows, but has to pay some of those back upon harvest. The pine forests planted in the 1990s will start reaching harvest age from around 2020. At that point, the forestry 'credit card' will be maxed out and would need to be repaid when harvesting takes off in the 2020s...

Now, the Government is proposing a new method of accounting for planted forests in our first commitment under the Paris Agreement. Under this new approach, New Zealand would only receive credits for carbon stored in a new forest up until it reaches the long term average carbon stock.... If we applied this rule now, New Zealand would receive far fewer credits during the period up until 2020, but also wouldn't have to pay any back on harvesting.

By changing the rules in 2020, New Zealand can keep all the credits received up until then, but doesn't have to pay any back...

¹⁷ Geoff Simmons & Paul Young *Cook the Books: Climate Cheats III: When the going gets tough, change the rules*, Morgan Foundation, November 2016, <http://morganfoundation.org.nz/wp-content/uploads/2016/11/Cook-the-Books-launch-version.pdf>, p.2. I understand that Paul Young, one of the co-authors of this report, is now a witness for the respondents.

Do the Special Report pathways precisely match the CRF tables?

53. In his paragraphs 148-149 Mr Smith makes the fair point that the 2018 Special Report worked with global total emission figures and that, since not all countries submit CRF reports, those global totals of necessity cannot consist solely of added-up CRF national inventory data, but must include also estimates prepared for some countries that have not produced their own CRF tables. He then claims that this means that I have incorrectly described the character of the Special Report numbers. What I said in para 30 of my first affidavit was that the Special Report exercises had been done “in terms of global GHGI net emissions as defined in the Common Reporting Framework” [emphasis added]. I did not say that the Special Report’s authors had access to a complete set of CRF country reports.
54. Paragraph 30 of my first affidavit could, however, be read as saying that in preparing their global figures, the IPCC authors used estimates of what the results of a complete global reporting exercise would have been, using precisely the CRF methodology. While I consider that my reference to the CRF tables captured the essence of the Special Report’s approach, I should clarify that the Special Report did not follow exactly in all respects the CRF definitions. There is, for example, a difference between the Special Report’s “AFOLU” (agriculture, forestry and other land use) and the CRF tables’ similar but not identical “LULUCF” (land use, land use change, and forestry). That difference is of small enough significance to make little difference in the global total numbers, especially since land-use emissions are a very small part of the global total numbers (cf Dr Glade’s evidence at paragraphs 36-37). With that qualification I believe that it is correct to say that the Special Report net-net pathways are consistent with the GHGI net-net pathways, as indicated by paragraph 9 of Dr Rogelj’s evidence and the Statistics New Zealand chart at <https://www.stats.govt.nz/indicators/new-zealands-greenhouse-gas-emissions>, whereas they are not consistent with the NDC’s gross-net pathways (cf Rogelj at paragraphs 10-11).

Claimed incentive effects of gross-net accounting

55. Several Commission witnesses have defended gross-net accounting on the basis that it supposedly has an incentive effect to drive governments to increased ambition.
56. Dr Brandon, for example, claims at paragraph 31 that “The Kyoto Protocol gross-net approach was aimed at driving additional effort, to reward or penalise actions taken since 1990.” In paragraphs 58.2 and 58.3 she further asserts that the additionality principle “is fundamental to driving climate action”, and at paragraph 67 she says that “target accounting is designed to incentivise emissions reductions”. Mr Smith in his paragraph 48 says

“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.”

57. I was surprised that Mr Smith (and apparently Dr Brandon though she is not explicit on this point) chose to defend the gross-net procedures, as they were actually established under the Protocol, as having strengthened the New Zealand Government’s incentive to change behaviour. The record of New Zealand policymaking under gross-net Kyoto accounting has been precisely the opposite. Having secured a licence under the Protocol to make its commitment in gross-net terms, New Zealand was able thereafter to meet its commitments 2008-2012 and 2013-2020 almost entirely by reliance on growing forests, with no serious effort to change behaviour in relation to gross emissions. That the gross-net accounting procedure relieved New Zealand of the need seriously to tackle its rising gross emissions was well understood at the time by officials and policymakers. Chapter 3 of our 2010 book *The Carbon Challenge* documented the progressive weakening of policy ambition between 1990 and 2008 as the opportunity to rely on forestry instead of reducing gross emissions was seized upon.
58. Following recent changes embodied in the NDC and the MAB methodology, New Zealand’s approach no longer matches the procedures actually established under the Protocol for gross-net accounting. The changes reduce, rather than increase, the degree of ambition behind the headline numbers:
- a. The gross-emissions starting point for the NDC was changed in 2016 from 1990 to 2005, which was the peak year of gross emissions¹⁸ and hence produces the greatest gross-net headline number for any given level of ambition.
 - b. When this change was made, the 1990 baseline for target accounting did not change. That is, removals from forests planted between 1990 and 2005 are counted towards our gross-net targets which are now expressed relative to 2005. This violates the ‘additionality principle’ by giving a head start equivalent to 15 years of forestry in meeting

¹⁸ See Figure 1 in my first affidavit.

targets expressed as a reduction from the 2005 gross-emissions starting point.

- c. As discussed at paras [50]-[52] above, New Zealand's target accounts will now switch to averaging forestry sequestration over harvest cycles. While this may have been a sensible approach to introduce at the start (back in 1990), introducing it at a time when we are about to go through a harvesting cycle means that most of the emissions from forest harvesting in the 2020s will not impact our target account measure, even where we have relied on removals by those forests to meet past commitments in excess of long-term averages. The introduction of averaging will make it much easier to our NDC commitment over the coming decade without any improvement in what the atmosphere sees.
59. Opportunistically making changes that increase our apparent level of ambition and make it easier to meet our targets under gross-net accounting undermines any desirable incentive effects that the original Kyoto procedures might have had.

Level of ambition

60. Dr Carr at paragraphs 119-131 defends the level of ambition in the Commission's budgets and argues that the modelled emission reductions presented by the Commission are not, as I have argued, almost painless, or imposing virtually no overall net cost on the New Zealand economy. By expressing an overall GDP reduction of around 0.5% in 2030 in dollar terms - \$30 billion - and equating this with the cost of the Christchurch earthquake, Dr Carr seeks to create the impression of severe cost impacts. He neglects to address my point (my paragraph 111) that the Commission's modelled costs are within the margin of error for the type of modelling used. Previous CGE modelling of carbon taxes and emissions trading in the New Zealand context has commonly reported costs of more than 1% of GDP at a ten-year horizon for serious policy measures. The Commission's proposed policies fall well below those previously modelled policies.
61. I point out, however, that (as recorded in my first affidavit at paragraph 3) back in 1993 my own modelling work, with colleagues, suggested that with an appropriate policy structure it would have been possible for New Zealand to impose a carbon tax of the order of \$30 per tonne with no net economic cost. Economic cost taken on its own, thus, is not rigidly tied to level of ambition; rather, it is one of the consequences of ambitious policies, and may be greater or less for a given level of ambition, depending on how the policy is designed and how much room the economy has to adjust to a new emission-restricting regime.

62. Dr Carr suggests in his paragraph 127 that I “desire” a greater GDP sacrifice and that I have confused an increase in economic cost (measured in terms of GDP) with wasteful and inefficient policy settings. I disagree. There is a world of difference between (i) seeking increased ambition in climate change policy while acknowledging the likelihood that this will incur greater costs, and (ii) seeking greater costs without reference to the purpose for which those costs are incurred or to the efficiency with which the policy is designed. In accusing me of the latter position, Dr Carr fails to make that crucial distinction.
63. Dr Carr’s point in his paragraph 130 that the Commission’s modelling excluded any consideration of the costs of adaptation is true but does not affect the point made in my evidence. The previous general-equilibrium modelling studies referred to in paragraph 60 above similarly did not include adaptation costs.
64. Figure 1 on pages 2 and 20 of the *Consistency* paper attached as AR-2 to the affidavit of Dr Reisinger summarises very well the range of levels of ambition that would be implied by various equity principles. By far the least ambitious of the seven principles considered is “equal rate of reductions (gross-net)” – the basis on which New Zealand has to date relied in setting its commitments. Within that lowest-ambition scenario, the adoption of MAB in place of Kyoto target accounting involves a shift to reduced rather than increased ambition for the coming decade.¹⁹

Advantages of gross over net measures

65. Dr Glade at paragraphs 28-35 has an extensive discussion of the wide variability and uncertainty associated with LULUCF data, and at paragraphs 34 and 48-49 suggests that gross-gross data is a more reliable basis for cross-country comparison than net-net or gross-net. I agree with her that gross-gross would have been a more solid basis than gross-net for setting New Zealand’s emission commitments. A gross-gross Kyoto target would arguably have both incentivized greater ambition and resulted in clearer accountability for New Zealand climate policy.
66. It remains the case, however, that net-net is what the atmosphere sees, however imperfectly it can be measured. Gross-net targeting, in contrast, neither facilitates cross-country comparisons nor escapes the problem of uncertain measurement of LULUCF.

¹⁹ For the record, my 1992 *Journal of Development Studies* paper on tradable permits advocated the most ambitious of the options in Figure 1 of AR-2, namely equalising per capita entitlements to the atmosphere across the global population.

67. Mr Smith at his paragraph 41 stresses the variability of net emissions, apparently as an argument in favour of gross-net as against net-net accounting. Reference to Figure 1 in my first affidavit clearly shows that volatility has been substantially greater along the gross-net path than the net-net one – a problem now being addressed by the “patch” of MAB accounting, described by Dr Glade in her paragraphs 69 – 91
68. Inescapable imprecision in measurement, and the impact of high variability, are no reason to abandon the attempt to obtain and use the best measurements possible, which is the scientific approach.

My responses to other points in the evidence of Mr Smith, Mr Young and Dr Reisinger

69. In this section I discuss some areas of material disagreement with the evidence of these three witnesses for the respondent.

Relative stringency of MAB versus net-net

70. Mr Young in his paragraph 76 suggests that my evidence is in conflict with that of Dr Taylor with regard to the relative stringency of gross-net versus net-net targets. In his paragraph 80 Mr Young further says “It appears that Dr Bertram and Dr Taylor have opposing views on the impact of modified activity-based accounting ... [W]hile Dr Taylor considers that it will require more stringent cuts in emissions than are strictly necessary, Dr Bertram seems to think it will have the opposite effect.”
71. With respect, Mr Young does not seem to have read our evidence with sufficient care. Dr Taylor’s comments on the relatively greater stringency of MAB versus net-net accounting relate to the period after 2030. My evidence on relatively less stringency applied to the period between 1990 and 2030. I am in full agreement with Dr Taylor’s point that the MAB path, if adopted and followed in preference to a net-net one, would imply greater stringency in the two decades leading up to 2050 (based on current projections), and I share his concern that the New Zealand Government’s adherence to MAB beyond 2030 might prove politically unsustainable and hence cannot be relied upon. The alleged conflict between myself and Dr Taylor does not exist.
72. Beyond 2030, New Zealand has as yet no definite policy apart from the 2050 target specified in the Zero Carbon Act, and it will remain open to a future Government to specify how target emissions are measured. Based on the Commission’s interpretation of “net accounting emissions” (which is challenged by LCANZI in this litigation) these will be whatever the

Commission says they should be from time to time for the purposes of meeting budgets under the Climate Change Response Act 2002.

73. I agree with Dr Reisinger's paragraphs 79 to 82, which are fully consistent with the points made above and with the evidence of myself and Dr Taylor. In particular Dr Reisinger's paragraph 82 confirms Dr Taylor's evidence regarding the relative stringency of a gross-net versus a net-net target for the period after 2030. As Dr Reisinger states, "achieving the currently legislated "net-zero" target for gases other than biogenic methane in 2050 would require substantially less effort if inventory reporting emissions (and a net-net target approach) were the basis for the calculation." This leaves untouched, however, my observation that for the period 2021-2030 the use of gross-net target accounting, and particularly MAB, imply less effort than would a net-net commitment to the same headline number.

The "fair shares" issue

74. In his paragraph 154 Mr Smith mis-characterises my view as being 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". That is a complete misrepresentation of my evidence, which was simply that in order to make valid assessment of the NDC against the Special Report pathways, a first and fundamental requirement is to get the numbers onto a consistent basis. This means applying the net CO₂ reduction pathway to 2010 net CO₂ and not to 2010 gross CO₂.
75. The basic step in determining whether the NDC is consistent with the Special Report has to be a like-with-like comparison of emission paths, and I noted in particular (paragraph 76 of my first affidavit) the importance of accounting separately for particular gases. I nowhere said that countries "must meet the average"; on the contrary, I acknowledged (paragraph 116) the argument that the importance of its forestry could make New Zealand a special case; and I noted (paragraph 107) the responsibility of more developed countries to act more strongly than others. Mr Smith's suggestion that I support an undifferentiated policy imperative across all countries is simply unfounded.
76. In his paragraph 155 Mr Smith then claims that "[i]n 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." I refer the Court to paragraph 77 of my evidence which contains no reference whatever to the issue of "fair share". Those words do not appear

anywhere in my first affidavit. Consequently when in his paragraph 156 Mr Smith accuses me of having a “preferred approach” that “allows for no nuances”, he is attacking an imaginary target entirely of his own construction.

Are gross-net and MAB misleading?

77. I do not agree with Mr Young’s suggestion in his paragraph 90 that, if MAB accounting is not misleading for the insiders who prepare the numbers, it cannot then be described as misleading for the general public, the politicians, or independent overseas analysts who are not privy to the detailed construction of New Zealand’s accounts and who have neither the time nor the inclination to devote scarce time to the onerous task of reconstructing a full picture from the sources outlined in Mr Young’s paragraph 91. I reiterate my view that the Commission’s presentation of gross-net figures without reference to the fact that they are gross-net, and without any explanation in the glossary, is misleading and does not accurately represent New Zealand’s actual net emissions. The fact that the authors of the Advice are not misled is no excuse.
78. An example of misleading use of gross-net numbers is found in Figure 1, page 11 paragraph 66 of the Cabinet Paper attached as “JS-5” to the affidavit of Mr Shaw. That chart purports to compare, in terms of headline numbers, New Zealand’s NDC commitment with commitments made by eleven other countries, relative to 2005 gross emissions. Not all the other countries’ commitments are gross-net²⁰, and the use of a 2005 gross-emissions baseline corresponds to New Zealand’s opportunistic re-setting in 2016 of the base for its gross-net accounting from 1990 to 2005, which was the peak year of gross emissions²¹ and hence produced the greatest headline number for any given gross-net emission reduction.

²⁰ For example, the UK NDC commitment is a 68% net-net reduction 1990-2030 (<https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/United%20Kingdom%20of%20Great%20Britain%20and%20Northern%20Ireland%20First/UK%20National%20Determined%20Contribution.pdf>). The US commitment is a 50-52% net-net reduction 2005-2030 (<https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/United%20States%20of%20America%20First/United%20States%20NDC%20April%202021%202021%20Final.pdf>). The Korean commitment is 40% gross-gross 2018-2030 (https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Republic%20of%20Korea%20First/211223_The%20Republic%20of%20Korea%27s%20Enhanced%20Update%20of%20its%20First%20Nationally%20Determined%20Contribution_211227_editorial%20change.pdf).

²¹ See Figure 1 in my first affidavit.

Mathematics are not the whole story

79. I agree with Dr Reisinger when he says at paragraph 63, apparently intending it as rebuttal of my evidence (along with that of Dr Gale and Dr Taylor)²² that “the question of what rate of emission reductions in New Zealand would be 'consistent with' the global rate of emission reductions in 1.5°C-consistent pathways is not a question that can be answered by mathematics alone.” I have never claimed that national capacity and international equity are irrelevant to our national commitment. My point has been simply that the up-front mathematical issue of like-with-like comparison must be resolved before consideration of the other real-world issues that arise in setting an NDC. In my first affidavit I made specific reference both to the issue of New Zealand’s unusual emissions profile (see my paragraphs 98-99 and 116), which is discussed by Dr Reisinger in his paragraphs 74-77, and (in my paragraphs 10 and 11) to the equity issues traversed by Dr Reisinger in his paragraphs 9, 38 and 63.

Sworn at Wellington)
 on 17 January 2022)
 before me:)

 Ivo Geoffrey Bertram

 A barrister and solicitor of the High Court of New Zealand

²² Cf Dr Reisinger’s paragraph 60.