BRIEF ON BLACK CARBON POLICY FRAMEWORK

Background

Black carbon aerosol, also referred to as soot, is part of particulate matter $PM_{2.5}$ and a product of incomplete combustion of fossil fuels, wood and other biomass. It is either emitted from natural sources such as savanna/forest fires, volcanic eruptions and other geogenic releases, or from anthropogenic sources including from fuel combustion in transportation (e.g., diesel engines, including on-road and off-road vehicles and marine transport), some industrial facilities (e.g., brick kiln, small boilers and gas flaring), domestic cooking/heating/lighting (using biomass, coal or kerosene), and during open burning of forest/savanna (including burning of agricultural wastes).

Black carbon a climate forcing agent with a short lifetime in the atmosphere (a week or two), hence it is a short-lived climate pollutant (SLCP). It is nearly always emitted along with other co-pollutants (at varying proportions, depending on the combustion source) including sulphates, NOx, carbon monoxide, methane, non-methane volatile organic compounds, and particulate black carbon and organic carbon (OC), which includes brown carbon. Brown carbon, like black carbon, also absorb sunlight and cause warming; while organic carbon and sulphates are cooling agents. Hence, the overall warming effect of black carbon from any particular emission source will depend on the black carbon to co-pollutants ratio.

Apart from its climate warming effects, black carbon, organic carbon and other co-pollutants make up a significant part of fine particulate matter ($PM_{2.5}$), and therefore is a major cause of ill health and premature deaths globally. Because of the climate and health benefits associated with black carbon mitigation, actions on its mitigation has been a major discussion point in some policy arena. This brief attempts to review how black carbon is dealt with in current regulatory and policy frameworks.

Black Carbon Policies and Regulatory Frameworks

1. From regulatory viewpoint, black carbon belongs to both air pollution and climate change. Currently, there is no global agreement for regulating its emissions. At the EU level, black carbon is regulated as an air pollutant under the 2012 amendment to the Gothenburg Protocol, which requires a reduction in the emission of $PM_{2.5}$ including black carbon by 22% from 2005 levels in 2020. The Protocol specifically recommends that priority should be given to $PM_{2.5}$ sources with high black carbon fractions when implementing emission reduction activities.
2. The WHO, in 2014, developed an indoor air quality guideline which provide recommendation on best-practice for household fuel combustion in order to mitigate the health and climate impacts associated with emissions of $PM_{2.5}$. The guideline recommends that the emission rates of $PM_{2.5}$ from household fuel combustion should not exceed 0.23 and 0.80 mg/min in an unvented and vented source respectively.
3. Several countries have specific air quality regulations or standards with targeted limits for particulate matter emissions. A catalogue[1] of existing air quality policies was collated by UNEP in 2016 together with a synthesis of findings[2]
4. As a climate forcer, the Arctic Council's non-binding Framework for Action on Black Carbon and Methane is possibly the only black carbon regulatory example available. In the framework, Member States committed to "reducing the overall black carbon and methane emissions from their countries" and to "work with Arctic Council Observer States and others to also reduce emissions produced beyond the borders of Arctic States".
5. At the national level, several countries have pledged specific actions relevant to the reduction of SLCPs, including black carbon, in their Intended Nationally Determined Contributions (INDCs). Only Mexico, Chile and Nigeria specifically discussed black carbon mitigation in their submission with Mexico pledging an unconditional

[1] http://www.unep.org/transport/airquality/catalogue.asp#N
[2] http://www.unep.org/Transport/Airquality/AQ_GlobalReport_Summary.pdf

51% reduction in black carbon emissions by 2030, compared to business as usual situation, and increasing to up to 70% dependent on provision of support[3].

Black Carbon Emissions Measurement, Inventory and Reporting

6. Several reason make the compilation of a global black carbon inventory difficult including variable emissions from similar sources, different measurement techniques, different particulate matter size cut points used in measurements, as well as differing definition of black carbon itself used in inventory development. Examples of existing inventories in the literature include Cooke and Wilson (1996); Cofala et al (2007); Junker and Liousse (2008); Lamarque et al (2010); as well as the GAINS (2005) and EDGAR 4.1 inventory which were used in the UNEP/WMO Assessment.
7. Despite challenges in common methodologies and metrics to developing inventory and reporting them, there have been some advances in recent years. For example, the Convention on Long-range Transboundary Air Pollution (CLRTAP) of the United Nations Economic Commission for Europe (UNECE) has developed a new guideline for reporting emissions and projections data for air pollution, including particulate matter[4]. The guidance particularly encourage reporting on black carbon defined as "carbonaceous particulate matter that absorbs light" and includes an EMEP/EEA guidebook on methodologies for estimating black carbon emissions for different source categories[5]. Furthermore, the Commission for Environmental Cooperation (CEC) has recently developed a guideline (for US, Canada and Mexico) which include recommendations on methodologies for estimating black carbon emissions consistent with the IPCC and EMEP/EEA guidance by CLTRAP[6]. A black carbon emissions inventory,[7] as reported by the EU-28, was published in the EU emission inventory report 1990-2014.
8. The Arctic Council Framework for "Enhanced Black Carbon and Methane Emissions Reductions[8]" commits each Arctic State to submit national reports on emissions following guidelines provided in the framework, and invites Observer States to join. In response to the framework, all eight Arctic States and eight Observer States, and the EU have submitted their national reports to the Council[9].
9. The subcommittee on bulk liquids and gases of the International Maritime Organization (IMO), in response to the request from some Member States including United States, Norway and Sweden, has developed definitions, measurement methodologies and appropriate control measures to reduce the impact of black carbon from shipping[10].

Financing Black Carbon Mitigation Activities

10. There seems to be a shortage of finance for deploying technically feasible mitigation measures for black carbon despite its potential contribution in achieving climate, health and other developmental goals. According to the report[11] of the Black Carbon Finance Study Group (BCFSG) established by the Climate and Clean Air Coalition and facilitated by the World Bank, "black carbon abatement is today largely financed indirectly, in pursuit of other objectives; as a result, it is not being achieved on a wide scale in many parts of the world".
11. One reasons for inadequate funding is the lack of agreed metrics for accounting for black carbon mitigation benefits – there is currently no single metrics widely accepted by the science or policy community for accounting for the impacts of black carbon. The GWP have been applied to black carbon but with difficulty due to the significant differences in the lifetime of black carbon and carbon dioxide. Other metrics such as Specific Forcing Pulse[12]

[3] http://www.ccacoalition.org/en/resources/indc-slcp-summaries
[4] https://www.unece.org/fileadmin/DAM/env/documents/2015/AIR/EB/English.pdf
[5] http://www.eea.europa.eu/publications/emep-eea-guidebook-2016
[6] http://www.cec.org/our-work/projects/north-american-black-carbon-emissions-estimation-guidelines
[7] http://www.eea.europa.eu/publications/lrtap-emission-inventory-report-2016
[8] https://oaarchive.arctic-council.org/handle/11374/610?show=full
[9] https://oaarchive.arctic-council.org/handle/11374/1168 and https://oaarchive.arctic-council.org/handle/11374/1169
[10] http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/Air%20pollution/Black%20Carbon.pdf
[11] http://www.ccacoalition.org/en/resources/black-carbon-finance-study-group-report
[12] Specific Forcing Pulse is the amount of energy added to or removed from a receptor region in the Earth-atmosphere system by a chemical species, per mass of emission in a source region (See Bond et al., 2011).

designed explicitly for species that remain in the atmosphere for less than a year, have also been proposed for black carbon.

12. Another reason for inadequate funding is because the distinct characteristics of black carbon makes it difficult to replicate the financing approaches that are applicable to greenhouse gases. For example, the climate and health benefits from one ton of emitted black carbon in a specific sector at a given location may differ from another sector and location because of the differences in the BC/OC ratio and the sensitivity of different location, e.g., the arctic or Himalayas, to black carbon emissions, suggesting the need for a customization of black carbon finance for specific intervention within key sectors.
13. The BCFSG report indicates that some existing funds, including those related to clean energy, green cities as well as to climate and health mandates, are already in a position to finance businesses, activities, technologies, and policies that can curb black carbon emissions, and that several black carbon-rich sectors, e.g., residential cooking/heating and municipal transportation, are sufficiently mature to absorb finance. Indeed, the Global Alliance for Clean Cookstoves reported in 2014 that carbon finance was the top source of funding for cookstoves providing up to 36% of all reported finance compared to government grants at 25%[13]. The BCFSG report further identified four additional black carbon-rich sectors that offer strong potential for impact and action in the near to medium term including brick kiln, domestic lighting (replacing kerosene lamps), agriculture (averting residues burning) and oil and gas (eliminating gas flaring).
14. Another report[14] by the Scientific and Technical Advisory Panel (STAP) of the Global Environment Facility (GEF) recommends significant investments in accelerating the reduction of black carbon as this will directly support implementation of Sustainable Development Goals including in the areas of improved air quality, climate change mitigation, reduced climate vulnerability, and transfer of low-carbon technologies. The report specifically recommends the mainstreaming black carbon mitigation measures into GEF project portfolio; providing support for programs and projects that focus on black carbon emissions reduction; and measuring and reporting on avoided or reduced black carbon emissions as a result of GEF-funded projects.
15. It is important, however, to continue to verify that the anticipated climate and health benefits from black carbon financed projects, especially for cookstoves, are achieved. A recent study[15] of Clean Development Mechanism-approved stove replacements in India suggest that intervention stoves emits a higher proportion of black carbon than traditional stoves that were being replaced, highlighting the need for standards.

[13] http://newsroom.unfccc.int/financial-flows/carbon-finance-fueling-shift-to-clean-cookstoves/
[14] http://beta.thegef.org/sites/default/files/publications/Black-Carbon-Web-Single_1.pdf
[15] Aung et al., 2016. Health and Climate-Relevant Pollutant Concentrations from a Carbon-Finance Approved Cookstove Intervention in Rural India. Environ. Sci. Technol., 50 (13), pp 7228–7238