GHG Metrics Guidelines

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Background

This document provides authors with guidelines on the reporting of emissions of different GHGs and the use of GHG emission metrics when their work involves dealing with gases other than CO_2. The amount of CO_2-equivalent emissions or abatement depends on the GHG emission metric adopted. This is parti1cularly true if the non-CO_2 gases in question have a lifetime of less than about 50 years. Therefore, the choice of the GHG metric can have a significant effect on conclusions. In addition, climate outcomes are ambiguous when emissions or abatement are stated only in terms of CO_2-equivalence rather than individual gases.

To reduce such problems in the WGIII report and increase transparency, the guidance in this document requests authors, where practical, to:

- Be clear whether you mean CO_2 only, CO_2-equivalent, or specific non-CO_2 gases whenever you refer to "CO_2" or "GHG" or "emissions/abatement" in general terms
- Report emissions/abatement of individual gases in their native units (i.e. Mt CH_4, kt N_2O, or percentage changes of emissions of those gases) where possible, especially where non-CO_2 emissions comprise a significant portion of the total. Where necessary, report CO_2-equivalent emissions *in addition to*, not *instead of,* individual gases.
- Where reporting of aggregate (CO_2-equivalent) emissions/abatement is considered by the authors to be necessary for policy-relevance, aim to use a consistent GHG metric as outlined below to ensure consistency across chapters and WGs.

It is recognised that using a single consistent GHG metric, and reporting emissions or abatement of individual gases in addition to CO_2-eq, may not always be possible and depends on the underlying literature. Some literature reports emissions/abatement of individual gases and then aggregates those into CO_2-eq (in which case it is relatively easy to state emissions of individual gases and to re-calculate CO_2-eq emissions using a single consistent metric), whereas other literature reports *only* CO_2-eq (often without even specifying the GHG metric).

GHG metric

The adopted GHG emission metric for the contribution of WG III to AR6 is GWP100, the values of which are based on the WG I SOD draft to AR6. The reasons for this choice are several:

- We want to increase consistency across Working Groups, so for the first time in IPCC history we would have WGIII use the same GWP values that have been assessed by WGI in the same assessment cycle.
- The Paris rule book requires countries to report emissions using GWP100 (from the AR5 initially, or a later report as agreed by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement), but they may in addition also use other metrics to report supplemental information on aggregate emissions and removals of GHGs.
- The draft assessment by WGIII (Box 2.2 in the FOD, to be revised in the SOD) shows that GWP with a fixed time horizon approximates the Global Damage Potential, i.e. the notion that each emission of a non-CO2 forcer at any point in time should be weighted by the marginal economic damages from this emission, relative to the marginal damages from emitting a unit mass of CO2. Based on social discount rates of 3-5%, such as those used in many integrated assessment models, the use of GWP100 would also approximate the cost-effective allocation of resources towards the abatement of different gases, in particular methane, in global emission pathways that limit warming to 2°C and below.[1]

Note that emissions and abatement potentials in the literature that are expressed in CO_2-eq will generally have used GWP100 from the SAR to the AR5. The weighting given to methane emissions in particular has changed markedly for those metrics: 1 tonne of methane represents 21 tonnes CO_2-eq emission if the SAR GWP100 is used, but 28 or even 34 tonnes CO_2-eq emission based on AR5 GWP100.

The AR6 GWP100 values table can be found in the **Appendix** below. These values might undergo small changes during the writing of WGI FGD and hence we are proposing the below specific steps in implementing this metric.[2]

[1] Other metric options exist and those could serve other policy goals better than GWP, but to promote consistency within the WGIII report we have to settle on one single GHG emission metric where authors chose to report aggregate emissions and abatement. For the above reasons we consider GWP100 to be a defensible choice. Chapters with large shares of short-lived non-CO2 emissions are encouraged to cross-reference the discussion of metrics in Box 2.2, and (where supported by literature) to consider how and why their conclusions might differ if a different metric to aggregate emissions would be used.

[2] The Appendix provides two GWP100 values for methane depending on the methane source. Biogenic

Steps in implementing the GHG metric

To ensure full yet flexible implementation of the metric, we ask you to follow these steps:

1- Consider whether the total contribution from non-CO_2 gases, especially methane or short-lived HFCs to total emissions and/or abatement options is greater than a few percent (when quantified using GWP100); or if some mitigation options target only a specific short-lived non-CO_2 gas (e.g. within the energy sector, some mitigation options target only fugitive methane emissions). If not, or if it is impossible to disentangle individual gases or different GHG metrics used in different studies, your chapter might simply include a short statement that reported CO_2-equivalent emissions are based on a range of GHG metrics used in the literature, and that the numbers you are reporting may be slightly different if GWP100 from the AR6 had been used – but that the difference would be small given the small (provide a quantitative estimate) contribution from non-CO_2 gases to the totals.

2- If non-CO_2 gases make a more significant contribution to emissions or abatement potentials that your chapter assesses (for totals or key sub-sectors), please do the following:

   a. Ensure that you have a spreadsheet set up by your chapter scientist, or whoever is responsible for these issues in your chapter, that disentangles the amount of emissions and abatement from non-CO_2 gases. This will allow you to report emissions and abatement by *individual gas by mass*, not just in CO_2-equivalents, as well as to switch to using the AR6 GWP100 values for CO_2-equivalents.[3]

   b. Wherever you report *high-level conclusions* expressed in CO_2-equivalents, please use the GWP100 value from WGI AR6 (provided in the **Appendix** below), using this spreadsheet (i.e. calculate emissions/abatement of the individual gases and then multiply those numbers by their AR6 GWP100 values to calculate CO_2-eq).

   c. Where possible for key conclusions (at the Executive Summary level), report emissions and abatement for individual gases as well as CO_2-equivalents

      i. e.g. if most of the increase in CO_2-equivalent emissions over a certain time period comes from increases in non-CO_2 emissions rather than CO_2, say so (and vice versa)

      ii. if you are unable to provide specific numbers for individual gases, at least provide an

methane has a lower value than fossil methane because the decay of fossil methane increases the total amount of CO2 in the atmosphere, which adds to the warming caused by methane itself. Emissions and abatement potentials for fugitive methane emissions from fossil fuel exploration and transport should therefore use, where possible, the GWP100 value for fossil methane if they are to be expressed in CO2-eq. Note that this does not apply for methane emitted from the incomplete combustion of fossil fuels since CO2 emissions from fossil fuel combustion reflect the total carbon content of the fuel.

[3] This will not be feasible for each individual paper; focus on high-level sectoral trends and key mitigation options/potentials.

qualitative indication of their contribution to the CO_2-eq total (e.g. “abatement potential is X tonnes CO_2-eq per year, with more than half of this in the form of methane”) .

For any advice or assistance, please contact Andy Reisinger (Andy.Reisinger@mfe.govt.nz) and Alaa Al Khourdajie (A.alkhourdajie@ipcc-wg3.ac.uk).

Appendix

Gas	GWP_100
CO2	1
CH4 (biogenic)	32
CH4 (fossil)	34.75
N2O	261
HFC-32	753
HFC-143a	5468
CF4	6651
C2F6	11734
C3F8	9512
C4F10	9661
C5F12	9156
C6F14	8340
C7F16	8251
c-C4F8	10255
HFC-125	3644
HFC-134a	1446
HFC-152a	160
HFC-227ea	3390
HFC-23	13422
HFC-236fa	8217
HFC-245fa	933
HFC-365mfc	853
HFC-43-10-mee	1591
SF6	25016