Fact Sheet No.4

Mitigating "Black Carbon" in Asia: An Opportunity for Co-benefits

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Introduction

Much of the climate change debate has focused on mitigating long-lived greenhouse gases (GHGs) to reduce global warming. But recently abating short-lived climate pollutants (SLCPs) such as black carbon (BC) has entered this debate. BC has a relatively short atmospheric lifetime during which it levels significant impacts on the climate, human health, crops, and ecosystems. Reducing emissions of BC can help limit the rate of increase in global temperature over the next two to four decades, while bringing immediate benefits for health and crop production. Controlling BC could therefore generate co-benefits. This fact sheet clarifies 1) what is BC; 2) what are BC's sources and impacts; and 3) how can BC be controlled to achieve co-benefits.

What is Black Carbon?

BC originates from the incomplete combustion of biomass and fossil fuels during a range of natural processes and anthropogenic activities. BC is not a GHG but an aerosol—a combination of minute particles of organic matter mixed with air. As an aerosol, BC is commonly found as the sooty subcomponent of particulate matter (PM). In addition to research linking BC to global warming, it has drawn steadily more attention because of measures known to control PM. Those control measures focus on a few key sources.

Sources of Black Carbon

BC is emitted from sources in residential, urban or rural areas. In residential areas, the key sources include burning firewood, dung cake, kerosene and crop residues for heating and cooking. In urban areas, the key sources include (diesel powered) transportation and some industrial facilities. In rural areas, the key sources include forest fires and agricultural open burning.

Overall, approximately 20% of black carbon is emitted from burning biofuels, 40% from fossil fuels, and 40% from open biomass burning (Ramanathan and Carmichael, 2008). By region, Asia accounts for about 36% of global BC emissions, Africa for about 23%, and Latin America for about 12% (Lamarque et al., 2010). China and India are major BC emission contributors in Asia due to both rapid industrialization and a continued reliance on biomass for cooking and heating. Asia hence has a great deal to gain from mitigating the impacts of BC.

Impacts of Black Carbon

BC absorbs solar radiation and releases energy

as heat. This radiative forcing contributes to regional and global atmospheric warming. BC also has other effects on the radiative balance. For instance, when BC is deposited on ice fields and snow-covered surfaces, it accelerates the melting of ice and snow both from atmospheric heating and the absorption of radiation. It not only dulls the reflectivity (albedo) of these surfaces, but can further accelerate warming by exposing darker water and ground cover that, in turn, absorbs more warming. Last but not least, at the regional level BC (along with other aerosols) can disrupt the formation of cloud and weather patterns such as the Asian monsoon (EPA, 2012).

There is a growing consensus that BC impacts extend beyond the climate to health, water, food resources, and livelihoods. Mitigating BC therefore offers a real opportunity to slow the rate of near-term climate change, while improving public health and crop yields. The opportunities for co-benefits like those listed in the box below are, again, especially significant in Asia (UNEP, 2011).

Box 1: Co-benefits from Mitigating BC

- Reduction of GHGs and other air pollutants (OC, O_3)
- Reduction in global and local temperatures
- Reduction in floods and droughts
- Stabilization of monsoon fluctuations
- Improvements in public health—especially among women and children
- Employment generation and improved livelihoods
- Reduction in health expenses

Controlling Black Carbon

Efforts to reduce BC emissions target a few key sources. Some of the most frequently referenced control measures include the following:

- Improving the efficiency of brick making by replacing traditional brick kilns with vertical shaft and Hoffman kilns
- Improving transportation efficiency and management
- Fuel switching in the industrial and transportation sectors
- Improving the efficiency of cookstoves
- Expanding the use of renewable energy—e.g. solar heater and biogas
- Promoting alternatives to open field burning of agricultural waste

It is worth highlighting, however, that none of the above solutions are a guaranteed success. Many require significant engagement with stakeholder communities to identify context appropriate and user friendly variants from the above list. They also require enabling environments that support implementation.

Conclusion

BC merits more attention for several reasons. First, it is estimated to be the second or third-largest human contributor to global warming. Second, it is relatively straightforward and cost-effective to abate. Third, in addition to the climate benefits, reducing BC emissions would also have a positive effect on public health, air quality, and agriculture. Fourth, because of its short atmospheric lifetime--days to weeks--action on BC will bring almost immediate results. Finally, reductions of BC will become increasingly important to offset warming anticipated to result from the removal of pollutants that cool the atmosphere. The unmasking of this warming could become more evident as large industrializing countries abate power plant and other industrial emissions that emit cooling pollutants.