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 DR OLIA GLADE

(Independent expert witness for the Climate Change Commission: accounting

issues) Affirmed **9** December 2021

I, **OLIA GLADE** of Wellington, affirm:

INTRODUCTION

1.   My full name is Olia Glade.

2.   I am the Director for Measurement, Reporting, and Verification (MRV) Systems at the Greenhouse Gas Management Institute (GHGMI), a non-governmental non-profit organisation based in the United States of America.

3.   I have been asked by the Climate Change Commission to provide expert evidence in response to aspects of the claim brought by LCANZ (Lawyers for Climate Action New Zealand Incorporated) against the Commission's advice to the Minister for Climate Change in *Ināia tonu nei: a low emissions future for Aotearoa*, released on 21 June 2021.

4.   In this affidavit I refer to the Climate Change Commission's Advice, as well as a number of other documents. I understand that the Commission's Advice and Supplementary Volumes have already been compiled into a paginated bundle, while for the other documents I have provided URL references given their size. References in this affidavit will accordingly be to the Commission's Advice and Supporting Volumes, which have been combined together as a single paginated "Advice Bundle". 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).

5.   I have been provided with a copy of the High Court Code of Conduct for Expert Witnesses. I have read the Code of Conduct and agree to comply with it.

QUALIFICATIONS AND EXPERIENCE

6.   A copy of my curriculum vitae is attached to this affidavit and marked "**OG-1**".

7.   I have significant experience and expertise in climate change accounting. I led New Zealand's National GHG measurement Programme and was New Zealand's GHG inventory 'focal point' at the UNFCCC (United Nationals Framework Convention on Climate Change) from 2011 to 2019. The national inventory 'focal point' is the national contact person for the UNFCCC regarding any national GHG inventory matters. The focal point is officially designated by the government and notified to the UNFCCC. At the same time, I also worked as New Zealand's national GHG inventory compiler.

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8.   My role involved managing New Zealand's national GHG inventory programme, being a key contributor to National Communications and Biennial Reports, and managing projects to design and build information systems and tools for GHG analysis for policy purposes and international climate change negotiations.   I was also involved in strengthening and supporting GHG inventories and inventory national systems for developing countries in Africa and Oceania.

9.   As part of this work, I was nominated by New Zealand to be a review expert in the UNFCCC. I served as an energy-sector expert, and then as an expert-generalist and a Lead Reviewer for GHG inventories, National Communications, Biennial Reports, and Biennial Update reports at the UNFCCC.

10.   While working as a Lead Reviewer for the UNFCCC, I was involved in several projects relating to review process improvements. I also presented at the Lead Reviewers meetings in Bonn, Germany, and authored a paper on quality assurance / quality control and verification.

11.   I have been in my current role as Director of Measurement, Reporting, and Verification Systems at the GHG Management Institute since 2019.

12.   The GHG Management Institute is a non-government non-profit organization based in the United States but with a focus on professional development globally. The mission of the Institute is "to build and support a community of experts with the highest standards of professional practice in measuring, accounting, and managing greenhouse gas emissions; meeting the needs of governments, corporations, and organizations large and small."

13.   My role involves managing projects designed to build international capacity for measurement, reporting, and verification (MRV)—including designing, implementing, and strengthening national MRV and data management systems. Part of this work is leading and supporting the development of training materials and MRV tools. I also perform systems analysis and design, including IT project management, for MRV data management systems.

14.   Another aspect of my work involves education and training. I act as a lead instructor and course designer for international courses and workshops relating to climate change MRV, including on the IPCC (Intergovernmental Panel on Climate Change) guidelines and the GHG Protocol.

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15.   I continue to work as a Lead Reviewer for international GHG reporting reviews under the UNFCCC.

16.   I have a PhD in Chemistry and Crystallography from Moscow State University and the Russian Academy of Science, an MSc in molecular biology and bio-organic chemistry from Moscow State University, and a Graduate Diploma in Teaching from Victoria University of Wellington.

17.   I have published over 100 research papers, as peer-reviewed articles in scientific journals, UNFCCC and/or as conference papers and presentations.

SCOPE OF MY EVIDENCE

18.   I have been provided with the Commission's advice and referred to relevant Chapters of the published supporting evidence. I have been provided with the affidavits filed by LCANZ.

19.   I have been asked to provide my expert opinion on two issues:

19.1   First, whether, in producing its advice on New Zealand's NDC, the Commission made a "logical error" in applying the modelling from the IPCC 2018 Special Report,[1] which is developed on net-net basis, to create comparator NDCs for New Zealand on a gross net basis.

19.2   Second, whether the modified activity-based accounting method is a legitimate and/or appropriate accounting method for New Zealand to use to account for its targets.

20.   I was also asked to provide any additional comments on any points raised in the LCANZ affidavits that related to the above areas.

21.   I confirm that the answers to these questions are matters within the scope of my expertise.

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[1]   IPCC *Special Report 15: 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) <https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf>

FIRST ISSUE: THE LOGICAL ERROR

22.   I do not agree with LCANZ that the Commission was in error in using the modelling from the IPCC 2018 Special Report in order to create comparator NDCs for New Zealand on a gross net basis, to use to assess the compatibility of New Zealand's gross net NDC. In my opinion the approach taken by the Commission was reasonable, and did not involve any mathematical or logical error.

23.   The IPCC 2018 Special Report was not designed to be used to set national budgets. However, I agree that the IPCC pathways could provide a useful starting point for addressing the question on the NDC the Commission was tasked with. The fact that the pathways are net emissions pathways does not mean that they can only be used as a basis for comparison with net-net targets. In a modelling exercise such as that undertaken by the Commission the difference between the IPCC pathways being net or gross emissions pathways is not a significant feature, and does not compromise the Commission's methodology.

The fundamentals of the pathways are the same, whether gross or net

24.   The first point to note is that the fundamental principles and logic for building emissions projections for gross and net emissions are the same. In both cases, the trends and projections are based on independent models for different sectors (energy, transport, waste, and so on). The results of those separate models are then combined together to give an "overall" projection. The only difference between gross and net emissions time series pathways is that net includes the projection for LULUCF (Land Use, Land-use Change and Forestry) in the final 'total' and gross does not.

25.   The modelling for each sector doesn't change depending on whether it is then combined into a gross or a net time series pathway. The IPCC adopted net emissions pathways reflecting that the LULUCF sector globally acts as a source of emissions, not a sink. That meant that it was important to add LULUCF emissions into the pathways, but it did not change the basic building blocks of the sector projections.

26.   To the contrary, in New Zealand, LULUCF sector was and still is a sink in every year of the time series starting from 1990, which means that removals from the sector exceeded its emissions. According to the Kyoto Protocol, this means that net-net approach to carbon budgeting is not applicable and a gross net approach should be used.

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27.   Also, because the LULUCF sector is a CO_2 sink in New Zealand, the average reductions in emissions in modelled pathways for net CO_2 may be significantly different from the underlying pathway modelled for emissions and removals from the LULUCF sector. In a gross net approach, emissions trends and projections from the LULUCF sector can, for any particular pathway, be kept separate and not merged with the emissions estimates of the other sectors, over each year of the time series, giving what is in effect a gross emissions pathway.

The distinction between gross and net in this context

28.   The next point is that at a global level, LULUCF has always been a source of emissions, so global net emissions (that is, including LULUCF) are higher than gross emissions. For New Zealand, the position is the opposite: LULUCF was a sink in the base year and continues to be a sink, so for New Zealand, net emissions will be lower than gross emissions. But in this context when comparing projected overall emissions from all sources, the global figures are effectively gross as well, as they represent the total amount of emissions from all sectors (including LULUCF) where each sector is a net emission source, while New Zealand's gross emissions similarly represent the total amount of emissions from all sectors (LULUCF not being a source of emissions for New Zealand). On a principled basis, this is a valid comparison.

29.   In addition to that, the net emissions from the LULUCF sector have high uncertainty, especially at a global level. At the same time, the contributions of the net LULUCF emissions to the net global total is relatively small comparative to the overall value so the actual difference from including LULUCF (net) or excluding LULUCF (gross) from the global pathways is debatable. On some data sources the difference would be close to non-existent.

30.   I will explain that in more detail. In general, estimates of gross emissions are more accurate than estimates of net emissions due to the high uncertainty values of the LULUCF component.

31.   The LULUCF sector causes high uncertainty because the quantity of emissions/ removals is affected both by changes in land use and changes in biological processes. Because these are living systems there is huge variability in how those operate. For example, if you deforested two identically-sized blocks of forest, one might generate more emissions than the other — depending on what tree species had been present in the forest and how old the forest was when it was cut down. Even where there is not

a change in land use, biological factors (such as differences in species or populations of species) can cause wide fluctuations in emissions or removals over time. Without very detailed data it is difficult to make precise estimates. Additionally, this is affected by high uncertainties in emission factors that are applied for calculating the estimates of emissions from different categories of the sector.

32.   In contrast, emissions from technological systems such as most categories in the energy sector and industrial processes are much easier to estimate. This is because these emissions are caused by well-understood chemical reactions. In addition, it is much easier to track the quantity of fuels used in New Zealand's energy sector than to track changes in forests.

33.   I have analysed the latest available national greenhouse gas inventory reports[2] and Biennial Update Report submissions[3] for the world's highest emitters (the USA, China, India, Indonesia, the Russian Federation, Brazil, and Canada). The uncertainty values for the LULUCF sector in the relevant inventories and BURs are very high: ranging from 19% (for the USA) to 72% (for Brazil).[4]

34.   This high level of uncertainty is one of the reasons why internationally, it is common practice to carry out country-by-country comparisons on a gross emissions basis. For example, the Climate Action Tracker, an independent collaboration between Climate Analytics and NewClimate Institute, explicitly excludes LULUCF from its comparisons.[5] I talk about this more below.

35.   The overall uncertainty values for net emissions (ie all emissions including LULUCF) published in the national inventories or BURs for the world's seven highest emitters (listed above) range from 5–17%. Based on this data, I would expect the global uncertainty value for 2018 to be at least 10% or higher. (Aggregate global uncertainty

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[2]   The National Inventory Reports for Annex I parties (developed countries) are published by the United Nations at <https://unfccc.int/ghg-inventories-annex-i-parties/2021>.

[3]   The BURs for Non-Annex I parties (developing countries) are published by the United Nationals at <https://unfccc.int/BURs>.

[4]   The uncertainty value measures how sure you can be that an estimate is accurate. A higher uncertainty value means that the estimate is less accurate. For example, if a person's weight was estimated as 60 kilograms, plus or minus 10 kilograms, their *actual* weight could be anywhere from 50 to 70 kilograms. If the uncertainty value was only 5 kilograms, their actual weight would be expected to be in a much narrower range: 55 to 65 kilograms.

[5]   See the Climate Action Tracker *CAT rating methodology* available at <https://climateactiontracker.org/methodology/cat-rating-methodology/>.

values are not published). (I refer to 2018 data, as this is the most recent year for which there is comparable data across countries).

36. At the same time, according to some sources LULUCF emissions only make up a very small contribution to global emissions. I reviewed the World Resource Institute's *Climate Watch* online database, which publishes historical emissions (by country and globally) between 1990 and 2018.[6] Using this data, I calculated that LULUCF contributed between 0.9% (in 2013) and 2.8% (in 2018) of global emissions.

37. According to the data above (see paragraph 35 above), then within the uncertainty range the difference between including LULUCF or not (net or gross) has no practical impact. Within the margin of error gross and net measures for the IPCC pathways are effectively the same. The vast majority of the emissions that the IPCC pathways are projecting are from sources other than LULUCF.

SPECIFIC COMMENTS ON LCANZ AFFIDAVITS

The IPCC pathways cannot be directly 'applied' to set national budgets

38. Some of the witnesses for LCANZ appear to assume that the IPCC pathways can be directly applied to set national budgets, as a sort of mathematical exercise. This is incorrect.

39. The purpose of the IPCC 2018 Special Report was not to create a methodology for setting national carbon budgets. This was outside of the scope of the Report. The purpose of the Special Report was to project different pathways for net emissions (defined as "anthropogenic emissions reduced by anthropogenic removals")[7] that are consistent with limiting global warming to 1.5°C above pre-industrial levels.

40. There are many international reports and publications that provide guidance to countries on how to set, calculate, and account for, carbon budgets.[8] The Special Report is not one of them.

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[6] World Resources Institute *Climate Watch*, available at < https://www.climatewatchdata.org/>.
[7] See IPCC *Special Report 15: 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) at 13 <https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf>
[8] For example:

41.   It is important to understand that the modelling in the Report reflects that the different sectors are affected by different influencing factors. Developments that change the emissions profile of the waste sector will not have the same effect on the energy sector or the LULUCF sector, and so on. This means that one cannot just assess 'total emissions' and then project that out: each sector is affected by different parameters and how those change directly affects the projections for that sector.

42.   To explain this by way of examples from the New Zealand context:

42.1   In the waste sector, the biggest influencing parameter is population growth. Population growth is often used as a proxy for emissions growth in this sector.

42.2   For agriculture, the key factors affecting sectoral emissions include (a) increased livestock productivity (milk and meat yield per head) achieved by New Zealand farmers that results in increased feed intake per animal to meet higher energy demands. Increased feed intake results in increased emissions per animal; (b) climate variations and commodity price fluctuations are also very important—favourable climatic conditions support pasture growth, which is reflected in the growing animal population numbers, and ultimately, can lead to annual the key factors affecting the emissions growth and vice versa. For example, droughts in 2008, 2013 and 2015–16 reduced agricultural production and emissions. The dairy sector was also affected by low milk prices in 2015, which reduced dairy cattle numbers, milk production and emissions; (c) the area of land used for agriculture–the agriculture sector uses 46.0% of New Zealand's land area, mostly for grazing. Since 1990, the area used for sheep and beef grazing has decreased, while the area used for dairy grazing

- UNFCCC secretariat "Issues relating to the transformation of pledges for emission reductions into quantified emission limitation and reduction objectives: methodology and examples 2011" FCCC/TP/2010/3/Rev.1
  <https://unfccc.int/sites/default/files/resource/docs/2010/tp/03r01.pdf>.
- Hood, C. and C. Soo (2017), "Accounting for mitigation targets in Nationally Determined Contributions under the Paris Agreement", OECD/IEA Climate Change Expert Group Papers, No. 2017/5, OECD Publishing, Paris, <http://dx.doi.org/10.1787/63937a2b-en>;
- Hood, C., G. Briner and M. Rocha (2014), "GHG or not GHG: Accounting for Diverse Mitigation Contributions in the Post-2020 Climate Framework", OECD/IEA Climate Change Expert Group Papers, Vol. No.2014/02, <http://dx.doi.org/10.1787/5js1qf652kd3-en>; and
- *Vaidyula, M., Hood, C.,* "Accounting for baseline targets in NDCs: Issues and options for guidance",   Climate   Change   Expert   Group   Paper   No.2018(2), COM/ENV/EPOC/IEA/SLT(2018)2,
  <https://www.oecd.org/env/cc/Accounting_for_baselines_targets_in_NDCS.pdf>.

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has increased; (d) use of nitrogen fertilisers by farmers, which has substantially grown since its 1990 values.

42.3 Emissions in the Energy sector are influenced not only by demand, which can be attributed to the population growth, but also climatic conditions, because a lot of New Zealand's stationary energy needs are met by renewable sources such as hydro power. The latter is heavily dependent on rainfall variations. If rainfall drops, then more fossil fuel generation needs to be brought online to meet demand, and emissions increase.

42.4 In the LULUCF sector, major drivers include demand for New Zealand wood (which will not be the same as demand for New Zealand food products), government interventions such as the ETS and carbon pricing, the proportion of the production forest estate reaching their harvest age, and log pricing. These affect the decisions whether to plant more forests or to convert plantation forests to other uses (such as agriculture). For example, the increase in net emissions from the LULUCF sector between 2004 and 2007 was largely due to the increase in planted forest deforestation that occurred leading up to 2008, immediately prior to the introduction of the New Zealand Emissions Trading Scheme.

43. The factors that affect each sector are not always linked. Parameters could be less relevant for some sectors and more relevant for the others, or could affect them in different ways. Therefore, it is not possible to make an accurate projection of emissions by modelling changes in "total" emissions over time. There are too many conflicting parameters involved.

44. This means that all modelling involves making independent projections about how the emissions profile of each sector will change, and then adding the components together. Examples of how this works in practice can be seen in Figure SPM.3b in the IPCC 2018 Special Report,[9] and more generally in the *Special Report on Emissions Scenarios* published by Working Group III of the IPCC.[10] As I have already outlined, the

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[9] 2018 Special Report at 14
<https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf>

[10] IPCC *Special Report on Emissions Scenarios* (Cambridge University Press, Cambridge, 2000)
<https://www.ipcc.ch/site/assets/uploads/2018/03/emissions_scenarios-1.pdf>

way the components are added together results in a gross pathway (excluding LULUCF) or a net pathway (including LULUCF).

45. In that sense, the IPCC interquartile range of 40 – 58% reduction in CO_2 emissions in IPCC pathways, for example, would not be directly applicable as a target to any one sector globally, let alone in a country. That range is made up of projected reductions in the electricity sector, the transport sector, forest emissions and so on, all of which are largely independent of each other, so it does not mean that the average has to apply equally across all these sectors. To attempt to do so in the context of an individual country without regard to its national circumstances and how those affect other relevant parameters would not make much sense.

International practice and the gross net approach

46. Some of the witnesses for LCANZ are critical of the gross net approach itself, and seem to suggest that the gross net approach was invented by New Zealand as some kind of misleading "accounting trick".

47. Gross net accounting is not a New Zealand invention. The Kyoto Protocol required that countries where LULUCF was a sink in a base year use gross net accounting, and countries where LULUCF was a source in the base year use net-net accounting. According to the time series published by the World research Institute (WRI), globally, LULUCF was a source of emissions in 1990-2018 (and is likely to continue being a source for the foreseeable future on a basis of the historic trend), but in New Zealand LULUCF is (and will be for the foreseeable future) an emission sink (that is, removals of CO2 from the atmosphere due to activities in the LULUCF sector will be higher than the sectoral CO_2 emissions). Using gross net accounting for NDCs is consistent with New Zealand's use of carbon accounting and calculating carbon budgets under the Kyoto Protocol.

48. I have already mentioned that internationally, it is a common practice to carry out country-by-country comparisons on a gross emissions basis. There are three reasons for this:

48.1 First, as I have already said, it is particularly difficult to arrive at accurate estimates for emissions in the LULUCF sector.

48.2 Second, looking at gross emissions focuses on the sectors where long-term decarbonisation needs to take place (energy, transport, waste, etc.). As the

IPCC confirmed in the Fifth Assessment Report, limiting warming below 2°C and 1.5°C requires deep and long-lasting changes in energy and industrial GHG emissions.[11] These cuts are necessary, and they cannot be 'replaced' by reductions from the LULUCF sector. Therefore, the major focus of mitigation activities needs to be on greenhouse gas emissions from the energy sector, industrial processes, solvent and other product use, agriculture and waste sectors.

48.3 Third, in countries where the LULUCF sector is a sink (rather than a source) of emissions, year-on-year fluctuations can mask real trends. If plantation forests happen to be at its peak in a growth phase one year, this could have the effect of making net emissions decrease without any changes having been made to decarbonise the economy. (I will discuss the mechanics of these fluctuations in more depth when explaining my opinion on modified activity-based accounting.)

49. The last two factors are particularly important when considering carbon budget accounting in countries like New Zealand, where both (a) the LULUCF sector has a significant impact on overall emissions (in contrast to the global position I discussed above); and (b) LULUCF removals always exceed LULUCF emissions (i.e., where the LULUCF sector is always a sink).

50. Net-net and gross net accounting both compare emissions in the target year with the base year. In both approaches, net emissions will be significantly affected by the selection of the base and target years, and where they each sit in the forestry harvesting cycle. For example, if a significantly high share of plantation forests were being harvested at one time, then net emissions for that year would be particularly high. As forests moved into a regrowth phase, net emissions would fall even if there were no changes in the economy. As long as the target year happened to be during the regrowth phase, the country would appear to have made significant reductions in emissions without taking any meaningful steps. On the other hand, if the base year was in a regrowth phase but the target year was in a harvesting phase, then even significant decarbonisation in the economy might not appear to reduce net emissions.

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[11] IPCC *Climate Change 2014: Synthesis Report Contribution of Working Groups 1, II and II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (2015) <https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf>

This is a recognised issue with net-net accounting where the LULUCF sector is an emissions sink.[12]

51. It is for this reason that the accounting framework under the Kyoto Protocol mandated that countries whose LULUCF sector was a sink in the base year (for example, 1990) should use a gross net accounting approach (other countries were to use net-net accounting). That is what New Zealand has done since it made its commitment under the Kyoto Protocol. Further, the activity-based approach factors out the long-term cyclical activities to measure and account for only real changes in underlying activity. I will talk about this more under the second issue.

52. The Paris Agreement (article 4, paragraph 13) requires Parties to use consistent carbon accounting approaches. As emphasised by international experts,[13] this is especially important in the LULUCF sector, because of the long time-frames associated with changes (for example, forest planting and harvesting cycles last several decades). If a country changes accounting methodologies, it is difficult to compare consecutive commitments. It also makes it very difficult to carry out a global stocktake of progress.

53. Accordingly, it is consistent with New Zealand's obligations under the Paris Agreement, and with international good practice, for New Zealand to use gross net accounting for its NDCs, like it has done under the Kyoto Protocol.

More specific responses to the affidavits

54. In this section of my evidence, I provide a response to some other aspects of the evidence from LCANZ witnesses. I am not responding to every area where I may disagree with what has been presented, but will only address a few specific issues, in addition to those I have addressed already.

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[12] See AC Prag and P Barata "Made to Measure: Options for Emissions Accounting under the UNFCCC" (2013) 1 *OECD/IEA Climate Change Expert Group Papers* (<https://doi.org/10.1787/2227779X>); C Hood and C Soo "Accounting for mitigation targets in Nationally Determined Contributions under the Paris Agreement", (2017) 5 *OECD/IEA Climate Change Expert Group;* C Hood, G Briner and M Rocha "GHG or not GHG: Accounting for Diverse Mitigation Contributions in the Post-2020 Climate Framework", (2014) 2 *OECD/IEA Climate Change Expert Group Papers;* M Vaidyula and C Hood "Accounting for baseline targets in NDCs: Issues and options for guidance"(2018) *Climate Change Expert Group Paper No.2018(2).*

[13] See AC Prag and P Barata "Made to Measure: Options for Emissions Accounting under the UNFCCC" (2013) 1 *OECD/IEA Climate Change Expert Group Papers*; and C Hood, G Briner and M Rocha "GHG or not GHG: Accounting for Diverse Mitigation Contributions in the Post-2020 Climate Framework", (2014) 2 *OECD/IEA Climate Change Expert Group Papers.*

55. As a general observation, though, some of these witnesses show a misunderstanding of the basic principles of carbon accounting and its international rules, and do not always demonstrate a clear understanding of modelling principles for forecasting net and gross emissions. Some witnesses also appear to be unaware of international good practice and core material that I would have expected them to have taken into account in formulating their opinions.

Dr Stephen Gale

56. In paragraphs 22–23, Dr Gale states that he is not aware of any current international accounting guidance in the IPCC 2018 Special Report. Dr Gale is correct that there is no international accounting guidance in the IPCC 2018 Special Report. As I explained above, that was not the purpose of that report. The IPCC has, however, published accounting guidance, which I have cited. That guidance is consistent with the accounting approaches recommended by the Commission.

57. Dr Gale also makes the statement in paragraph 22 that he understands target accounting to "just refer … to the net emissions level required in 2030, together with the emissions budgets between now and then". I do not understand this statement, it does not seem to align with the principles of carbon accounting.

Dr William Taylor

58. At paragraph 14 of the report attached to his affidavit, Dr Taylor says that the Commission's:

> … approach implies a 2030 level of net emissions for all gases of 52.6 Mt. This represents an _increase_ to the 2010 level of net emissions which was 48.6 Mt.

59. Dr Taylor appears to have made a mathematical error in calculating 2010 net emissions.

60. Dr Taylor appears to be comparing net emissions values for 2010 and 2030 obtained using the GHG inventory figures that apply land-based accounting to the LULUCF sector, while the recommendation of the Climate Change Commission is to use activity-based accounting approach to LULUCF sector, which employs a different calculation method and leads to a different result. These figures are not directly comparable.

61. I analysed New Zealand's Kyoto Protocol submission for the reporting period ending in 2012. I added the 2010 gross emissions and the 2010 figures recorded for afforestation, reforestation, and deforestation (the LULUCF sector emissions for the applicable target period) to obtain the correct net emissions comparator. The result was 64 Mt (not 48.6 Mt) for 2010, which is above the calculated net emissions level for 2030 (52.6 Mt). Dr Taylor's conclusion here is accordingly incorrect: the comparison represents a reduction from the 2010 level of net emissions.

62. Applying Dr Taylor's approach to the correct 2010 figures, he should have predicted that the Commission's approach would result in a reduction of net emissions from 2030 to 2010 of approximately 11.4 Mt.

Professor Piers Forster

63. I note that at paragraph 7 Professor Forster agrees that both gross net accounting (with a 1990 baseline) and a modified activity-based accounting approach are reasonable.

64. Professor Forster says at paragraphs 8 and following that the Commission has made an error by taking gross 2010 emissions as the baseline for the 2030 NDC, because this will have the effect of making it easier for New Zealand to reach its 2030 target. He says that net 2010 emissions should have been used.

65. I note that 2010 gross emissions include all sectors that were net emitters during that year. Using the 2010 gross figure is consistent with the gross net approach that Professor Forster agrees is reasonable.

66. In my opinion, it is correct to treat new forestry removals (that is, afforestation and reforestation) as appropriate mitigation measures. They are recognised as such in the IPCC 2018 Special Report. I therefore do not agree with Professor Forster's criticism.

SECOND ISSUE: MODIFIED ACTIVITY-BASED ACCOUNTING

Summary

67. I have been asked for my opinion on whether the modified activity-based accounting method is a legitimate and/or appropriate accounting method for New Zealand to use to account for its targets, in response to the affidavits of Dr Ivo Bertram and Dr William Taylor.

68.   There are two aspects to this:

    68.1   whether it is appropriate to use an activity-based or land-based approach; and

    68.2   whether the "modified" (that is, averaging) approach recommended by the Commission is legitimate and/or appropriate.

69.   I agree that it is appropriate for New Zealand to use activity-based accounting. This is consistent with New Zealand's reporting and carbon accounting under the Kyoto Protocol. It is also an appropriate approach to use when accounting for progress in reducing emissions. It has lower uncertainty than land-based accounting and is more clearly focused on human activities. This is appropriate for a carbon budget, which is designed to reduce emissions by influencing behaviour and practices, and promoting accountability.

70.   I also agree with the averaging approach recommended by the Commission. The methodology is consistent with IPCC methodological guidelines to supplement reporting under the Kyoto Protocol in regards to using the averaged data in higher-tier process models, and New Zealand's initiative has been welcomed by international experts. It significantly reduces the uncertainty caused by harvesting cycle fluctuations and provides stable and consistent signals about whether New Zealand is on track to meet its emissions-reduction target.

Activity-based vs land-based approach

71.   To start with, it is important to understand that this issue relates to *how* to account for the LULUCF sector. The gross net issue I talked about above in question 1 was about whether to include the LULUCF sector at all. Once we are in the net measure (ie including LULUCF), though, the next step is to determine how the LULUCF emissions and reductions are to be measured. There are a number of approaches that have been developed, and their appropriate use depends on the context and purpose of the measurement.

72.   There are two main approaches that are used to report emissions in the LULUCF sector:

    72.1   One is a land-based method (also referred to as "carbon stock change", "gain-loss", "UNFCCC reporting", "reporting under the Convention"). Its starting point is the total carbon stock change in applicable carbon pools on land units.

Next, the total change in carbon stocks on these land units is determined. This is what is used in New Zealand's GHG inventory for its national inventory reporting under the UNFCCC.

72.2   The other is "activity-based accounting". Its starting point is the carbon stock change attributable to designated LULUCF activities rather than lands. It focuses on measuring the *human-caused activities* after the base year – afforestation, reforestation, deforestation, and forest management. Data on these activities is then used to estimate the effect on emissions and removals. New Zealand used this approach to report under the Kyoto protocol.

73.   Both of these are just different ways of measuring the emissions and removals from land use, land use change and forestry. The Parties could decide to adopt either one of these approaches, or some combination of the two. New Zealand reports on both of them in its GHG Inventory.

74.   There are three reasons why I agree that activity-based accounting is appropriate for use in relation to the carbon budgets.

75.   First, using this approach maintains consistency:

75.1   New Zealand reported under the Kyoto Protocol, developed its carbon budget and set the targets under the Protocol using activity-based approach for the following activities mandatory under the Kyoto Protocol: Article 3, paragraph 3 of the Kyoto Protocol required parties to account for the specific activities of afforestation, reforestation, and deforestation against a 1990 baseline. Forest management activity was also mandated under Article 3, paragraph 4 of the Kyoto Protocol.

75.2   As already mentioned, article 4, paragraph 13 of the Paris Agreement requires consistency to be applied to accounting over time.

75.3   Maintaining a consistent (with Kyoto) approach to carbon accounting helps New Zealand comply with its obligations under the Paris Agreement.

76.   Second, adopting an activity-based approach helps minimise the uncertainty associated with accounting for LULUCF emissions and removals. I have already mentioned this in my opinion on the gross net issue, but basically, the land-based approach requires detailed estimates of the biological activity happening across large

areas of land, over a long period, with significant variability in base conditions. This is difficult to do with any precision. Therefore, the land-based approach has large uncertainty values.

77. On the other hand, the activity-based approach can more directly assess the impact of *changes in human behaviour* and its impacts on the land. This is easier to observe: for example, to tell when forests are being planted or cut down.

78. The activity-based method currently includes forestry activities, and omits some other sources of land emissions. These sources are relatively small compared to the forest sector. In my view, the value of including them in target accounting now is outweighed by the higher inherent uncertainty in these sources. The Commission considered this in its advice and I agree with the Commission's recommendation that the government address this by improving the quality of data collected.[14]

79. Third, the activity-based method better promotes accountability. Even when it is possible to take direct measurements (for example soil samples) of the carbon stocks on land it is not always possible to isolate long-term trends from ordinary fluctuations, and it is especially difficult to determine which changes are a result of human actions and behaviour that can be influenced, and which are not. This means it is harder to say with certainty whether progress is being made—and to design interventions to change behaviour. Conversely, the activities such as deforestation and afforestation are directly related to how behaviour is (or is not) changing over time, meaning it is a useful measure to hold decision makers accountable for. This also makes it easier to track impacts from specific mitigation efforts through monitoring relevant measures and associated activities.

80. It might be useful to compare the land-based and activity-based methods by thinking about financial accounting. The land-based measure is like a bank statement: it records money going in and money going out of a bank account. The activity-based measure is like a budget: it itemises what the money is being spent on, and whether income is enough to cover expenses.

81. The short point is that the land-based and activity-based methods have different strengths and weaknesses, and so are useful tools for different tasks. The land-based

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14 Climate Change Commission *Ināia tonu nei: a low emissions future for Aotearoa* (June 2021) at [10.5] [Advice Bundle page 219 and 220].

method makes sense when reporting on emissions and removals under the UNFCCC. But for the reasons I have given, I agree with the Commission that an activity-based measure is more appropriate for accounting for carbon budgets.

Averaging approach

82.   The "modified" part of the modified activity-based accounting approach relates to the averaging recommended by the Commission for post-1989 forests.

83.   As I have mentioned, the base year for the Kyoto Protocol for New Zealand was 1990. The area of land that was in forest prior to 1 January 1990 is considered the baseline. Increased removals caused by afforestation of new areas are accounted for, and any reduction in forest area (deforestation) is accounted for, as is reforestation of previously deforested areas.

84.   The averaging approach used in New Zealand means that removals from post-1989 forests will only be accounted for until the forests reach their long-term average carbon stock, taking into account all carbon pools and activities.   The long-term average carbon stock is the amount of carbon the forest will store on average over multiple cycles of growth and harvest, based on typical harvest ages seen in New Zealand forestry.   The age that the forest reaches its long-term carbon stock is called its "average age".

85.   With averaging, the level of net removals is driven primarily by the areas of new forest planted and the amount of deforestation.   Fluctuations that are caused only by harvest cycles are not taken into account.   This measure of emissions therefore much more closely tracks against actual actions taken.

86.   This kind of averaging is consistent with international good practice.   In 2014, the IPCC published the *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol.*[15]   This guidance suggests that measures to reduce the reported impacts of environmental variability (including climate, trends in atmospheric CO_2 concentration or N deposition) can include time-averaging of environmental data

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[15]   IPCC *2013 Revised Supplementary Methods and Good Practice Guidance arising from the Kyoto Protocol* (2014)
        <https://www.ipcc.ch/site/assets/uploads/2018/03/KP_Supplement_Entire_Report.pdf>

over 5–10 year (or longer) periods when using such data in higher-tier[16] process models. The guidance provides that averaging measures can also help isolate the impacts of changes in human activities relative to a baseline.[17] This is described as 'good practice'.

87.   New Zealand developed the averaging approach for both the NDC and also adopted an equivalent averaging approach for forests more generally for the Emissions Trading Scheme. The application of the approach to the ETS was announced in March 2019 and came into effect on 1 January 2021.

88.   The introduction of the averaging approach for the ETS was welcomed by international experts. The International Carbon Action Partnership, an international forum for governments and public authorities that have implemented or are planning to implement emission trading schemes, published New Zealand's approach using averaging as a good practice case study.[18]

89.   I agree that the modified activity-based approach is an example of good practice and is appropriate in the New Zealand context.

90.   As I've already mentioned, one of the Paris Agreement's requirements for NDCs is accuracy (article 4, paragraph 13). New Zealand's national inventory reports to the UNFCCC (which use a land-based measure) record high inter-annual variations (up to 30%) in net emissions, due to the effect of plantation forest harvest cycles. This creates high uncertainty levels that substantially reduce the accuracy of estimating emission trends and make it difficult to build projections.

91.   The modified activity-based accounting approach that New Zealand will use for its NDC under the Paris Agreement provides more stable and consistent information over the relevant period, with lower uncertainty levels (compared to the land-based method that requires forest owners to account for any change in their carbon stocks, even if

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[16]   "Higher-tier" models are those that do not use the IPCC's default approaches and instead use country specific models and data to estimate emissions. New Zealand's models for forestry emissions and removals are higher tier.

[17]   IPCC *2013 Revised Supplementary Methods and Good Practice Guidance arising from the Kyoto Protocol* (2014) at [2.3.5] <https://www.ipcc.ch/site/assets/uploads/2018/03/KP_Supplement_Entire_Report.pdf>

[18]   ICAP "New Zealand announces changes to forestry under the NZ ETS introducing averaging accounting" (11 April 2019), available at <https://icapcarbonaction.com/en/news-archive/629-new-zealand-announces-changes-to-forestry-under-the-nz-ets-introducing-averaging-accounting.>

OG KB

the change is temporary). Smoothing out the "sawtooth" pattern of peaks and falls makes it easier to project a clear trend line, and therefore to track progress.

92. The improved clarity does not come at the cost of reduced environmental integrity. The science around average age and forest carbon stock is robust. Deforestation or persistent higher-than-average emissions are fully accounted for.

93. For those reasons, it is my opinion that the modified activity-based accounting approach is consistent with international best practice and is an appropriate method to use in New Zealand's carbon budgets.

94. I do not agree with the criticisms of this approach made by Dr Taylor and Dr Bertram. I also consider that both Dr Taylor and Dr Bertram appear to have somewhat misunderstood the purpose of activity-based accounting and how it works.

Affirmed

Olia Glade

at Wellington this 9th day of December 2021

before me:

Katie-Anne Budgen
Solicitor
WELLINGTON

A Solicitor of the High Court of New Zealand

 europass · · · | Curriculum Vitae | Olia Glade

PERSONAL INFORMATION Olia Glade

📍 New Zealand

✉ olia.glade@ghginstitute.org
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www.ghginstitute.org

JOB APPLIED FOR
POSITION
PREFERRED JOB
STUDIES APPLIED FOR

Director for MRV Systems at the Greenhouse Gas Management Institute

WORK EXPERIENCE

2019 - Present   **Director for MRV Systems at the Greenhouse Gas Management Institute**

Greenhouse Gas Management Institute, Washington DC / Seattle (United States)

The GHG Management Institute is a non-profit organization focused on professional development globally. The mission of the Institute is "to build and support a community of experts with the highest standards of professional practice in measuring, accounting, and managing greenhouse gas emissions; meeting the needs of governments, corporations, and organizations large and small."
www.ghginstitute.org

- Managing international MRV capacity building projects associated with design, implementation and strengthening national MRV systems and data management systems;
- Leading and supporting projects through the preparation of training materials/courses, workshops and webinars, as well as MRV and capacity building tools;
- lead instructor on IPCC Guidelines online courses and deliver training workshops on IPCC Guidelines and other carbon management topics
- Lead Instructor and course designer for international workshops on climate change (for example, M.I.C.E. Global (Asia), CGE/UNFCCC (Latin America, Africa, Eastern Europe, Asia and Oceania Regions), CCMRVH workshops on data institutionalization (Caribbean Region), and the Caribbean Summer Academy (Caribbean Region)
- Serving as a Lead Reviewer for the international GHG reporting reviews under the UNFCCC and the Paris Agreement (on GHG Inventories, Biennial Reports, Biennial Update reports, and National Communications)
- Performing systems analysis, system design, and IT project management for MRV data management systems
- Providing technical reviews for the Carbon Journal
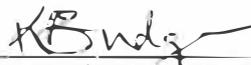
2011 – 2019   Senior Climate Change Analyst, National GHG Inventory Program Manager;
New Zealand's Inventory Focal Point at the UNFCCC
Ministry for the Environment (New Zealand)

- Managing New Zealand's national Greenhouse Gas Inventory programme
- Key contributor to National Communications and Biennial Reports
- Managing projects on design and building information systems and tools on GHG analysis for policy purposes and international climate change negotiations
- Strengthening and supporting GHG inventories and inventory national systems for developing countries and SIDS (Africa, Oceania)
- Supporting New Zealand's Ministers for Climate Change and Environment through briefing notes, ministerial and parliamentary questions
- Responding to public requests regards climate change and greenhouse gases
- Serving an expert (generalist, national systems) and a Lead Reviewer for the international GHG reporting reviews under the UNFCCC and the Paris Agreement.

2009 – 2011   Senior Analyst

New Zealand's Tertiary Education Commission (New Zealand)
- Leading and coordinated New Zealand's tertiary education research and analysis projects;
- Designing and implementing information systems and tools for tertiary education
- Presenting at the international forums on education.

2008 – 2009   Senior Researcher
New Zealand's Qualification Authority

Leading and coordinated New Zealand's tertiary education research and analysis projects.

2004 – 2008   Leading Lecturer
New Zealand's International Campus

- Reading undergraduate courses on systems analysis, project management, software design, and mathematics for University of Central Queensland and University of Ballarat, Australia at their international campus in New Zealand
- Leading research program at the campus (as a Head of the Research Committee)
- Providing consulting, technical and personal supervision to students and academic staff
- Designing and implementing information systems and tools for tertiary education.

2002 – 2012   Adjunct Faculty
The Open Polytechnic of New Zealand, School of Information Technology and Humanities

- Designing undergraduate courses on database management systems, systems analysis and design
- Reading undergraduate courses on project management, systems analysis, database management systems and programming.

2000 – 2004   Senior Teacher
Kip McGrath Educational Centre (New Zealand)

- Teaching Mathematics, Chemistry, Physics, and Biology at senior school level (years 10-13)
- Providing coaching and consulting services to students and developed course materials.

1994 – 2000   Lecturer
Victoria University of Wellington (New Zealand)

- Designing and reading undergraduate and graduate courses on chemistry and material science
- Performing intensive research work
- Managing research projects
- Publishing and presenting research papers nationally and internationally
- Providing laboratory supervision
- Supervising student's research work
- Providing consulting services for internal and external stakeholders
- Providing coaching and consulting services to students
- Developing course materials.

1998 – 1998   Lecturer
Wellington Polytechnic Conservatory of Music (New Zealand)

- Designing and reading undergraduate course on Russian Phonetics for Opera Singers
- Designing courses, course materials and assessments Managing research projects
- Providing coaching and consulting services to students.

1993 – 1994   Visiting Lecturer
University of Canterbury (New Zealand)

- Managing research projects;
- Performing intensive research work on chemistry and crystallography
- Publishing and presenting research papers nationally and internationally
- Providing laboratory supervision
- Supervising student's research work
- Providing consulting services for internal and external stakeholders
- Providing coaching and consulting services to students.

1991 – 1993   Research Scientist
Russian Academy of Sciences (Russia)

- Managing research projects;
- Performing intensive research work on chemistry and crystallography
- Publishing and presenting research papers nationally and internationally
- Providing consulting services for internal and external stakeholders

1985 – 1991   Junior Research Scientist
Moscow State University (Russia)

- Managing research projects;
- Performing intensive research work on chemistry and crystallography
- Publishing and presenting research papers nationally and internationally
- Providing consulting services for internal and external stakeholders
- Providing coaching and consulting services to students.
- Teaching undergraduate courses

1985 – 1985   Research Manager of the environmental expedition in Volga basin
Moscow State University/Russian Academy of Sciences (Russia)

- Managing environmental research projects (water quality and sustainability – Volga river)
- Environmental research
- New equipment testing
- Providing consulting services for internal and external stakeholders
- Providing coaching and consulting services to junior staff.
- Managing the research ship
- Report writing

1984 – 1984   Research assistant of the environmental expedition in Seliger region
Moscow State University/Russian Academy of Sciences (Russia)

- Performing environmental field research and analysis in the north Russian area – at lake Seliger
- New equipment testing
- Providing consulting services for internal and external stakeholders

EDUCATION AND TRAINING

2011 - 2017   Certified expert reviewer for greenhouse gas inventories
(Generalist, Energy, IPPU); expert reviewer of National
Communications, Biennial Reports for Annex I Parties, and Biennial
Update reports for non-Annex Parties

UNFCCC / Greenhouse Gas Management Institute (GHGMI)

- National GHG inventory review – Energy sector
- National GHG inventory review – IPPU sector
- National GHG inventory review – Generalist (National systems & cross-sectoral analyses) under the 1996 IPCC Reporting Guidelines for National GHG Inventories
- National GHG inventory review – Generalist (National systems & cross-sectoral analyses) under the 2006 IPCC Reporting Guidelines for National GHG Inventories
- Modalities for the accounting of assigned amounts under article 7.4
- National Systems (CP1)
- Application of Adjustments process under the Kyoto Protocol (CP1)
- National Systems (CP2)
- Application of adjustments under the Kyoto Protocol (CP2)
- Accounting of assigned amounts under Article. 7.4 of the Kyoto Protocol
- Review of National Registries and information on assigned amounts under the Kyoto protocol
- National Communications and Biennial Reports for Annex I Parties - Modeling and Projections
- General - Review of National Communications and Biennial Reports for Annex I Parties
- Biennial Update Reports for non-Annex Parties - National Greenhouse Gas inventories
- Review of activities under Article 3.3 and 3.4 of the Kyoto protocol
- Improving communication and facilitating consensus in expert review teams

2003 - 2004   Graduate Diploma - Teaching

Department of Education - Victoria University of Wellington (New Zealand)

- Biology
- Chemistry
- Physics
- Mathematics (Calculus and Statistics
- Information Communication and Technology
- Pedagogical theory (Teaching for Learning)

2002 - 2002   Microsoft professional Certificate

Executrain (New Zealand)

- MS 2000 Professional
- MS 2000 Server
- Active Directory Design
- Active Directory Management

2000 - 2001   Certificate in Microcomputing Technology

Computer Power Institute (New Zealand)

- Programming (Pascal, C, Java)
- System programming (DOS, Unix)
- Web Design
- Database design and management
- Microsoft office Products
- Accounting Fundamental
- Electronic accounting
- Professional excellence

1987 - 1992   PhD – Doctor of Philosophy in Chemistry

Moscow State University & Russian Academy of Sciences (Russia)

- Chemistry
- Crystallography
- Information Technology & Mathematics
- Philosophy
- English

1980 - 1985 MSc – Master of Science in Chemistry

Moscow State University (Russia)

- Chemistry (Bioorganic Chemistry, Physical Chemistry, Theoretical Chemistry)
- Physics
- Environmental Studies
- Mathematics
- Computer Science
- History
- Philosophy
- Physical Culture
- English

PERSONAL SKILLS

Communication skills

Olia is a thought leader on GHG measurement, reporting, and verification (MRV), systems analysis, design, and IT project management for MRV data management systems, and national systems for implementation the Enhanced Transparency Framework under the Paris Agreement. She is an international expert and a UNFCCC Lead Reviewer on GHG inventories, Biennial Reports, Biennial Update reports, and National Communications and the expert on the international capacity building and the creation of MRV infrastructure needed to produce highly credible environmental information. Prior joining the GHGMI, Olia served as a national GHG inventory compiler, the national GHG inventory programme manager and the national Focal point for GHG inventory in New Zealand. Throughout her learning, research and management career, Olia has gained excellent communication skills, specifically:

- technical and creative writing – through writing research papers, study reports, creating teaching materials, preparing proposals and written translations for scientific journals and the 2006 IPCC primer (editing Russian translation), writing and editing UNFCCC assessment review reports as a UNFCCC Lead Reviewer
- oral communication – delivering presentations, teaching in the classroom, lecturing, conference and workshop presentations, communication with project leaders and researchers and campus management, and leading UNFCCC expert teams

Organisational / managerial skills

Program and project management skills, team leadership & team work, for example:

- leadership (currently managing over 20 people across several project teams)
- Director for MRV systems at the GHGMI, which includes multiple projects management across several international teams
- leading international expert review teams at the UNFCCC as a lead reviewer for GHG inventories, national Communications, and Biennial reports
- New Zealand's focal point for the GHG inventory at the UNFCCC and New Zealand's national inventory compiler since 2013.
- Experienced program manager: managed national greenhouse case inventory program from 2013 onwards. This included planning, management and coordination multiple projects and sub-programs between different government agencies, companies and teams
- Experienced project manager: taught project management for MBA students and within

undergraduate programs; coached new project managers through all phases of the project cycle with a high rate of success; managed and co-managed multiple projects within last 6 years covering technical reporting for greenhouse gas inventory, software development, and international relations; applied agile management techniques for successful work in changing environment and comprehensive task prioritizing to enable smooth project flow and to successfully balance multiple projects; hired and managed personnel

- Team planning work; led and contributed to several work planning workshops for the climate change analysis team at the Ministry for the Environment; as a Lead reviewer, did planning for the review weeks at the UNFCCC
- Comprehensive planning for the national GHG inventory program (including financial and resource planning)
- Financial planning for several projects: greenhouse gas program support, greenhouse gas inventory, information systems
- Contract management
- Cross-government agency coordination for the GHG inventory; coordination of efforts between different organizational units

Managed national and international stakeholders to ensure high quality and timely delivery of the national GHG inventory program and supported inventory use by various organizations

Organisational / managerial skills	Program and project management skills, team leadership & team work, for example:

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- Contract management
- Cross-government agency coordination for the GHG inventory; coordination of efforts between different organizational units
- Managed national and international stakeholders to ensure high quality and timely delivery of the national GHG inventory program and supported inventory use by various organizations

Job-related skills	GHG inventories & national inventory systems, synergetic: environment.

- Led three-year project to establish the GHG inventory national system in Tokelau, training Tokelauan experts and bringing Tokelau in the New Zealand inventory reporting domain
- Participation in hands-on training for GHG specialists from African countries
- Trained GHG inventory teams and inventory compilers from developed and developing countries
- Actively engaged in building GHG inventory capacity in the Caribbean Region through the Caribbean Cooperative MRV Hub project; Turkmenistan, Fiji, North Macedonia, Trinidad and Tobago through dedicated inventory capacity building projects, building materials for the GHG inventory certification programme, creating roadmaps for MRV system development
- Leading instructor for the 2006 IPCC methodology courses (cross-sectoral analyses and general issues, energy, IPPU, agriculture, waste, and LULUCF)

- Regional GHG expert capacity building, including project development and delivery, designing materials, delivering presentations and facilitating hands-on training sessions for the African, Latin-American, Caribbean, Asian, East European and Oceanian regions on institutionalization of data management for national GHG inventory.
- Hands-on experience in planning and producing annual New Zealand's GHG national inventory from 2012 as a deputy compiler and the national inventory compiler from 2013 to 2019
- New Zealand's inventory system management, maintenance and improvement
- Cross-sectoral analyses for the national GHG emissions and authored the relevant chapters of the GHG inventory from 2011 onwards
- Successfully completed UNFCCC/GHGMI courses on reviewing national inventories for Energy and IPPU sectors, national systems, national registries and modalities under the Kyoto Protocol and became an inventory expert reviewer at the UNFCCC (Energy, IPPU, Generalist and the Lead reviewer)
- Lead expert reviewer on GHG inventories, national Communications, and Biennial Reports
- Specialist on the national inventory systems: organized several bilateral meetings between New Zealand and other Annex I Parties (Australia, Austria, Germany, Denmark and France) to discuss and review respective national GHG inventory systems through learning and knowledge exchange; as a review generalist expert, reviewed national systems of several Annex I Parties
- Leading expert on the MRV data management systems through systems analysis and design, IT management of the MRV tool development, template development for data collection and processing, national system, QA/QC systems
- An author of National Systems Guidelines for New Zealand
- An author of the fundamental paper on QA/QC for the UNFCCC
- Among other selected Lead reviewers, participated in the projects run by the UNFCCC secretariat to implement decisions of the Lead reviewers' meetings in 2017 and 2018
- Countries of Work Experience: New Zealand (permanently); Netherlands, Germany and Kazakhstan – on assignments (UNFCCC review work); Algeria, Cambodia, Malaysia, Grenada, Belize (CGE and MICE Global workshops); Turkmenistan, Fiji, Trinidad & Tobago (remote work due to the COVID-19 situation), Russia (former Soviet Union).

Computer skills	Replace with your computer skills. Specify in what context they were acquired. Example:

- Data Processing, modelling and forecasting; Research and Evaluation:
  - Greenhouse gas data processing, analysis and presentation
  - Quantitative and qualitative research (incl. data collection) in a wide range of fields: science, environment, education, financial conceptual modelling
  - Forecasting of provision and performance metrics for the organizational Statement of Intent
  - Quantitative modelling and forecasting of different effects in policy design process
  - Mathematical modelling of demographic changes in tertiary education (custom-made functions)
  - Requirement analysis
  - Survey, focus group, and interview design and supporting documentation
  - Risk analysis
  - Management of data processing and data transfer between applications and from paper-based sources into electronic form
  - Designing data quality assurance procedures
  - Documenting business rules and processes, process analysis and modeling
- Database skills:
  - Solid understanding of database management systems, structure, design and administration
  - Work experience with a variety of databases and a Data warehouse
  - Data models design (for relational databases)
  - Microsoft certification in Active Directory design and Active Directory administration
  - 4 years of experience as a course designer, Lecturer and a Leading Lecturer in Database
- Management Systems and Systems Analysis
  - Information systems analysis and design:
  - Systems analysis and design for visualization of greenhouse gas projections, emission reduction targets, international comparisons, emission abatement
  - Feasibility research and analysis of software applications (survey design and management software, analysis and reporting tools, 3D visualization prototypes) good command of Microsoft

Office™ tools
- A principal contributor to the aggregate software requirement documents and a representative in software acquisition and data warehouse development meetings and negotiations on behalf of the Evidence and Analysis group at the Tertiary Education Commission (TEC)
- Design, development and implementation of interactive Excel-based software application to visualize provision and performance information for the Tertiary Education sector in New Zealand for analysis, reporting and presentation
- Creating excel-based modeling applications for data analysis and forecasting

Teaching and training Replace with other relevant skills not already mentioned. Specify in what context they were acquired. Example:

- 2019 - present Greenhouse Gas Management Institute – international online instructing on 2006 IPCC methodology on cross-sectoral analyses and general issues, energy, IPPU, agriculture, waste, and LULUCF
- Expert international trainer for international workshops on GHG data institutionalization, national systems, subnational inventories and GHG Protocol
- Coaching staff in presentation skills and presentation software,
- 10 years' experience as a Leading lecturer and supervisor on Project management, Systems analysis, Programming, and Databases
- Over 10 years of teaching experience in tertiary and secondary education in New Zealand and overseas: lecturing, tutoring, and laboratory supervision for individuals, small and large groups; in both on-line and face-to-face modes
- Professionally trained educator: Graduate Diploma of Teaching with majors in Informational Technology, Mathematics, Statistics, Physics, Chemistry, Biology and General Science
- Teaching and training in Performing Arts (all ages, small and large groups, and individuals)