From: s 9(2)(a)
To:
Cc:
Subject: RE: Distributional impacts
Date: Monday, 15 February 2021 11:08:24 am

Morena s 9(2)(a)

Great questions, thanks for reaching out.

On the presentation for DIM-E: we have an open webinar next Tuesday 23rd where we will be talking about both C-PLAN and DIM-E work, and we're contemplating a follow-up the next week on the results from those two models. You can register and find all our open events on this page - Climate Change Commission Events | Eventbrite.

We are also in the process of lining up an agency Q&A session on the models after the webinar next week – just waiting to hear back from one of the modellers on his availability for that. We'll let you know asap when we have confirmed that date.

On the details/numbers: we have nearly finished preparing our DIM-E results for public release, including the numbers on age, region etc. We are aiming to get them online end of today or tomorrow (I can give you a heads up when they are ready). We are also in the process of getting a report written up on the DIM-E model by s 9(2)(a) (MOTU), which should be available in a month or so.

On the households impact model: I think s 9(2)(a) might have been talking about our future modelling efforts? We are still at the early scoping stage for our DIM-Households model , so unfortunately no results to share at this time.

Hope that answers your questions.

s 9(2)(a)

From: s 9(2)(a) @mfe.govt.nz>
Sent: Monday, 15 February 2021 9:55 am
To: s 9(2)(a) @climatecommission.govt.nz>
Cc: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @mbie.govt.nz) s 9(2)(a) @mbie.govt.nz>
Subject: Distributional impacts

Hi s 9(2)(a)

I hope you are doing well.

I am in the transition team at MFE and we have been discussing some of the gaps in information that we have around distributional impacts. With this in mind I have a few questions that I was hoping you could respond to.

1. Are you planning on holding a specific Q&A session on DIM? Most sessions so far have

focussed on ENZ and to a lesser extent CPLAN, but both us and MBIE (and likely others) would see value in a session on distributional impacts.

2. s 9(2)(a) mentioned that you are still working on a household impacts model. Is this the case and if so, when are you planning on making results available?
3. There is not much detail (in terms the actual numbers output of DIM-E) in the report. Are you able to provide more detail (numbers) around cuts by TA, ethnicity, gender, age band?

Kind regards,

s 9(2)(a)
Ministry for the Environment – Manatū Mō Te Taiao
s 9(2)(a) Website: www.mfe.govt.nz

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From: s 9(2)(a)
To:
Subject: RE: [UNCLASSIFIED] RE: yet more complications on publishing a paper on updated waste methods
Date: Friday, 26 February 2021 7:19:55 pm
Attachments: image001.png
image002.jpg
image003.png
image004.png
image005.png
image006.png
image007.png

FYI we're waiting to hear back from Stats about their recommendations (it affects numerous people getting hold of draft inventory data this time).

Out of Scope

Cheers

s 9(2)(a)

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Monday, 22 February 2021 10:13 AM
To: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) @mfe.govt.nz>
Subject: RE: [UNCLASSIFIED] RE: yet more complications on publishing a paper on updated waste methods

Ah yes I had forgotten about that… we need the accumulated DDOC in the base year (2018 currently, or 1990 if we update the model to run from then). This is assuming these will have changed for municipal landfills due to the new DOC values.

I can't think of anything else we need currently.

Cheers,
s 9(2)(a)

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Monday, 22 February 2021 10:01 am
To: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) s 9(2)(a) @mfe.govt.nz>
Subject: [UNCLASSIFIED] RE: yet more complications on publishing a paper on updated waste methods

[UNCLASSIFIED]

Hey all,

We more meant the historic DOC values that we wanted to update our model with. Some of that

is in the updated GHG inventory that I peer reviewed – but I think that's not everything.

As long as we're allowed to get them and start doing our analysis from them before hand that would be fine.

s 9(2)(a) what more did we need from MfE?

Thanks,

s 9(2)(a)

W climatecommission.govt.nz

[UNCLASSIFIED]

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Friday, 19 February 2021 5:24 pm
To: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) s 9(2)(a) @climatecommission.govt.nz>
Subject: RE: yet more complications on publishing a paper on updated waste methods

Excellent, thanks!

From: s 9(2)(a) @mfe.govt.nz>
Sent: Friday, 19 February 2021 4:48 pm
To: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) s 9(2)(a) @climatecommission.govt.nz>
Subject: RE: yet more complications on publishing a paper on updated waste methods

Ok, sounds good

Summary factors for open burning are presented in the draft waste chapter that s 9(2)(a) reviewed (under open burning) which might answer that question. Since you're not going to be publishing anything till after the inventory publication it should be ok to use that.

Cheers

s 9(2)(a)

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Friday, 19 February 2021 4:37 PM
To: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a)

s 9(2)(a) @climatecommission.govt.nz>
Subject: RE: yet more complications on publishing a paper on updated waste methods

Hey s 9(2)(a)

When I wrote that I was referring to what you'd already provided (so that's good to hear). I haven't seen any of the draft inventory content so will leave that question to s 9(2)(a)

I haven't gone back to the earlier work yet so my memory is patchy, but I recall some data gaps where we might have to request more info in order to be able to replicate the emissions results. I think it was mainly around how you'd applied CO2 combustion factors to the different waste types for open burning. A pretty second order thing so wouldn't be a deal-breaker, but it would be good if you were able to provide additional info like this. Something to discuss next week?

Cheers,
s 9(2)(a)

From: s 9(2)(a) @mfe.govt.nz>
Sent: Friday, 19 February 2021 3:21 pm
To: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a)
s 9(2)(a) @climatecommission.govt.nz>
Subject: RE: yet more complications on publishing a paper on updated waste methods

Hey s 9(2)(a) ok to respond next week)

I've gone through your responses, thank you very much – just to clarify when you say "as long as it's fine for us to use the data before then", are you referring to data you've already got from MfE's projections work? If it's just what you've already got from projections, then yes that is fine with me.
Or are you using content provided for peer review of the draft inventory? Also would you be seeking anything more before the 13 April 2021 inventory publication?

Cheers
s 9(2)(a)

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Friday, 19 February 2021 2:00 PM
To: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a)
s 9(2)(a) @climatecommission.govt.nz>
Subject: Re: yet more complications on publishing a paper on updated waste methods

No worries! My fault for not setting up an auto reply haha. Have a good weekend team

Get Outlook for Android

From: s 9(2)(a) @mfe.govt.nz>
Sent: Friday, February 19, 2021 1:42:23 PM
To: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) s 9(2)(a) @climatecommission.govt.nz>
Subject: RE: yet more complications on publishing a paper on updated waste methods

Alright, that's much appreciated! And sorry to bother you on leave.

s 9(2)(a)

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Friday, 19 February 2021 1:39 PM
To: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) s 9(2)(a) @mfe.govt.nz>
Subject: Fwd: yet more complications on publishing a paper on updated waste methods

Sorry I'm supposed to be on leave today but I stand by s 9(2)(a) draft answers

Get Outlook for Android

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Friday, 19 February 2021, 09:27
To: s 9(2)(a)
Subject: RE: yet more complications on publishing a paper on updated waste methods

Hey here are some suggested answers:

From: s 9(2)(a) @mfe.govt.nz>
Sent: Thursday, 18 February 2021 8:14 pm
To: s 9(2)(a) @climatecommission.govt.nz>
Cc: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @mfe.govt.nz>
Subject: yet more complications on publishing a paper on updated waste methods

Hey s 9(2)(a)

As the subject suggests, there are yet more complications on publishing a paper on updated waste methods, as there are some conversations with stats NZ and other considerations underway with the goal of having a system/process for this. However, it may still be possible to publish the waste methods as a one-off.

I just have a couple questions that will help me figure out what is best for CCC & MfE:

- Have you already prepared data/analysis based on the updates that MfE is doing in the waste sector that are not published?

We started doing this for our draft advice then pulled back after finding out we wouldn't be able to publish the new data and methods. We are about to start updating our waste modelling for our final advice.

- If yes, are you intending to publish some/all of this data and or analysis and if so, when?

We would want to publish emissions results and some data (e.g. waste volumes) and information about methodology with our final advice on 31 May 2021.

- What is the impact of MfE not publishing any updated methodology until the April inventory publication?

Probably nothing, as long as it's fine for us to use the data before then and you can provide any additional data or info we need to be able to replicate the updated MfE waste emissions models.

- Do you require quantitative impacts of the methodology changes in the methods update in able to include the updates in your data/analysis?

No, we would be able to do this ourselves.

Your answers will help us determine what we need to do in order to publish the methodology updates, assuming it goes ahead before the inventory publication.

Cheers

s 9(2)(a)

Ministry for the Environment | Manatū Mō Te Taiao
s 9(2)(a) @mfe.govt.nz | mfe.govt.nz

Ministry staff work flexibly by default. For me, this means I work afternoons & evenings Tuesday to Friday. You may receive an email from me in the evening. Please respond at a time that is convenient for you.

From: s 9(2)(a)
To:

Subject: FW: Modelling Q & A - Interagency officials to meet with the Commission's modelling analyst team to understand modelling

---

-----Original Appointment-----
From: s 9(2)(a) @mfe govt nz> >
Sent: Thursday, 27 May 2021 3:43 pm
To: s 9(2)(a)
s 9(2)(a)
Subject: Modelling Q & A - Interagency officials to meet with the Commission's modelling analyst team to understand modelling
When: Tuesday, 1 June 2021 1:30 pm-4:30 pm (UTC+12:00) Auckland, Wellington
Where: Microsoft Teams Meeting or WREMO 2 Turnbull Street Thorndon

Hi team –

Forwarding the invite for those attend our inter-agency briefing; to be hosted by MfE at their office

Thanks
s 9(2)(a)

-----Original Appointment-----
From: s 9(2)(a) @mfe govt nz> >
Sent: Thursday, 27 May 2021 3:17 pm
To: s 9(2)(a)
Subject: Modelling Q & A - Interagency officials to meet with the Commission's modelling analyst team to understand modelling
When: Tuesday, 1 June 2021 1:30 pm-4:30 pm (UTC+12:00) Auckland, Wellington
Where: Microsoft Teams Meeting or WREMO 2 Turnbull Street Thorndon

---

Microsoft Teams meeting

Join on your computer or mobile app

Click here to join the meeting <https://teams microsoft com/l/meetup-join/19%3ameeting_MTM3N2M5ZWEtMWExMS00NTQ2LTkxN2QtZGEyMjJlZmQyODRk%40thread v2/0?context=%7b%22Tid%22%3a%22761dd003-d4ff-4049-8a72-8549b20fcbb1%22%2c%22Oid%22%3a%2293de20ad-1113-4e38-af2f-585fe5b5d135%22%7d>

Ministry for the Environment

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DAY

DATE

TIME

PROCESS STEPS

WHAT WE WOULD LIKE FROM THE COMMISSION

CCC respons s 9(2)(a)

ACTIONS FROM OFFICIALS / INTER-AGENCY GROUP

Tues

25 May

TBC
s 9(2)(h)

s 9(2)(a) (and/or other CCC representative familiar with consultation) to be available to meet for 60-90 mins to discuss detail on consultation (timing TBC via s 9(2)(a) MFE)

Meeting booked for 27/05 To be attended by s 9(2)(a)

s 9(2)(h)

Tues

25 May

TBC

MFE and Commission officials to meet and confirm modelling baselines and data (to understand baselines) to consider this information in advance of final Commission report (noting officials considering this info and alignment pre final report in no way compromises the independence of the Commission's work and models)

Modelling and data analysts from Commission to be available for 60-90 mins (Timing TBC vi s 9(2)(a) at MFE), and to make available information on baselines used for Commission models – ideally prior to this meeting so that the right repres m MFE/agencies are present

Also to confirm timing of release of modelling data and models

Modelling team not available before 31 May, but happy to host MfE staff at CCC offices after this time to allow them access to the models

MFE Climate team representatives responsible for modelling s 9(2)(a) TBC whether other agency representatives may contribute here

Mon

31 May

TBC - but understand this may be around 10am?

The Commission to provide Minister Shaw with its final advice

Out of Scope

Mon

31 May

TBC

Minister Shaw to share the Commission's advice with other members of the Climate Response Ministerial Group

Note: The Commission's advice will also be shared with ERP agencies at this time

N/A

The timing in the next column will need to be updated to reflect likely delivery timeframe of the final report

Tues

1 June

10 30—12 30pm

Policy Q & A - Interagency officials to meet with the Commission's policy analyst team for an intensive Q&A session on the key changes between the draft and final report

Commission policy representatives to be available to meet at MFE with Interagency working group at Environment House to discuss key changes between the draft and final report

Yes – CCC staff attendance tbc; need a meeting invite from MfE

Should we separate out the methane & NDC? Imagine it will be the same MfE staff though so need to agree the time, potentially add an hour to the Modelling Q&A?

Click here to join the meeting <https://teams microsoft com/l/meetup-join/19%3ameeting_NzZlMmNhYWQtZDgwYi00MzY0LWE4ODctNzM1NTc5NWI4NTli%40thread v2/0?context=%7b%22Tid%22%3a%22761dd003-d4ff-4049-8a72-8549b20fcbb1%22%2c%22Oid%22%3a%2293de20ad-1113-4e38-af2f-585fe5b5d135%22%7d>

or WREMO 2 Turnbull Street Thorndon

Available at Environment House with questions to meet with Commission representatives, so that initial advice summary to CRMG can be developed

Tues

1 June

1 30 – 3 30pm

Modelling Q & A - Interagency officials to meet with the Commission's modelling analyst team to understand modelling

Commission technical modelling team representatives to be available to meet at MFE with Interagency modelling/analysis working group at Environment House to discuss modelling questions – assumptions, sensitivity analysis, pathways etc

Yes – CCC staff attendance tbc; need a meeting invite from MfE

Available at Environment House with questions to meet with Commission representatives, so that initial advice summary to CRMG can be developed

Tues

1 June

1 30 – 3 30pm

Consultation Q & A - MFE Officials and Legal team to meet with the Commission's consultation and lead team to understand processes and substantive issues received as part of consultation

Commission consultation team representatives to be available to meet at MFE to discuss questions on consultation and how submission views were reflected or not, and how iwi/Maori consultation and engagement was advanced

Yes – CCC staff attendance tbc; need a meeting invite from MfE

Available at Environment House with questions to meet with Commission representatives, so that initial advice summary to CRMG can be developed

Wed

2 Jun

10am-1pm

Interagency officials go into a sprint to prepare a joint briefing on the Commission's final advice

N/A – if possible to have CCC staff representatives available on phone for any questions, that would be very useful

Yes, CCC staff can be available to take calls We will coordinate any requests from through s 9(2)(a)

Wed

2 June

2-3pm

Interagency directors receive briefing, advised on government response and provide directions to interagency working group

Thurs

3 June

9am

Interagency directors (at least MFE, MBIE, MPI, MoT, TSY) review final briefing note and jointly sign out [check MFAT re NDC]

Thurs

3 June

10am

Briefing Note to Minister Shaw's office and Climate Response Ministers Group

Thurs

3 June

12 30-1 30pm

Minister Shaw to meet with the Commission

Dr Carr, Jo Hendy meeting with Minister Shaw

Supporting CCC staff attendance tbc, would be helpful to have insight from MfE on areas Minister may like to discuss in detail so we can have the right staff available

s 9(2)(a) and MFE Officials to attend CCC and Minister Shaw meeting

Fri

4 June

11 30-12 30pm

Climate Response Ministers Group meeting to discuss the advice and next steps

N/A

Fri

4 June

During market hours

EPA to send notice to all NZETS Registry holders advising on timing of final CCC report

Other media advice on timing of final report release TBC

Please confirm by 31 May (to MFE Officials and Minister's comms lead) the web location for viewing final report and associated materials (when made live on 8 Jun), so that this can be confirmed in any related communications, including the EPA notice that will be sent to registry account holders

Yes, we can provide the weblink (ie the url) by 31 May but it will not be active

Mon

7 June

-

Tues

8 June

TBC

Media lock up (Timing TBC by Minister's Office - before or after presentation to the House)

Note: This could allow a window of around two hours for the media to come together and read the report

TBC any media requirements with Minister's Office

CCC staff to attend will likely be subject leads and comms staff

Tues

8 June

Copies and Private Secretary email confirmation to Office of the Clerk by 1pm

Minister Shaw to present a copy of the Commission's final advice to the House of Representatives

Presentation will likely be accompanied by a statement welcoming the Commission's report and highlighting the process that will be followed over the coming months More detailed Q&As and indications of how the Government plans to respond to the Commission's advice may not be possible at this stage

TBC any media requirements with Minister's Office

Tues

8 June

TBC

Commission to make the following publicly available:

Final Report

Evidence report

Updated modelling assumptions

Information on submissions received and how CCC incorporated these

To confirm timing of website links going live on website and make live

To confirm during week of 24 May this is the material being publicly released – what else will be available 8 Jun?

And subsequently – what is the detail and timing of additional supporting materials and their availability for:

* Public release
* Availability to Officials

Yes - agree Commission will make this publicly available as well as clarity on when further releases (eg subs and model surce code) will be available

14-20 June

Parliamentary recess

23 June

Climate Response Ministers Group meeting

****

****

From: s 9(2)(a)
To:
Cc:
Subject: RE: Collating questions
Date: Tuesday, 1 June 2021 2:46:06 pm
Attachments: image001.png

Kia ora s 9(2)(a)

Thank you for your email, sounds like you have a good plan speaking with agencies where they need more info.

I'll check in on our MFE team to see where they may need a deeper dive and into what topics and I'll help co-ordinate.

Ngā mihi

s 9(2)(a)

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Tuesday, 1 June 2021 2:42 pm
To: s 9(2)(a) @mfe.govt.nz>
Cc: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) s 9(2)(a) @climatecommission.govt.nz>
Subject: Collating questions

Hi s 9(2)(a)

We had a brief discussion today about how to get questions from Ministries over to us so we can help answer them speedily. We are happy to do this in whatever way is easiest. We are arranging meetings with Ministries where these have been requested, but if there is a prepared list already (?) or post-today please let me know. It may well be faster for me to arrange the right person from our end to pick up the phone to answer someone's question rather than doing everything in writing.

s 9(2)(a)

s 9(2)(a)

W climatecommission.govt.nz

s 9(2)(a)

From: s 9(2)(a) @mfe.govt.nz>
Sent: Wednesday, 7 April 2021 11:09 am
To: s 9(2)(a)
Subject: FW: copy of your paper on ethical choices
Attachments: Dooley et al 2021 Ethics quantifying fair shares.pdf

The attached paper may be of interest. Quoting from its conclusions/recommendations:

"Do not claim value neutrality. As there is no ethically neutral position in the climate context, pretending to be value-free obscures unconscious biases under a veneer of neutrality, particularly in quantitative modelling. Analysis may be rigorous, replicable and systematic, but it should also explicitly outline normative assumptions and values within the specific political landscape of climate equity debates[62]. Transparency about values enables all users to place the analysis in the context of other work and evaluate it accordingly."

From: s 9(2)(a) @uct.ac.za>
Sent: Tuesday, 6 April 2021 7:21 pm
To: s 9(2)(a) @mfe.govt.nz>
Cc: s 9(2)(a) @climate-energy-college.org>
Subject: Re: copy of your paper on ethical choices

Hi s 9(2)(a)

Thanks for the interest – here you go! While writing – very much liked the Comment that you co-authored with s 9(2)(a) on net zero, and that one of the things to 'fix' is how fairness is treated. Am increasingly thinking we need to talk of a 'just transition to net zero', not focus (only) on which year a country announces.

Am copying s 9(2)(a) who was the first author. If you have any comments, including critical ones, please do let us know.

Keep well,
s 9(2)(a)

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nature climate change

PERSPECTIVE

https://doi.org/10.1038/s41558-021-01015-8

Ethical choices behind quantifications of fair contributions under the Paris Agreement

Kate Dooley[1]✉, Christian Holz[2,3], Sivan Kartha[4], Sonja Klinsky[5], Timmons J. Roberts[6], Henry Shue[7], Harald Winkler[8], Tom Athanasiou[3], Simon Caney[9], Elizabeth Cripps[10], Navroz K. Dubash[11], Galen Hall[6], Paul G. Harris[12], Bård Lahn[13], Darrel Moellendorf[14,15], Benito Müller[16], Ambuj Sagar[17] and Peter Singer[18]

The Parties to the UNFCCC and Paris Agreement agreed to act on the basis of equity to protect the climate system. Equitable effort sharing is an irreducibly normative matter, yet some influential studies have sought to create quantitative indicators of equitable effort that claim to be value-neutral (despite evident biases). Many of these studies fail to clarify the ethical principles underlying their indicators, some mislabel approaches that favour wealthy nations as 'equity approaches' and some combine contradictory indicators into composites we call derivative benchmarks. This Perspective reviews influential climate effort-sharing assessments and presents guidelines for developing and adjudicating policy-relevant (but not ethically neutral) equity research.

All 197 nations agreed to the core principle of the 1992 UNFCCC that nations would act to "protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities" (Article 3.1)[1]. The language has persisted: 189 of those countries have ratified the 2015 Paris Agreement, which included nearly identical wording and reaffirmed that "this Agreement… aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty" (Article 2.1) and to do so "on the basis of equity" (Article 4.1)[2]. Every five years, countries are expected by the Paris rules to explain how their planned efforts are fair, to respect equity and enable ambition.

Arguably, the primary reason to integrate equitable effort sharing in the climate convention is to enable countries to protect their most vulnerable residents and promote sustainable development while facilitating an ambitious international climate mobilization. A series of studies, as well as the IPCC, have evaluated a range of quantitative approaches for assessing equitable and adequate mitigation efforts. Here we consider a number of those studies that profess, either explicitly or implicitly, to provide impartial or 'value-neutral' assessments.

The idea that an equity assessment of countries' efforts can be value-neutral is invariably premised on the assertion that the assessment is based on an impartially assembled and suitably diverse set of equity approaches. It presumes that a comprehensive ensemble of approaches, or an appropriately representative sample of approaches, is unbiased, and that further quantitative analysis is also unbiased, yielding results that can serve as impartial inputs to a political process[3,4]. We argue that such analyses of 'all relevant equity perspectives' place a value-neutral gloss over deeply contested and irreducibly normative perspectives. This is exacerbated in cases where the quantitative analysis distils and aggregates the various equity approaches into a single indicator, such as an overall score of 'fairness'.

Any form of action (or inaction) on climate change necessarily imposes burdens on some while conferring benefits on others, so any form of policy-making entails normative choices. Scholars debate how political decision processes might best be supported[5,6]. In this Perspective, we argue that approaches presented as value-neutral represent a technocratization of what is ultimately a political debate. We evaluate a selection of recent effort-sharing studies to determine whether they purport to be value-neutral or are explicit about the ethical choices underlying their analysis. To do this, we first sketch the moral bases for equity in the international climate regime. We then review which effort-sharing approaches are considered in recent studies, how they are treated and how they compare with the full range of equity viewpoints relevant to effort sharing. We propose a way forwards that emphasizes transparency in communicating the ethical underpinnings of assessments of climate action and suggest guidelines for developing policy-relevant—but not ethically neutral—equity research.

Foundations of equity in the climate regime

During the climate regime's 30-year history, equity reasoning has been based on three foundations: protecting the most vulnerable,

[1]Climate & Energy College, University of Melbourne, Melbourne, Victoria, Australia. [2]Department of Geography and Environmental Studies, Carleton University, Ottawa, Ontario, Canada. [3]Climate Equity Reference Project, Berkeley, CA, USA. [4]Stockholm Environment Institute, Boston, MA, USA. [5]School of Sustainability, College of Global Futures, Arizona State University, Tempe, AZ, USA. [6]Institute at Brown for Environment and Society, Brown University, Providence, RI, USA. [7]Centre for International Studies, University of Oxford, Oxford, UK. [8]Faculty of Engineering and the Built Environment, African Climate and Development Initiative, University of Cape Town, Cape Town, South Africa. [9]Department of Politics and International Studies, University of Warwick, Coventry, UK. [10]Politics and International Relations, University of Edinburgh, Edinburgh, UK. [11]Centre for Policy Research, New Delhi, India. [12]Department of Social Sciences, Education University of Hong Kong, Tai Po, Hong Kong. [13]CICERO Center for International Climate Research, Oslo, Norway. [14]International Political Theory and Philosophy, Goethe University, Frankfurt, Germany. [15]Department of Philosophy, University of Johannesburg, Johannesburg, South Africa. [16]University of Oxford, Oxford, UK. [17]School of Public Policy, Indian Institute of Technology Delhi, New Delhi, India. [18]University Center for Human Values, Princeton University, Princeton, NJ, USA. ✉e-mail: kate.dooley@unimelb.edu.au

guaranteeing sustainable development and encouraging greater ambition by states with greater capability. Equity and justice are essential for effective international cooperation[7]. Therefore, assessment of adequate action on climate must reflect core principles of equity and justice in ways that inform and facilitate political debate. Although concerns of equity and climate justice (which we treat interchangeably) are much broader than nation states and include individuals and corporations among others, the Parties to the UNFCCC and its Paris Agreement are countries, and they should be held accountable for their actions[8,9].

At the core of equitable climate action is a mandate to protect the vulnerable against deprivation. Powerful parties routinely promote their own interests, but vulnerable parties frequently cannot. Principles of equity include guarantees designed to provide security for the vulnerable. Such guarantees are reflected in early calls to distinguish "the 'survival emissions' of the poor" from "the 'luxury emissions' of the rich" and to protect the former under all schemes for reducing total global emissions[10]. The UNFCCC emphasizes the protection of the most vulnerable through several provisions, including the commitment that "the Parties have a right to, and should, promote sustainable development" (Article 3.4)[1].

Article 3.1 of the UNFCCC[1], as noted above, is another acknowledgement that not all countries can afford to be equally ambitious. The acknowledgement that responsibilities are differentiated protects the vulnerable because respective capabilities are unequal.

Although survival and promotion of sustainable development represent different levels of guarantee for the most vulnerable, they both rest on a core principle of climate justice: that, at the very least, the urgent, basic needs of poor people and poor countries ought to be secured against the effects of climate change and of measures taken to limit it[11]. Sustainable development was introduced as a purposefully vague term, utilized to garner consent but always guaranteeing a floor of human well-being[12]. Indeed, the capabilities approach—used as the basis for the human development index and central in the sustainable development goals—is built on the explicit recognition of the inherently multifaceted nature of human well-being. From this perspective, multiple capabilities are required for the very notion of human freedom[13].

Any set of principles for equity in climate action that does not protect the vulnerable by recognizing differentiated responsibility due to different capabilities ignores both the actual history and a fundamental purpose of including equity in the assessment of climate action[14]. It also raises pointed questions about equity analyses in which approaches that run contrary to this core concern, such as grandfathering or cost optimization, are treated as foundational elements.

Grandfathering has been interpreted by some as the burden-sharing basis of emissions reductions in the 1997 Kyoto Protocol, since developed nations agreed to emissions entitlements proportional to their current emissions. These mitigation commitments might be considered an example of an instrumental use of grandfathering. This approach cannot be considered an acceptable principle for equity in the global climate context, and ought not be presented as such in analyses. Studies including grandfathering, often presented implicitly as 'staged approaches', reward Parties with permissions to emit in the short term in proportion to their past emissions. Although grandfathering is advocated by some for purely pragmatic reasons, to consider it as a principle of equity is morally perverse[15].

In a global context characterized by vast imbalances of political power and material wealth, grandfathering directly contradicts the ethical imperative to protect the most vulnerable. It is also diametrically at odds with another principle: that the polluter should pay. The protection of the most vulnerable requires rapid and transformative climate action, led and paid for by those with the most responsibility and resources (capacity); grandfathering would significantly slow such action[16]. We find little support among moral and political philosophers for any moral principle that justifies grandfathering, and indeed many philosophers have disavowed it[17–20]. The term was first coined in the post-civil-war United States in the context of racist and sexist laws intended to undermine any equal right to vote[21]. The parallel to the contemporary use of the term in the climate discourse is striking, as both uses serve to justify the perpetuation of an unjust allocation of rights on the basis of the previous unjust allocation of the same rights.

Quantified approaches also often implicitly assume that cost optimization is neutral, requiring no ethical justification. Imposing the same least-cost solution in a highly unequal world, however, is inherently unjust. An equal distribution to parties starting out with different capacities, different needs and vulnerabilities or different responsibility for the problem does not yield an equitable result.

Equity principles

Commonly used equity principles, in part because of their resonance with common but differentiated responsibilities and respective capacities, include need, responsibility, capacity and equality. We draw on an extensive normative literature to sketch the bases of these principles here. The full range of equity considerations is much broader, as shown in a recent systematic overview of the normative aspects of climate justice[22].

In determining a party's equitable contribution to addressing climate change, need takes account of the requirements for sustainable development and poverty eradication. For example, an agreement can exempt the poorest from contributing to climate action because meeting their basic needs has moral priority. This commitment to enabling the least advantaged to meet their needs can be derived from a number of different philosophical traditions, including those that affirm basic rights to socio-economic goods[23], utilitarian arguments[24], social contract arguments[25] and global egalitarianism[26]. Although these traditions reach different conclusions on the ideally best world and employ different concepts (some appealing to rights and others emphasizing the promotion of welfare), they all give paramount importance to enabling the world's poorest to meet their needs[27].

Responsibility connects parties' obligations in addressing climate change to the degree to which they have caused it. It is a widely shared principle of justice that agents can be held responsible for their actions and thus for the harmful consequences of their choices and policies.

Capacity reflects the principle that those who can afford to contribute more than others towards solving the climate problem should do so. Those with the greatest financial resources to bear a larger proportion of costs towards implementing a shared goal can reasonably be asked to bear them. Because capacity is an exclusively forward-looking indicator of equity, capacity should be utilized along with others that, like responsibility, are partly backward-looking.

Equality reflects the principle that each human being has equal worth and therefore ought to have equal rights. Concrete interpretations are, admittedly, contentious. One interpretation of equality requires those in equal positions to contribute equally to addressing the problem. A more common approach is to affirm an equal right to emit GHGs, often employed as an equal-per-capita (EPC) indicator starting from current emissions in each nation[28,29]. This view encounters a number of problems. EPC emission rights ignore the inequalities in people's needs, their level of development, internal economic stratification and access to other sources of energy. Emission rights matter to people only insofar as they serve important human interests. It is a mistake, then, to focus on the distribution of emissions rather than the distribution of what really matters to people: their capacity to meet their needs and pursue their goals in life[20,30]. Moral equality and an equal ability to lead decent lives is

important, but equality without consideration of unequal needs and vulnerabilities, unequal capacities and unequal responsibility leads to equality for unequals, which philosophers since Aristotle have condemned as gross inequity[31].

Some competing principles can be usefully combined in the pursuit of an overarching goal such as a fully lived life by splitting the difference or assigning 50% weight to each of two (that is: work and family, safety and excitement, responsibility and capability). Other principles, however, are directly contradictory, and attempts to include both in a composite index turn the composite into nonsense. This is the case when a principle affirming a guarantee that the vulnerable should be able to attain a decent minimum standard of living is combined with grandfathering, which guarantees existing advantages for the wealthy and in practice denies the vulnerable the resources to meet their basic needs. Here, no meaningful middle ground is available.

Approaches to quantification of fair shares

There is a rapidly growing body of scholarship examining other equity dimensions of climate change, including vulnerability and adaptation[32], fossil fuel extraction[33], loss and damage[34], accounting metrics[35] and climate modelling[36]. Here we focus on equity studies that attempt to quantify effort sharing among nations in mitigation. We reviewed 16 studies that quantify the equitable effort sharing of a country or group of countries under the UNFCCC and its Paris Agreement.

Without space for a comprehensive literature review, we have chosen recent and influential studies that represent a diversity of approaches. We assessed this literature to identify the different claims to authority made, the equity perspectives and other allocation approaches incorporated, and how these are combined. Of the selection of studies evaluated, we find that nearly two-thirds (ten studies) present as neutral or value-free, while six studies are explicit about their application of effort-sharing criteria and the ethical implications. The good news is that the recent papers tend to be more upfront about their normative assumptions, implying a shift from a perceived utility of presenting value-neutral analysis to policymakers, to presenting ethically explicit analysis that informs political debate.

Value-neutral approaches. We identified different ways that equity and effort-sharing frameworks tended to 'signal' that the approach utilized was neutral or value-free. These include: metastudies creating composite indicators and presenting them as value-neutral, studies including contradictory measures in one composite index, studies claiming to reflect the IPCC's full range of indicators and studies relying on grandfathering. Some studies take more than one of these problematic approaches.

Comprehensive approaches. A number of metastudies claim objectivity through the comparison of a comprehensive range of approaches to effort sharing, each based on different ethical or normative positions[37–42]. These are then synthesized into composite indicators or ranges that purportedly reflect all identified equity principles. Their aim is to offer an 'objective' assessment to avoid the fraught negotiations that typically attend efforts to arrive at an ethical or political consensus. These papers often use definitive language such as 'equitably determined' contributions or the 'relative fairness' of the nationally determined contributions[41] without conceding that any assessment is relative to the specific approaches adopted.

Many of these studies claim that their benchmarks or ranges are neutral and value-free because they derive from a supposedly comprehensive set of peer-reviewed quantitative models. However, benchmarks are highly sensitive to settings, such as the time horizon for historical emissions, temperature goals, exceedance probabilities and other factors. Sampling is often biased and parameter choices

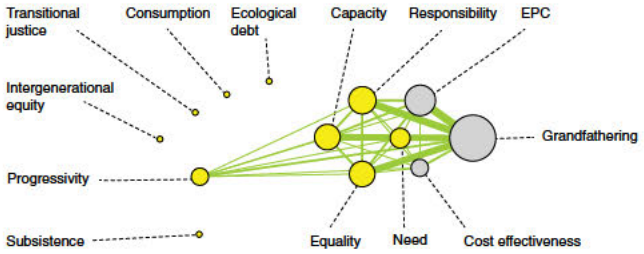

Fig. 1 | Equity principles included in studies presented as value-neutral. Coverage of equity perspectives is shown in yellow, and coverage of other allocation approaches is shown in grey. The size of the nodes represents the relative number of times each allocation principle is invoked. Green lines link approaches occurring in the same paper, and the thickness of the lines reflects the relative frequency of the link. Unlinked nodes are not utilized in any study reviewed.

are arbitrary or reflect implicit value judgements, with no reference to the underlying normative choices. The choice of parameters is far from comprehensive, and critically important variables are often excluded. This is illustrated in Fig. 1, where we can see that these studies cluster around a narrow set of equity perspectives.

These comprehensive approaches often include cost effectiveness as a value-free point of comparison[37–40], yet economic cost optimization is itself one normative choice that requires justification.

Contradictory composites. Other studies claim objectivity via reflecting a spectrum of equity approaches. But rather than aiming to represent all equity approaches, these studies choose a subset, commonly excluding need (a principle that reflects the right to sustainable development) in favour of variations of grandfathering and EPC allocation[38,39,41,43]. The goal of this strategy is to reflect a plurality of often contradictory equity approaches without having to achieve an ethical or political consensus.

The Climate Action Tracker[39,40] is a prominent example of such work, generating a 'fair share' range of emissions allowances for each country that is widely used by media, academia, civil society and governments to assess countries' mitigation ambition. This range is constructed from estimates in the literature as a way to avoid the ethically fraught process of "deciding on an approach to determine what is fair"[39]. For each country, a large number of studies are untransparently excluded from further analysis on grounds of being statistical outliers[39]. This approach excludes whole categories of ethical positions, while nonetheless claiming to represent the "spread of results across all these categories in the underlying studies"[39].

On the basis of its methodology, the Climate Action Tracker grades countries on a range from highly insufficient to role model, but in doing so mixes the incompatible indicators and ethical principles that underlie them.

Spanning the space. Other approaches to span the equity space include adopting extremes, such as equality and grandfathering, to ostensibly represent the spectrum of equity approaches[29,44], or conversely excluding numerical 'extremes', such as need and grandfathering, as statistical outliers[43]. These approaches leave out many important equity principles, including need and capacity, which are essential to protect the most vulnerable. Often, when equality is interpreted as EPC, they include no ethically sound principles at all[29,44]. Raupach et al.[29] introduced the concept of a 'blended approach' based on a spectrum of 'sharing principles' represented as EPC (termed equity) and grandfathering (termed inertia). Given that pure grandfathering would allow vulnerable countries little access to sustainable development, and EPC would pose high mitigation demands on developed countries, the authors concluded that

"a blend of these endpoints emerges as the most viable option"[29]. They do not say for whom blended approaches would be most viable, nor do they discuss their underlying ethical assumptions. This blended approach forms the basis for subsequent studies[45,46].

Appeal to IPCC authority. Some studies claim objectivity through presenting what they claim to be IPCC endorsed 'equity categories'. An influential paper[37] developed six categories of equity approaches, and the same authors took these categories into Chapter 6 ref. [47]) of the Working Group III contribution to the IPCC Fifth Assessment Report (AR5 WGIII)[48]. The six categories are based on one or more of the equity principles of capability, responsibility and equality, while need is included through combinations of approaches. Staged approaches are used, beginning with grandfathering, which is gradually phased out in favour of more equitable allocations. Subsequent studies suggest that these six categories are somehow endorsed by the IPCC[41,43,49]. One study references as its organizing framework the "IPCC categorization of over 40 studies", and signals the comprehensive nature of this categorization by referring to "the … concepts of equity"[41]. In fact, climate equity principles have been developed over many decades of scholarship, and other chapters in the same volume review that scholarship to reach quite different conclusions. Chapters 3 (ref. [50]) and 4 (ref. [51]) of AR5 WGIII provide a recent summary of some of this broader range of equity perspectives, including environmental justice and transitional justice, ecological debt, intergenerational equity, survival emissions, progressivity, prioritarianism and egalitarianism. In our view, the six categories of Chapter 6 (ref. [47]) "cannot be considered an authoritative and ethically robust taxonomy of equity approaches in any sense"[16].

Invoking grandfathering. The ten quantified studies reviewed that claim to be value-neutral commonly focus on a small subset of the available indicators for effort sharing (Fig. 1, see Supplementary Data 1 for details). Instead of presenting a comprehensive view of the equity landscape, these studies are dominated by inequitable approaches such as grandfathering and EPC.

Our analysis finds that grandfathering is most frequently and centrally invoked. The inclusion of blended or staged approaches (the latter shifting from grandfathered allocations to more just ones) introduces grandfathering into the other allocations to varying extents. This causes a systematic bias in favour of wealthier, higher-emitting countries. In some studies, nearly half of the remaining carbon budget is grandfathered[16]. With emissions needing to rapidly decline to near zero under the goals of the Paris Agreement, the dominance of grandfathering contradicts concern for the most vulnerable, undermines sustainable development and discourages ambition by the more capable.

Ethically explicit approaches. In contrast to effort-sharing frameworks that are presented as value-neutral, we found other quantified allocation approaches that are explicit about the ethical and moral implications of their underlying assumptions[46,52–56].

One study assessed national mitigation pledges relative to 'equity benchmarks' in which a range of effort-sharing parameters were combined and weighted in a deliberative stakeholder process to determine the most accepted range of specific expressions of the equity principles used[52]. The resulting effort-sharing framework adopts responsibility, capacity and right to development (need), all principles repeated in UNFCCC agreements. Other studies consider fairness in the distribution of mitigation effort in the context of a rapidly dwindling global carbon budget[53,54].

Other recent examples show deliberate and transparent ethical choices applied in national case studies. In approaches that calculate fair-share carbon budgets for Ireland[55], the UK and Sweden[54], the results suggest Paris Agreement-compliant emissions targets

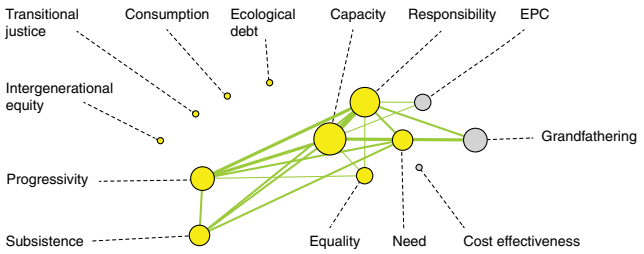

Fig. 2 | Equity principles included in studies presented as ethically explicit. Coverage of equity perspectives is shown in yellow, and coverage of other allocation approaches is shown in grey. The size of the nodes represents the relative number of times each allocation principle is invoked. Green lines link approaches occurring in the same paper, and the thickness of the lines reflects the relative frequency of the link. Unlinked nodes are not utilized in any study reviewed.

that are approximately twice as ambitious as current national policy positions. These papers acknowledge that the methods used "embody tacit ethical values and choices which can, and should, be the subject of wide societal discussion and critique"[55]. In explicitly distinguishing between emissions and allocations, the authors of one study propose a "pragmatic apportionment regime", where effort sharing is constrained on the basis of what is "still physically possible to deliver within a Paris-compliant global carbon budget"[54]. The authors acknowledge that such an approach "falls far short of an equitable sharing of the climate burden"[54].

The equity principles included in ethically explicit approaches incorporate the most commonly used principles of capacity and responsibility (Fig. 2, see Supplementary Data 1 for details). These approaches however, also cover a broader range of less frequently quantified perspectives, such as need, progressivity and subsistence emissions. Grandfathering is far less prominent in this group of studies, and is not combined with other principles.

Yet, across all of the quantitative effort-sharing frameworks we reviewed, the broader range of equity perspectives (as outlined in Chapters 3 (ref. [50]) and 4 (ref. [51]) of AR5 WGIII[48]) is not well represented, highlighting the limitations of the entire current body of literature concerned with quantified approaches. Indeed, the focus on core aspects of equity in the academic literature can be seen as a narrowing of the broader normative conceptions of climate and environmental justice[57].

Guidelines for research on equity in climate action

Fair shares indices, against which national pledges of action are ranked in ways that judge some nations to be leaders and others to be laggards, are central to climate diplomacy. They should be transparent about their ethical foundations. The processes of creating such indices are themselves rooted in the same power dynamics into which these products are intended to provide insight[58,59]. Central to climate and environmental justice conceptualized more broadly, and highlighted in political theory and justice studies, is an awareness that the way analyses are conducted can privilege some and marginalize others[57,60,61]. Grandfathering of emissions, in particular, should not be included in equity assessments of global climate action; it is not a defensible general principle of equity. Grandfathering undermines the foundations of climate equity reasoning by contradicting principles that aim to protect the vulnerable and promote sustainable development. It allows polluters to evade paying their due and discourages ambition.

Analyses that attempt to provide meaningful insight into the political process of navigating equity in the climate context therefore must accomplish at least three things. First, they must reflect the core principles of equity, which requires centring the needs of

the most vulnerable (in the context of sustainable development). Second, they must refrain from combining contradictory principles of equity into a purportedly neutral composite index. Third, analysis should inform, rather than supplant, the political process.

This leads to inevitable debates about how climate equity should be analysed and communicated as inputs into political processes. We propose several guidelines aimed at authors, editorial boards, the IPCC and other users of these analyses for adequately evaluating policy-relevant contributions about equity in an inherently political climate policy context:

- Do not claim value neutrality. As there is no ethically neutral position in the climate context, pretending to be value-free obscures unconscious biases under a veneer of neutrality, particularly in quantitative modelling. Analysis may be rigorous, replicable and systematic, but it should also explicitly outline normative assumptions and values within the specific political landscape of climate equity debates[62]. Transparency about values enables all users to place the analysis in the context of other work and evaluate it accordingly.
- Analysis needs to ensure that the losses of those who are potentially marginalized remain clearly visible. This requires explicit recognition that some forms of analyses are inaccessible to some audiences, and that extremely important dimensions of climate loss and vulnerability may be difficult to accommodate in quantitative analysis[36]. Recognition is central to climate justice and is frequently invoked in the language of those marginalized. Failing to acknowledge or normalizing losses of those who are most vulnerable would only heap further injustice on those who have historically been unseen and unheard, and who may have most to lose.
- Analytical work should aim to support inherently political processes. Technical analysis is not a substitute for political debate about inherently normative decisions. Instead, to facilitate negotiation, good-quality work will clarify differences in interests or ethical positions, identify key issues of divergence, suggest points of convergence and be explicit about its limitations.

Although we found that many studies did explicitly acknowledge the ethical underpinnings of their allocation frameworks while taking a range of different stances[52,54,55], many did not. Such acknowledgement should become standard practice for equity research to be grounded in the wider ethical literature and to meaningfully inform political debate. Reliance on quantification can systematically exclude loss of life, subsistence livelihoods, culture, spirituality and identity. Many of these losses are particularly pressing for those who are most vulnerable to climate impacts. At a minimum, the exclusion of such losses inherent in standard quantification, and the ethical implications of relying on these results to inform political debate, must be acknowledged.

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Author contributions

All authors contributed to the conception of the work. K.D., C.H., S. Kartha, S. Klinsky, H.S., T.R. and H.W. jointly wrote the paper. K.D., C.H., S. Kartha and G.H. contributed to the analysis and interpretation of data, including the figures. All authors contributed to discussions of revisions and improvements to this paper.

Competing interests

The authors declare no competing interests.

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Correspondence should be addressed to K.D.

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s 9(2)(a)

From: s 9(2)(a)
Sent: Friday, 23 April 2021 12:03 pm
To: s 9(2)(a)
Subject: FW s 9(2)(a) explanation of target accounting FW: Reporting and accounting of emissions from land-use and forestry
Attachments: Reporting and accounting of emissions from land-use and forestry.docx

Found it!

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Tuesday, 30 June 2020 10:00 am
To: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) s 9(2)(a) @climatecommission.govt.nz>
Subject: s 9(2)(a) explanation of target accounting FW: Reporting and accounting of emissions from land-use and forestry

Hi s 9(2)(a)

FYI – see attached doc from s 9(2)(a)

Sorry – I should have sent out the room update. For some reason I thought that you'd set up the meeting and it was your...

s 9(2)(a)

From: s 9(2)(a) @mfe.govt.nz>
Sent: Tuesday, 30 June 2020 9:41 am
To: s 9(2)(a) @climatecommission.govt.nz>
Subject: Reporting and accounting of emissions from land-use and forestry

Might be useful context? An internal document I drafted.

s 9(2)(a)

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Reporting and accounting of emissions from land-use and forestry

Summary

There are differences in the methods used to **report** and **account** for greenhouse gas emissions for land-use and forestry. The reason for the two approaches are to estimate what the atmosphere sees with regard to emissions and removals (reporting), and to create an incentive for behaviour change for reducing emissions (accounting).

Reporting and accounting of emissions

Reporting[1] of greenhouse gas emissions for land-use and forestry (also referred to as net emissions[2]) relates to **estimated emissions to and removals from the atmosphere**, with no exclusions or special rulesets. This means that emissions and removals from vegetation and soils across all forests and land-uses are included under reporting. This also means that historical activities in forests and on land can affect emissions and removals today and into the future. These activities include the historical harvesting of natural forests, with the subsequent regrowth of these forests that is occurring currently. Or the recent increase in harvesting of production forests that were planted from the 1920s onwards. Emissions from harvesting in particular are cyclical and create large inter-decadal peaks and troughs that can be difficult to manage if we were to account for them in our climate change targets. The impact of this can be seen in figure 1 below. This shows that emissions, driven mainly by harvesting of production forests, have increased as these forests have matured through time. This has resulted in decreasing removals from land-use and forestry since 1990. This trend is projected to reverse from the mid-2020s as harvest rates decrease and new planting from the One Billion Trees programme becomes established, resulting in increased removals.

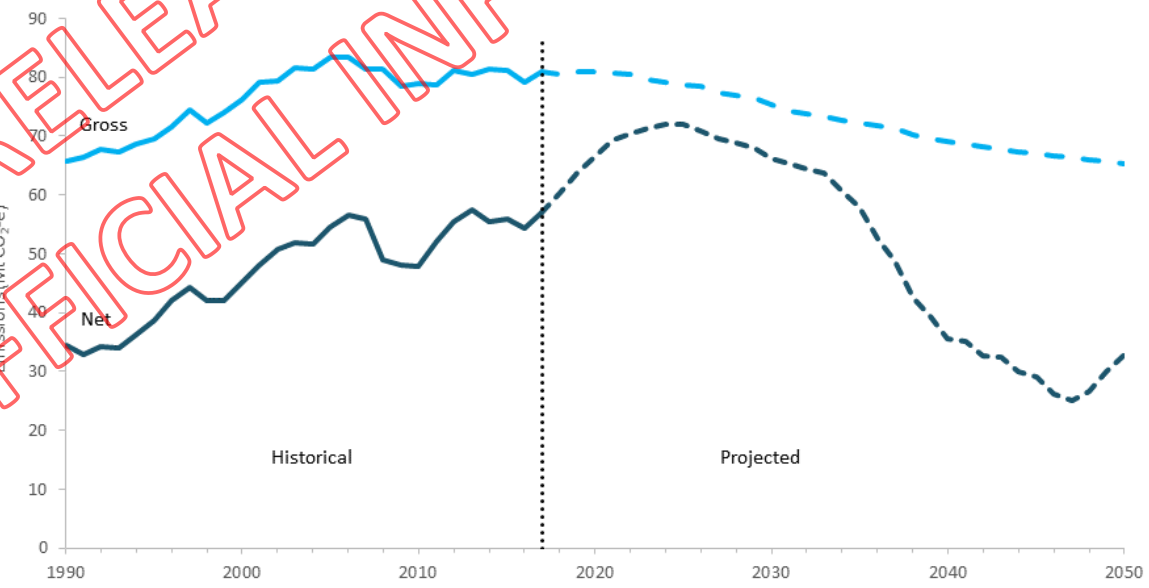

Figure 1: Gross and net emissions 1990 to 2050

[1] Referred to formally as reporting under the United Nations Framework Convention on Climate Change.
[2] Net emissions refers to gross emissions, and emissions and removals from land-use and forestry combined.

The methods we use for accounting of our greenhouse gas emissions from land-use and forestry for our climate change targets uses special rulesets. These rulesets are designed to provide an **incentive for behaviour change to reduce emissions** (e.g. reduced deforestation and increased afforestation). The rules largely factor out emissions and removals that are the result of historical actions that are difficult to influence or would have occurred anyway. These actions include the historical harvesting and subsequent regrowth of natural forests, and increases in the harvesting of production forests that were established since the 1920s. Target accounting removes these inter-decadal variations in emissions and removals and focuses on actions that reduce emissions over the long term. That means that only activities (e.g. afforestation and deforestation) since a base year (1990 in our case) are accounted for against our climate change targets.

Target accounting rulesets

Different target accounting rulesets for land-use and forestry are utilised for the three past, current and future emissions reductions targets. A simplified version of how these rulesets relate to emissions and removals in forests is shown in figure 2 below.

The accounting approach that New Zealand uses for its current target under the United Nations Framework Convention on Climate Change (for the period 2013 to 2020) is similar to the ruleset it used for accounting under the Kyoto Protocol's first commitment period (2008 to 2012). These rulesets include afforestation since 1990 and deforestation, while largely excluding emissions from pre-1990 forests[3]. These rulesets were internationally agreed by Parties to the Kyoto Protocol (including New Zealand) and New Zealand undergoes annual reviews of its greenhouse gas inventory for adherence to the rules.

The Paris Agreement target (as set out in New Zealand's first nationally determined contribution or NDC) utilises a modified version of the Kyoto Protocol approach for accounting of emissions and removals from land-use and forestry. This approach is referred to as averaging and it includes removals from afforestation up until the long-term average carbon stock is reached. Averaging limits removals compared to the Kyoto Protocol approach, but also excludes emissions from harvest as long as the forest is replanted. This approach provides a better incentive for afforestation by removing peaks and troughs associated with growth and harvest cycles in forests. The Paris Agreement target continues to account for deforestation and largely excludes emissions from pre-1990 forests.

The Paris Agreement ruleset for land-use and forestry is largely nationally determined (as allowed by the Agreement), but what countries do needs to be compatible with principles of transparency, environmental integrity and avoiding double counting. New Zealand's ruleset is similar to that of the European Union's approach and is based on existing guidance for the Kyoto Protocol and for reporting.

[3] Emissions and removals from pre-1990 forests are largely factored out by use of a business as usual reference level. Emission above and removals below this baseline that are the result of forest management or policy changes can be included in target accounting.

Land-use and forestry's contribution to New Zealand's climate change targets and the impact of using the three different accounting rulesets can be seen in figure 3 below.

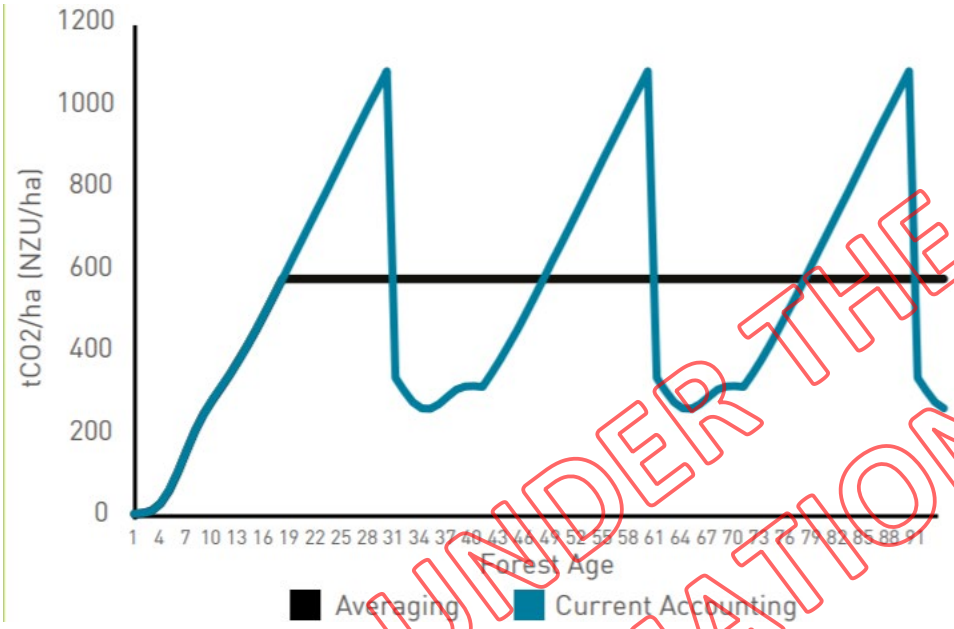

Figure 2: The current accounting method for afforestation using the Kyoto Protocol ruleset and averaging under the Paris Agreement

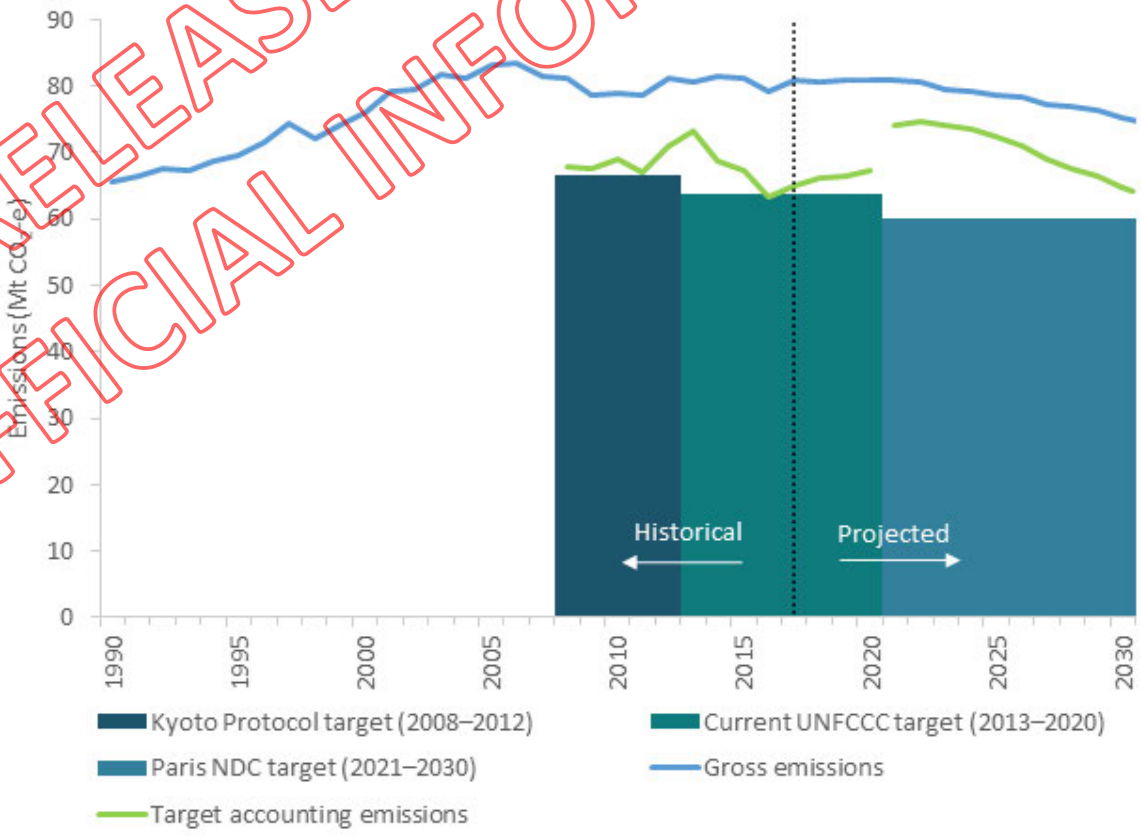

Figure 3: Gross emissions and target accounting emissions under the Kyoto Protocol and the Paris Agreement

Existing forests importance in mitigating climate change

New Zealand's forests offset 30 percent of gross emissions in 2017, despite net emissions increasing since 1990. It should also be recognised that pre-1990 forests (those largely factored out by accounting) are an enormous store of carbon, regardless of inter-decadal variations in removals. Our data estimates that all forests in New Zealand, the vast majority of which are pre-1990, currently store over 2000 million tonnes of carbon (the equivalent to over 7000 million tonnes of CO_2).

s 9(2)(a)

From: s 9(2)(a)
Sent: Tuesday, 1 June 2021 10:06 am
To: s 9(2)(a)
Cc: s 9(2)(a)
Subject: RE: [IN-CONFIDENCE] In-confidence: updated Commission Current Policy Reference baseline
Attachments: F gases data.xlsx; NZ NDC calculator 20210507-working.xlsx

[IN-CONFIDENCE]

H s 9(2)(a) all

As promised, here is the latest version of the NDC calculation sheet. I am planning to tidy it up a bit before publication but this is the version I have been using. It can do the comparator NDC budgets based on the IPCC pathways in either AR4 or AR5. It can also recalculate the current NDC based on AR5 GWPs.

To make the GWP conversion work I converted the past emissions of fluorinated gases into AR5. Although these figures were not used in the report, I have attached the workings from a separate sheet for your reference. It appears to be an exact match to the inventory data for AR4 aside from the extra fluorinated gases included for Tokelau which as far as I can tell were not estimated separately by gas (or at least those gas figures were not included in the CRF tables).

In my calculation of F-gas emissions under AR5, I have not attempted to convert Tokelau's emissions as they are not material – these have just been added in in the existing estimation. The results of the F-gas spreadsheet were then included in the NDC spreadsheet.

Cheers

s 9(2)(a)

He Pou a Rangi
Climate Change Commission
s 9(2)(a)
W climatecommission.govt.nz

[IN-CONFIDENCE]

From: s 9(2)(a)
Sent: Thursday, 27 May 2021 8:57 pm
To: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>
Cc: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @mfe.govt.nz>
Subject: RE: [IN-CONFIDENCE] In-confidence: updated Commission Current Policy Reference baseline

[IN-CONFIDENCE]

Yes it certainly will. While those figures won't be in the report I'm happy to send you my spreadsheet stepping through all the NDC calculations (including my assessment of the NDC budget under AR5) once final advice is out next week.

Cheers

s 9(2)(a)

[IN-CONFIDENCE]

From: s 9(2)(a) @mfe.govt.nz>
Sent: Thursday, 27 May 2021 3:41 pm
To: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>
Cc: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @mfe.govt.nz>
Subject: RE: [IN-CONFIDENCE] In-confidence: updated Commission Current Policy Reference baseline

Hi s 9(2)(a)

Thank you, good to know. Yes the % reductions won't be much different, but obviously the GWP will change the absolute budget number corresponding to the %.

Best
s 9(2)(a)

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Thursday, 27 May 2021 1:51 pm
To: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>
Cc: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @mfe.govt.nz>
Subject: RE: [IN-CONFIDENCE] In-confidence: updated Commission Current Policy Reference baseline

[IN-CONFIDENCE]

Hi s 9(2)(a) all

In the NDC chapter all our figures are in AR4 to be consistent with the budget chapters. As our quantitative recommendations on the NDC are wrt to the % reduction targets, which don't change when the calculation is done in AR5 (at least not to 2 sf) we haven't presented the figures in AR5 for the NDC.

Cheers

s 9(2)(a)

[IN-CONFIDENCE]

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Thursday, 27 May 2021 1:20 pm
To: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>

Cc: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @mfe.govt.nz>
Subject: RE: [IN-CONFIDENCE] In-confidence: updated Commission Current Policy Reference baseline

[IN-CONFIDENCE]

I'll have to pass to s 9(2)(a) to answer that one.

From: s 9(2)(a) @mfe.govt.nz>
Sent: Thursday, 27 May s 9(2)(a) Young <Paul.Young@climatecommission.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>
Cc: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @mfe.govt.nz>
Subject: RE: [IN-CONFIDENCE] In-confidence: updated Commission Current Policy Reference baseline

[IN-CONFIDENCE]

Thank you.

Is the same approach taken for the NDC advice?

s 9(2)(a)

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Thursday, 27 May 2021 12:53 pm
To: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>
Cc: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @mfe.govt.nz>
Subject: RE: [IN-CONFIDENCE] In-confidence: updated Commission Current Policy Reference baseline

[IN-CONFIDENCE]

Hi s 9(2)(a) and all,

In our final advice we convert the recommended budget levels to AR5 (as well as showing them in AR4), but all other numbers throughout our analysis are using AR4.

Hope that answers your question. Give me a call if not.

Cheers,
s 9(2)(a)

He Pou a Rangi
s 9(2)(a)
W climatecommission.govt.nz

From: s 9(2)(a) @mfe.govt.nz>
Sent: Thursday, 27 May 2021 12:29 pm
To: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>
Cc: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @mfe.govt.nz>
Subject: Fw: [IN-CONFIDENCE] In-confidence: updated Commission Current Policy Reference baseline

[IN-CONFIDENCE]

Hi s 9(2)(a)

Thank you for this - extremely helpful.

The Commission's draft advice said that the final advice would update for AR5 GWPs, but these baselines are still in AR4. Could you urgently clarify what GWPs the advice will use? If it will be AR5, do you have a version of this spreadsheet with AR5 GWPs?

Thank you,
s 9(2)(a)

From: s 9(2)(a) @climatecommission.govt.nz>
Sent: Wednesday, 26 May 2021 12:51 pm
To: s 9(2)(a) @mfe.govt.nz>; s 9(2)(a) @mbie.govt.nz>; s 9(2)(a) s 9(2)(a) @mbie.govt.nz>; s 9(2)(a) @mpi.govt.nz>; s 9(2)(a) @mpi.govt.nz)' s 9(2)(a) @mpi.govt.nz>; s 9(2)(a) @transport.govt.nz>; s 9(2)(a) @mfe.govt.nz>
Cc: s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>; s 9(2)(a) @climatecommission.govt.nz>
Subject: [IN-CONFIDENCE] In-confidence: updated Commission Current Policy Reference baseline

[IN-CONFIDENCE]

Dear Colleagues,

Thank you for your work over the last few months helping us to update and align our Current Policy Reference baseline with agency projections. Please see attached our CPR for final advice on emissions budgets 1-3.

We are sharing the CPR before formally presenting our advice to Ministers to allow agencies time to understand any remaining differences between the baselines.

We are happy for you to share this information with anybody else within your agency who needs to access it. **It should not be shared outside your agency until after the Minister for Climate Change has tabled the Commission's final advice in the House, and our report and data sets are published.**

As we are busy finalising the reports we will not have time to respond to any queries on this data until after our advice is handed to Ministers.

Thank you again for your help,

s 9(2)(a)

s 9(2)(a)

W climatecommission.govt.nz

[IN-CONFIDENCE]

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[IN-CONFIDENCE]

[IN-CONFIDENCE]

[IN-CONFIDENCE]

[IN-CONFIDENCE]

TABLE 10 EMISSION TRENDS
HFCs, PFCs, SF_6, and NF_3
(Sheet 5 of 6)

In entory 2019
Submission 2021 1
NEW ZEALAND

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year [1]	1990	1991	1992	1993	1994	1995	1996	1997
	(kt)								
Emissions of HFCs and PFCs - (kt CO_2 equivalent)	909.95	909.95	903.79	62.17	210.51	19 .08	177.80	3 1.92	295.9
Emissions of HFCs - (kt CO_2 equivalent)	NO NA	NO NA	NO NA	0.29	0.36	7.91	2 .52	62.9	9 .83
HFC-23	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA
HFC-32	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	0.00	0.00	0.00
HFC- 1	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC- 3-10mee	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-125	NO NA	NO NA	NO NA	NO NA	NO NA	0.00	0.00	0.00	0.01
HFC-13	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-13 a	NO NA	NO NA	NO NA	0.00	0.00	0.00	0.01	0.03	0.0
HFC-1 3	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-1 3a	NO NA	NO NA	NO NA	NO NA	NO NA	0.00	0.00	0.00	0.00
HFC-152	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-152a	NO NA	NO NA	NO NA	NO NA	NO NA	0.00	0.00	0.00	0.00
HFC-161	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-227ea	NO NA	NO NA	NO NA	NO NA	NO NA	0.00	0.00	0.00	0.00
HFC-236cb	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-236ea	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-236fa	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-2 5ca	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-2 5fa	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA
HFC-365mfc	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA
Unspecified mix of HFCs[4] - (kt CO_2 equi alent)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Emissions of PFCs - (kt CO_2 equivalent)	909.95	909.95	903.79	61.88	210.16	186.18	153.28	278.98	201.11
CF_4	0.11	0.11	0.10	0.05	0.02	0.02	0.02	0.03	0.02
C_2F_6	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
C_3F_8	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	0.00	0.00	0.00
C_4F_{10}	NA	NA	NA	NA	NA	NA	NA	NA	NA
$c-C_4F_8$	NA	NA	NA	NA	NA	NA	NA	NA	NA
C_5F_{12}	NA	NA	NA	NA	NA	NA	NA	NA	NA
C_6F_{14}	NA	NA	NA	NA	NA	NA	NA	NA	NA
$C_{10}F_{18}$	NA	NA	NA	NA	NA	NA	NA	NA	NA
$c-C_3F_6$	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unspecified mix of PFCs[4] - (kt CO_2 equi alent)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unspecified mix of HFCs and PFCs - (kt CO_2 equivalent)	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA
Emissions of SF_6 - (kt CO_2 equivalent)	19.97	19.97	20.86	21.91	22.69	23. 3	2 . 2	2 .65	25.58
SF_6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions of NF_3 - (kt CO_2 equivalent)	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA
NF_3	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
	(kt)										
Emissions of HFCs and PFCs - (kt CO_2 equivalent)	273.21	2 6.65	301.26	370.71	85.85	630 66	681 69	763 39	905. 1	955.23	1056.35
Emissions of HFCs - (kt CO_2 equivalent)	121.83	177.98	233.65	300.10	01.36	503 85	582 58	69 01	798 68	906.83	1010.89
HFC-23	NO NA	NO NA	NO NA	NO NA	0.00	0 00	NO NA	NO NA	0 00	NO NA	NO NA
HFC-32	0.00	0.00	0.00	0.00	0.00	0 00	0 01	0 01	0 01	0.01	0.02
HFC- 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC- 3-10mee	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-125	0.00	0.00	0.01	0.02	0.02	0 03	0 0	0 05	0 05	0.07	0.08
HFC-13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-13 a	0.06	0.08	0.11	0.13	0.17	0 20	0 21	0 2	0.26	0.27	0.29
HFC-1 3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-1 3a	0.01	0.01	0.01	0.01	0.02	0 03	0 03	0 0	0 05	0.06	0.07
HFC-152	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-152a	0.00	0.00	NO NA	0.00	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA
HFC-161	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0 00	0 00	0 00	0 00	0.00	0.00
HFC-236cb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-236ea	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-236fa	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-2 5ca	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFC-2 5fa	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	0 00	0 00	0 00	0.00	0.00
HFC-365mfc	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	0 00	0 00	0 00	0.00	0.00
Unspecified mix of HFCs[4] - (kt CO_2 equi alent)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Emissions of PFCs - (kt CO_2 equivalent)	151.38	68.67	67.61	70.61	8 . 8	126 81	99 12	69 38	106.73	8. 1	5. 7
CF_4	0.01	0.01	0.01	0.01	0 01	0 01	0 01	0 01	0.01	0.01	0.00
C_2F_6	0.00	0.00	0.00	0.00	0 00	0 00	0 00	0 00	0.00	0.00	0.00
C_3F_8	0.01	NO NA	NO NA	NO NA	0.00	0 00	0 00	NO NA	0 00	0.00	0.00
C_4F_{10}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
$c-C_4F_8$	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C_5F_{12}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C_6F_{14}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
$C_{10}F_{18}$	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
$c-C_3F_6$	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unspecified mix of PFCs[4] - (kt CO_2 equi alent)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unspecified mix of HFCs and PFCs - (kt CO_2 equivalent)	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA
Emissions of SF_6 - (kt CO_2 equivalent)	2 .86	2 .56	19.56	20.0	23.32	25 19	28 92	25. 1	21 05	19.87	19.3
SF_6	0.00	0.00	0.00	0.00	0 00	0 00	0 00	0 00	0.00	0.00	0.00
Emissions of NF_3 - (kt CO_2 equivalent)	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA
NF_3	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Change from base to latest reported year
	(kt)											%
Emissions of HFCs and PFCs - (kt CO_2 equivalent)	10 7.92	1100.87	1217.72	1278.02	13 0.69	1389.26	1 96.90	1622.53	1733.81	1913.0	1823.20	100.36
Emissions of HFCs - (kt CO_2 equivalent)	99 .06	1053.31	1182.57	1230.56	1292.56	1315.85	1 38.32	1573.8	1673.35	18 0.6	173 .06	100.00
HFC-23	NO NA	0.00	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	0.00	0.00	NO NA	0.00
HFC-32	0.02	0.02	0.0	0.0	0.0	0.05	0.06	0.08	0.10	0.13	0.1	100.00
HFC- 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
HFC- 3-10mee	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
HFC-125	0.08	0.09	0.10	0.11	0.12	0.12	0.1	0.16	0.18	0.21	0.21	100.00
HFC-13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
HFC-13 a	0.28	0.28	0.32	0.32	0.33	0.3	0.35	0.37	0.38	0. 0	0.39	100.00
HFC-1 3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
HFC-1 3a	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.08	100.00
HFC-152	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
HFC-152a	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	0.00	0.00	0.00	0.00	0.00	100.00
HFC-161	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-236cb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
HFC-236ea	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
HFC-236fa	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
HFC-2 5ca	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
HFC-2 5fa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-365mfc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Unspecified mix of HFCs[4] - (kt CO_2 equi alent)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
Emissions of PFCs - (kt CO_2 equivalent)	53.86	7.56	35.15	7. 6	8.13	73. 1	58.59	8.69	60. 6	72. 0	89.13	-90.20
CF_4	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-90. 8
C_2F_6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-88.52
C_3F_8	0.00	NO NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
C_4F_{10}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
$c-C_4F_8$	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
C_5F_{12}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
C_6F_{14}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
$C_{10}F_{18}$	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
$c-C_3F_6$	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
Unspecified mix of PFCs[4] - (kt CO_2 equi alent)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
Unspecified mix of HFCs and PFCs - (kt CO_2 equivalent)	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	0.00
Emissions of SF_6 - (kt CO_2 equivalent)	22.5	22.8	18.9	20.91	18.19	16.81	16. 7	17.37	1 .80	1 .71	15.71	-21.35
SF_6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-21.35
Emissions of NF_3 - (kt CO_2 equivalent)	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	0.00
NF_3	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	NO NA	0.00

Note All footnotes for this table are gi en at the end of the table on sheet 6.

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Tokelau HFCs (kt CO2-e)	0	0	0	0	0	0.003511365	0.008431372	0.015103052	0.019943148	0.024682274	0.029419744	0.033619274	0.04044049	0.054750076	0.06698815	0.071820555	0.07690128	0.081668568	0.09845809	0.115537426	0.132645384	0.149862831	0.168141765	0.182709288	0.195735248	0.208629196	0.22180862	0.234696404	0.234342944	0.234203339	0.234203339

Source Tokelau data https / en ironmen .go t.nz/publications/new-zealands-greenhouse-gas-in entory-1990-2019/ Sheet Time series emissions data by category retrie ed 5 May 2021

Error checks	*Flags here only check for compatibility with existing AR4 inventory data. Will be red flags when other GWP used.*																																
Exact matches	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Within rounding differences	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Error threshold (kt CO2-e pa, per category)																																	
0.000001																																	

	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
HFC-23	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0 3848	1.2284	#VALUE!	#VALUE!	7.4	#VALUE!	#VALUE!	#VALUE!	0.30636	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.5328	0.2664	#VALUE!
HFC-32	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.019506	0 082537728	0.117489016	0.273279	0.748794	1.062648	1.659753	2.422461	2.394629	4.07387	4.114866	6.438318	9.72483	12.56128	12 20247	16.75003	26.18063	26.10324	26.54152	30 59062362	39.72794827	51.34758	66.9517	85 03041	96.56194
HFC-41	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
HFC-43-10mee	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
HFC-125	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	3.65596	1.131161	11.15056066	18.03116077	11 87116	16.45276	29.64368	52 59668	67 3843	89.7721	126.9815	162 9938	190.2419	240.5916	276.215	275.2724	307.758	364.8379	389.21	408 5677	413.8885877	495 8152338	575.4282	636.6525	744.8165	719 5459
HFC-134	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
HFC-134a	#VALUE!	#VALUE!	#VALUE!	0 286	0 3575	3.339122	18 02054	41.33520454	61.79778298	80 36502	116.5055	155.5881	190.0971	244 9701	281.9717	299.6592	337 9071	364.6932	384.1651	419 3196	402.1248	403.3491	453.8799	463.8537	471 5935	484.1639423	505 5105267	522.4422	549.4526	571.8784	553.7403
HFC-143	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
HFC-143a	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.779926	5.035366	10 0903992	14.5536048	28.9023	43.60413	46.83407	55.0544	85.51314	127.6806	150.8415	187.6889	228.2828	270.4722	300.6249	302.2783	321.8873	329.8197	338.7516	372 5667	373.1247121	382.4445127	409.0091	403.8833	422.9846	348 0683
HFC-152	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
HFC-152a	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.0496	0.1488	0.0496	0.02976	0.0496	0 207477	#VALUE!	0.11284	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0 031	0.062	0.062	0 062	0.062
HFC-161	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
HFC-227ea	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.07728	0.15456	0 21735	0.28035735	0.343579	0.435991	0.485141	0.535824	0.634047	0.730796	0.825853	0 940784	1.0594	1.158801	1 285353	1.404259	1.767808	6.074507	10.47294	10.70425	10 81542398	11.21448084	11.13375	10.80161	10 27234	9.745804
HFC-236cb	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
HFC-236ea	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
HFC-236fa	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
HFC-245ca	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
HFC-245fa	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.082487	0.1891	0.307095	0.384572	0.470994	0.4082	0.59234	0.746204	0.886095	1 022868	1.411789534	1.609987696	2 066857	2.371455	2.641163	3 218608
HFC-365mfc	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.040494	0.09921	0.176149	0.230816	0 293986	0.239502	0.747947	0.866192	1.097722	1 369596	1.647125607	1.740726297	2.113318	2.41239	2.453215	2.88698
Total HFCs (kt CO2-e)	0	0	0	0 286	0 3575	7.901888	24 50993	62.92565212	94.81015491	121.8049	177.9547	233.6137	300.0566	401 3089	503.7783	582.5049	693 9338	798.5988	906.7279	1010.771	993.93	1053.159	1182.405	1230 375	1292.366	1315.642205	1438.094416	1573.603	1673.12	1840.405	1733 83
CF_4	780.629348	780.6293	775.6899	385 019	175.143	155.19	121 935	197.313	165.536	67.3229	57.1986	56.3857	58.8983	62 3716	92.375	75.378	57.7898	80 551	39.167	35 3981	43.5271	39.39609	29.2968	39 55741	40.10937	61.18293451	48.82743287	40.58122	50.38945	60 33907	74.28692
C_2F_6	129.32	129.32	128.1	76.86	35.014	30.988	24 278	39.284	33.062	13.42	11.468	11.224	11.712	12.444	18.544	15.128	11 59	15 982	7.808	7.076	8.662	8.16546	5.853162	7.902429	8 013765	12 22473443	9.755440477	8.107456	10.06549	12 05383	14.84068
C_3F_8	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	7 064	42.384	2.50772	70.64	#VALUE!	#VALUE!	#VALUE!	9.66885	15.894	8.60925	#VALUE!	10.19865	1.43046	2.99337	1.66887	#VALUE!	0.001766	0.001766	0 002119	0.0021192	0.00233995	0 002737	0.002781	0.003267	0 004018
C_4F_{10}	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
c-C_4F_8	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
C_5F_{12}	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
C_6F_{14}	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
$C_{10}F_{18}$	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
c-C_3F_6	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Sum PFCs here	909.949348	909.9493	903.7899	461 879	210.157	186.178	153 277	278.98	201.11	151.3829	68.6666	67.6097	70.6103	84.48445	126.813	99.11525	69 3798	106.7317	48.40546	45.46747	53 85797	47.56155	35.15173	47.46161	48.12525	73.4097881430920000	58.585213292696300000	48.69142	60.45772	72 39616	89.13161
SF_6	19.9728	19.9728	20.862	21.9051	22.69256	23.43046	24.41617	24.64745418	25.58456689	24.8574	24.56468	19.56415	20 03673	23.31738	25.18736	28.91584	25.41353	21 04587	19.87462	19.34122	22 53609	22.83751	18.93978	20 90516	18.19086	16 80668347	16.47045727	17.36885	14.79562	14.71466	15.70822

Calculated total HFCs includin	0	0	0	0 286	0 3575	7.905399	24 51836	62.94075518	94.83009806	121.8296	177.9841	233.6473	300.0971	401 3636	503.8453	582.5767	694 0107	798.6805	906.8263	1010.887	994.0627	1053.309	1182.573	1230 558	1292.562	1315 850834	1438.316225	1573.838	1673.355	1840.639	1734.064
CRF total HFC data	0	0	0	0 286	0 3575	7.905399	24 51836	62.94075518	94.83009806	121.8296	177.9841	233.6473	300.0971	401 3636	503.8453	582.5767	694 0107	798.6805	906.8263	1010.887	994.0627	1053.309	1182.573	1230 558	1292.562	1315 850834	1438.316225	1573.838	1673.355	1840.639	1734.064
HFC exact check	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
HFC difference	0	0	0	5 55E-17	0	5.9E-13	2.16E-11	9.35785E-12	5.52802E-12	3.15E-12	1.6E-11	1.05E-11	8.47E-12	2.25E-11	1.44E-11	2.1E-11	3.37E-11	2 96E-12	1.74E-11	2.84E-12	2.73E-11	3.43E-11	2.61E-11	1.5E-11	2.59E-11	2.18279E-11	3.93356E-11	2.02E-11	3.68E-11	7 96E-12	4.02E-11
HFC error check	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
PFC exact check	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
PFC difference	2.27374E-13	2.27E-13	0	0	0	0	0	5.68434E-14	2.84217E-14	0	0	0	0	0	0	0	0	0	7.11E-15	0	0	0	0	0	7.11E-15	3.66072E-11	3.6593E-11	0	0	0	1.42E-14
PFC error check	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
SF6 exact check	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
SF6 difference	0.00	0.00	0 00	0.00	0.00	0.00	0.00	0.00	0 00	0.00	0.00	0.00	0.00	0 00	0.00	0.00	0 00	0.00	0.00	0 00	0.00	0.00	0 00	0.00	0.00	0.00	0.00	0.00	0 00	0.00	0.00	0.00	0.00
SF6 error check	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE

Input selection

2

	1	2	3		
	SAR	AR4	AR5		Selected
Methane	21	25	28		25
Nitrous oxide	310	298	265		298
HFC-23	11700	14800	12400		14800
HFC-32	650	675	677		675
HFC-41	150		116		0
HFC-43-10mee	1300	1640	1650		1640
HFC-125	2800	3500	3170		3500
HFC-134	1000		1120		0
HFC-134a	1300	1430	1300		1430
HFC-143	300		328		0
HFC-143a	3800	4470	4800		4470
HFC-152			16		0
HFC-152a	140	124	138		124
HFC-161			4		0
HFC-227ea	2900	3220	3350		3220
HFC-236cb			1210		0
HFC-236ea			1330		0
HFC-236fa	6300	9810	8060		9810
HFC-245ca	560		716		0
HFC-245fa		1030	858		1030
HFC-365mfc		794	804		794
CF_4	6500	7390	6630		7390
C_2F_6	9200	12200	11100		12200
C_3F_8	7000	8830	8900		8830
C_4F_{10}	7000	8860	9200		8860
c-C_4F_8	8700	10300	9540		10300
C_5F_{12}	7500	9160	8550		9160
C_6F_{14}	7400	9300	7910		9300
$C_{10}F_{18}$		7500	7190	Noting tha	7500
c-C_3F_6			9200		0
SF_6	23900	22800	23500		22800

CO2 equivalent kt

Year	HFCs	PFCs	SF_6
1990	0.0000	909.9493	19.9728
1991	0.0000	903.7899	20.8620
1992	0.2860	461.8790	21.9051
1993	0.3575	210.1570	22.6926
1994	7.9054	186.1780	23.4305
1995	24.5184	153.2770	24.4162
1996	62.9408	278.9810	24.6475
1997	94.8301	201.1057	25.5846
1998	121.8296	151.3829	24.8574
1999	177.9841	68.6666	24.5647
2000	233.6473	67.6097	19.5642
2001	300.0971	70.6103	20.0367
2002	401.3636	84.4845	23.3174
2003	503.8453	126.8130	25.1874
2004	582.5767	99.1153	28.9158
2005	694.0107	69.3798	25.4135
2006	798.6805	106.7317	21.0459
2007	906.8263	48.4055	19.8746
2008	1,010.8868	45.4675	19.3412
2009	994.0627	53.8580	22.5361
2010	1,053.3088	47.5616	22.8375
2011	1,182.5732	35.1517	18.9398
2012	1,230.5580	47.4616	20.9052
2013	1,292.5618	48.1253	18.1909
2014	1,315.8508	73.4098	16.8067
2015	1,438.3162	58.5852	16.4705
2016	1,573.8376	48.6914	17.3689
2017	1,673.3546	60.4577	14.7956
2018	1,840.6392	72.3962	14.7147
2019	1,734.0640	89.1316	15.7082

In GWP AR4