



Energy BOG Report

Joint 1st and 2nd IPCC Expert Meeting
on Short-Lived Climate Forcers (SLCFs)

Virtual sessions, 13-20 October 2021

Participants

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TFB members: Kiyoto Tanabe (Co-Chair), Dario Gomez, Rob Sturgiss, Fatma Betül Demirok, Riitta Pipatti, Thomas Wirth

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Highlights of energy cross-sectoral issues 1

- Tier 1 EFs for SLCF could be based on the approach for non-CO₂ GHG methodologies but would need to include additional details on fuel characteristics (e.g., S content) and abatement technologies applied (e.g., reduction efficiency and implementation rate)
- Methodologies for stationary combustion should allow the possibility of estimating emissions under co-firing practices and provide the corresponding guidance, including activity data collection, emission factors and other parameters
- PM_{2.5} is considered a SLCF, highly heterogeneous spatially and temporally (varying from positive to negative radiative forcing depending on sources and meteorological characteristics). The participants of this BOG decided to include primary PM_{2.5} in the list of emissions to be estimated not only because it is a SLCF but as an intermediate variable often needed to estimate BC and OC emissions (most BC and OC EFs are expressed as fraction of PM_{2.5}).

Highlights of energy cross-sectoral issues 2

- The IPCC methods for SLCFs should include small emissions sources and nonconventional/informal fuels. Combustion and abatement technologies guidance currently in IPCC categories for GHGs will therefore require additional analysis when developing SLCF guidance for these smaller sources and fuels. Critical aspects of developing SLCF methodologies for small emission sources include:
 - EFs vary by several of orders of magnitude as a function of appliances and abatement technologies for a given fuel type. Furthermore, cooking exhaust (meat cooking etc, not from fuel itself) could be considered as small-scale combustion sources for OC, BC, and PM2.5.
 - Emissions from informal combustion normally uses various types of fuels across the same year. This practice may be difficult to capture in an inventory. The AD of non-conventional fuels are often difficult to obtain and there are issues concerning the reconciliation of AD with the energy balance which may not contain nonconventional fuels.
 - Quality, type, and moisture content of solid fuels may have a large effect on emission factors. Many solid fuels are collected rather than marketed and estimates of activity data would benefit from diverse inputs.
 - Country-specific practices of one country are not always translatable to other countries therefore there is the need to develop country-specific EFs and parameters.

List of changes / knowledge gaps 1

- Category 1.A.1 Energy Industries
 - The co-firing of fuels could be a major contributor in this category
- Category 1.A.2 Manufacturing industries and construction
 - Small-scale combustion and use of nonconventional and variable fuels may occur under some facilities in particular for brickworks
 - Emissions arising from off-road and other mobile machinery in industry should, if possible, be broken out under the corresponding subcategory
 - The use of product produced as activity data instead of fuel used deserves attention for developing T1 factors and potential omission or double counting with IPPU sector should be considered

List of changes / knowledge gaps 2

- Category 1.A.3 Transport
 - For aviation sources LTO is critical for SLCFs so if only fuel based T1 approach is used the EF needs to reflect the whole LTO and cruise phase
 - For on road sources:
 - The time dependency of technologies is especially relevant for mobile source fleet, including that as technology ages it emits differently so EFs may vary over time and that the EFs and other parameters may need to be updated to reflect the evolving nature of future technologies
 - Engine start-up SLCF emissions may be large for high-mileage fleets, especially in developing countries
 - Super emitters might be a large portion of fleet emissions so may need to consider those in technology or EF development
 - It is expected that the distance travelled approach would be the appropriate AD to estimate SLCF emissions, however, it is convenient to have a fuel-based Tier 1 approach as a check
 - Include category 1.A.3.b.v “Evaporative emissions from vehicles” for SLCF and note any potential double counting with post meter estimates from fugitive emissions in Category 1.B.2
 - Include category 1.A.3.b.vi “Urea-based catalysts” there are some SLCF EFs for urea SCR vehicles available in the literature, failure of urea SCR systems also should be considered
 - Include a new category of “Non-exhaust emissions” from brake and tire wear for OC, BC etc. (maybe as fugitive) also important for EVs so EFs not just based on fuel use, there are globally applicable methodologies
 - Include a new category (or as new fuel use for existing categories?) for use of lubricants also note the need for a discussion on avoiding double counting with category 2.D.1 “Lubricant Use”, the contribution of lube oil is important for SLCFs (more so than GHGs)
 - Exclude distinction of 3-way catalysts, also the types of control could vary going forward so need to be forward looking and not mention specific technology

List of changes / knowledge gaps 3

- Category 1.A.3 Transport (cont.)
 - For waterborne sources:
 - IPCC factors and technology description for GHGs might be too simple for SLCFs especially for NO_x (e.g., new hybrid types of ships) so flag need to use new information
 - Add a new Tier 3 to the IPCC methodology for NO_x and particulates based on engine power (current GHG approaches does not have a T3 for this category)
 - For off-road sources:
 - Although the estimation methods for this subcategory are addressed under mobile combustion, off-road mobile combustion encompasses a wide variety of off-road vehicles and other machinery used across the different combustion categories, therefore, the SLCF methodology for SLCFs should be consistent with the wide spread distribution of off-road combustion across the different categories
 - Except for SO₂, the emissions of SLCFs are highly dependent on the type of equipment and technology so the EFs need to reflect that
 - Most alternative methodologies do not cover BC and OC emissions from these sources.
 - Guidance on the collection and/or estimation of AD is required as this may constitute the main challenge in estimating these emissions.
 - Include category 1.A.3.e.i “Pipeline transport” with all SLCF species for combustion related emissions from the operation of pump stations and maintenance of pipelines. Note: the EMEP methodology refers to the estimation of these emissions as that of small-scale combustion under category 1.A.4.

List of changes / knowledge gaps 4

- Category 1.A.4 Other Sectors
 - For this category especially there would be a diverse amount of small source combustion technologies and difficulties in collecting activity data on fuels which may not be marketed and therefore not included in traditional energy use data.
 - Age of technology and developing age dependent technology factors is especially important for this category
- Category 1.B.1 Fugitive emissions from Solid fuels
 - The category 1.B.1.a was expanded to include sub categories for underground and surface mines and within each category emissions from mining, post-mining activities and flaring and conversion of gas were included
 - For coal mining and handling, EFs for underground and surface mines should contain, if possible, the three level values provided for CH₄ EFs (e.g., EFS for low, average and high values)
 - Regarding cross cutting comment on consistency of tier definitions, the EMEP tier 2 approach provides information for SLCFs at a more aggregated level that is considered a tier 1 IPCC method for GHG
 - All SLCFs instead of just NMVOC were included. Mining and post-mining are not combustion sources so likely there aren't any NO_x or SO₂ emissions but leave to further scoping to define
 - For category 1.B.1.c There could be potential differences in emissions from commercial vs informal production so development of EFs would need to take that into consideration

List of changes / knowledge gaps 5

- Category 1.B.2 Fugitive emissions from Oil and natural gas
 - All SLCFs instead of just NMVOC were included. Non combustion sources will not likely have any NOx or SO2 emissions but leave to further scoping to define
 - The 2019 Refinement to the 2006 IPCC Guidelines provides tier 1 default emission factors for NMVOC for a number of technologies used under the different oil and natural gas subcategories. In addition, Annex 4A.2 to chapter 4, presents the percent of emissions that are leaked, vented, and flared in the data sets used for the Tier 1 emission factors. This disaggregation should be kept and, if possible, enriched for NMVOCs and considered for the other SLCFs, when applicable. It is expected that the IPCC SLCF methodology development for estimating NMVOC emissions for oil and natural gas would take as a starting point the detailed information already available in the 2019 Refinement.
 - If alternative methodologies are used for SLCF estimation, it is important to identify which types of emissions (leaks, venting or flaring) are estimated.
 - The category 1.B.2.a.vi “Other” was added with NMVOC to include leakage from the use of LPG in appliances. A methodology similar to that to estimate post-meter emissions from natural gas appliance may be developed for LPG.
 - For category 1.B.2.b.vi Gas post-meter, depending on the approach used to estimate emissions from road transportation especially evaporative emissions in category 1.A.3.b.v, checks for double counting of AD may be needed.
- Category 1.B.3 Other emissions from energy production
 - Add SO2 to potential SLCF emissions from geothermal activities. Some Parties (e.g., Iceland and Italy) already estimates and report SO2 emissions from geothermal power to the UNFCCC.
 - Not include (as suggested) categories for civil power generation facilities and combustion due to agriculture/livestock/fishery facilities as they are already covered in other categories

Other Issues Discussed

- For industrial sources, emissions of SO₂, PM, and NMVOCs are often due to a combination of fuel combustion, the materials that are processed, and emission control techniques. This poses a challenge for SLCF emission allocation between the Energy sector and the IPPU sector categories because in some cases the only data available are the sector fuel use or amount of industrial product created by the sector.
 - Conclusion was that this is the same as for GHG emissions from similar sources and there is already existing IPCC guidance on avoiding double counting across sectors (energy and IPPU) so the existing IPCC guidance on this for GHGs so would also apply to SLCFs
- Waste incineration Method/Activity data/Cross-sectoral: Fuel consumption is used as AD in J-STREAM method. In the 2006 IPCC Guidelines, amount of waste incinerated is used as AD. According to the 2006 IPCC Guidelines, emissions from waste burnt for energy are reported under the Energy Sector.
 - It was determined that the J-STREAM method should be consistent with the IPCC guidance and therefore nothing more was needed in terms of SLCF methodology consideration
- Cooking exhaust (J-STREAM) - Method: Times of meals multiplied by emissions (See the Waste sector compilation table).
 - During the discussions it was determined that the cooking category could be captured as part of the small scale emission methodology development discussion above as part of Category 1.A.4 Other Sectors.

Cross-cutting issues identified by the BOG

- Consistency of tiered-approaches between alternative methodologies and the IPCC approach
- Decision trees and the lack of key category analysis based on GWP
- Black carbon / Effective black carbon / Elemental carbon
- Organic carbon / Organic material
- Estimation of PM_{2.5} emissions
- Precursors of secondary organic aerosols.

Energy BOG

The screenshot shows a Zoom meeting interface with 21 participants. The top bar indicates 'Recording...' is active. The participants are arranged in a grid:

- Top row: IPCC TFI TSU (Valentyna Slivinska) (muted), Darío Gómez, Amit Garg (IIMA India), Leonidas Ntziachristos, Bundit (SIIT-TU).
- Second row: Luis Gerardo Ruiz Suárez, Michael Strogies, Yugo Kanaya, Naga Oshima, Aminata Mbow - Senegal.
- Third row: Toshihiko TAKEMURA, Vincent Camobreco, takeshi enoki, Kim Oanh Nguyen, Puji Lestari.
- Bottom row (larger tiles): IPCC TFI, Anouk Bass, Nathan Borgford-Parnell, Veronika Ginzburg, Vladislav Lytov.
- Bottom row (smaller tile): Nouredine Yassaa.

The bottom toolbar includes controls for Mute, Start Video, Security, Participants (21), Chat, Share Screen, Pause/Stop Recording, Breakout Rooms, Reactions, and a red Leave button.

BOG Report

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Any Questions?