***Call for input 2023 - development and assessment of mechanism methodologies*.**

Question 1:

A mechanism for crediting reductions in aerosol emissions is lacking in existing carbon market frameworks. This is largely owing to the fact that the widely adopted metric for normalizing emission reductions to CO_2 (i.e., global warming potential or GWP) is ill-suited to represent the radiative impacts of non-gaseous and short-lived pollutants. Defined as the time-integrated radiative forcing due to a pulse emission of a given component relative to a pulse emission of an equal mass of CO_2 [IPCC, AR5, Chapter 8], GWP does a particularly poor job of representing the radiative impacts of pollutants such as black carbon (BC) and organic carbon (OC). The primary reasons for this are as follows:

- Pollutants such as BC often have an indirect radiative impact through their influence on cloud life cycles, as well as upon deposition (e.g., when deposited on ice sheets, BC can affect surface albedo on a regional scale)
- Unlike gasses that are "well-mixed in the atmosphere," BC and OC are spatially variable with higher concentrations existing near pollution sources. This translates to regional variability in radiative forcing. Studies done by Rypdal et al. and Bond et al. both estimate this variability at "±30–40% for the direct effect, with the largest forcings typically found for emissions from regions located at low latitudes since there is more solar radiation available."
- While CO_2 resides in the atmosphere for centuries, the lifetime of BC and OC in the atmosphere is on the scales of days to weeks. As such, the model of comparing "pulse emissions" of pollutants is unrealistic for CO_2 and BC/OC. A more accurate approach involves comparison of a one off pulse of CO_2 emission to a *sustained step change* in BC or OC emission.

Building on this last point, alternative applications of GWP have been proposed to more accurately represent the climate change mitigation potential of BC and OC in carbon accounting frameworks (e.g., carbon markets, life cycle assessments, etc.) Specific approaches are described in Allen et al., 2016, Allen et al., 2018, and Lynch et al., 2020.

This is important because short-lived climate pollutants (SLCPs) have significant potential impacts on climate change during the next 20 years. Current policies and laws, according to the IPCC's most recent report, will very likely lead to increases greater than 2 degrees C during that time frame. Reducing SLCPs now will help ease the transition to policies, practices and technologies that reduce GHG emissions in the long term.

A key source of SLCPs is the burning of kerosene in single wick lamps. By updating the methodology, **AMS-III.AR: Substituting fossil fuel based lighting with LED/CFL lighting systems**, to include SLCPs we can more accurately account for the climate impacts and potentially drive more funding into the effort, thereby reducing the usage of kerosene lamps and reducing SLCPs (and carbon emissions).

There are still uncertainties including how to normalize GWP across different pollutants and time horizons, but based on the uncertainty bounds given by Bond et al. (2011), when we factor in both CO_2 and BC, the resulting range goes from 33.5kg of CO_2e up to 110.1kg per month per household. Taken on its own (without factoring in BC) switching a kerosene lamp with a solar lamp removes 3kg CO_2 per month. Even at the conservative end, this represents significant reductions in global warming pollutants.

Further data is needed to accurately estimate the current usage of kerosene lamps (the last study was conducted 10+ years ago), as well as the most accurate way to estimate the GWP of SLCPs. As such, we are working with 60 Decibels to conduct a baseline survey of kerosene lamp use, and in discussion with the Berkeley Air Monitoring Group to integrate approaches described in the referenced papers into carbon crediting infrastructure to accurately model GWP of these SLCPs. With this data, we believe that we can accurately and conservatively estimate the true climate benefits of transitioning from kerosene lamps to solar lamps.

Therefore we strongly encourage the UNFCCC to include a mechanism for crediting reductions in aerosol emissions in future carbon market frameworks. Crediting of BC could force investment in renewable energy infrastructure in contexts where it would not occur otherwise. According to Lighting Global/ESMAP, et all, up to 240 million people will be left behind by the current solar market. These are people in “last mile” communities who are most likely to use kerosene lamps and are the least likely to be able to afford to switch to solar.

Thank you for your time and consideration.

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