Fifty-eighth session of the Working Group on Strategies and Review
Item 5 of the provisional agenda
Review of sufficiency and effectiveness of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone

Informal document on prioritizing reductions of particulate matter to also achieve reduction of black carbon

Prepared by the Task Force on Integrated Assessment Modelling in cooperation with the Task Force on Techno-economic Issues

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This short informal document on how to prioritize reduction of particulate matter emissions to ensure black carbon emission reductions is prepared by the Task Force on Integrated Assessment Modelling (TFIAM). It constitutes an initial evaluation of mitigation measures for black carbon emissions, as a first response to the review requirements specified in Article 10, paragraph 3 of the Amended Gothenburg Protocol. It also responds to item 2.2.1 of the 2020–2021 workplan for the implementation of the Convention (ECE/EB.AIR/144/Add.2). The informal document is a summary of a longer draft report[1] with the purpose to encourage future ratification and implementation of the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone. The draft report contains more information on inter alia measures already in place and how effective they are. It is also complementary to a coming TFTEI report titled "Technologies for PM and Black Carbon emission reductions". The preparation of this informal document and the draft report was made feasible through the EU-funded project[2] EU Action on Black Carbon in the Arctic (https://eua-bca.amap.no/) and the publicly available data and scenario results of the GAINS model developed by the Air Conventions' Centre for Integrated Assessment Modelling.

Introduction

Black carbon – carbonaceous particulate matter that absorb light – is a component of PM2.5 and is therefore linked to severe effects on human health such as respiratory disease and reduced life expectancy. And there are indications that black carbon might be more toxic than other PM2.5 components. Black carbon is also a short-lived climate forcer (SLCF), an air pollutant that contributes to global warming. To slow the pace of global warming over the next two to three decades, black carbon emission reductions are needed as a complement to reductions of carbon dioxide and other long-lived greenhouse gas emissions.

Black carbon emissions originate mainly from combustion of fuel. But even though black carbon is within the PM2.5 size fraction, it is not certain that all PM2.5 emission abatement measures will have co-beneficial effects on human health and climate change. The reason for this is mainly that the share of black carbon in PM2.5 emissions varies between emission source sectors, fuel types and emission control measures. Correspondingly, reduction of PM2.5 emissions in sectors with low shares of black carbon risk leading to trade-off between human health and climate change. This occurs since the co-emitted organic carbons, and non-carbonaceous PM as well as coarser PM-fractions, all are cooling forcers. Reduction of these will warm the climate, thereby partly or fully counteracting the cooling effect of associated black carbon emission reduction.

In the amended Gothenburg protocol, it is stated that parties should, when "*implementing measures to achieve their national targets for particulate matter, give priority, to the extent they consider appropriate, to emission reduction measures which also significantly reduce black carbon in order to provide benefits for human health and the environment and to help mitigation of near-term climate change.*". But given the variable relationship between PM2.5 and BC emission reductions, more detailed information is needed to aid prioritization. Correspondingly, this document presents an initial evaluation and general guidance on measures (for which we have technical and economic information) that could be prioritized to also significantly reduce black carbon emissions.

[1] https://www.unece.org/index.php?id=52975

[2] The document does not necessarily reflect the views and opinions of the European Union / the European Commission.

The analysis supporting this informal document is based on the best available and previously reported emission scenarios available in the GAINS model.[3] Correspondingly, the measures considered are those included in the GAINS model database, primarily end-of-pipe emission reductions. Details on implementation of these measures as well as emission trends for PM2.5 and black carbon were extracted from these scenarios. With this information it was possible to identify which of the already implemented (pre 2020), forthcoming (2020-2030) and still available (2030 – MTFR[4]) measures that ensures co-beneficial PM2.5 and black carbon emission reduction, and which measures that include trade-offs. The results of the scenario comparison are aggregated for three regions. The first region includes the countries Belarus, Moldova, Russia, and the Ukraine, the four EECCA countries available for analysis with the European online version of the GAINS model. The second region includes Albania, Bosnia-Herzegovina, Kosovo, North-Macedonia, Montenegro, Serbia and Turkey (non-EU Balkan + Turkey). The third group consists of the EU countries, Norway, Switzerland and the United Kingdom. The situation in the North American part of the UNECE region, which doesn't have PM2.5 emission reduction obligations under the Gothenburg protocol, has yet to be examined. The main messages from the analysis is presented below, but the reader should be reminded that more information and results are presented in the draft report available online.[5]

Main messages

In general for all regions, the analysis made for this informal document can reconfirm that given the expected trends, legislation and emission control, additional measures to reduce PM2.5-emissions from domestic wood burning in boilers and stoves and agricultural waste burning should be prioritized to also achieve large reduction of black carbon emissions.

For the countries that represent the EECCA region it would be useful to consult the scenario assumptions with national experts prior to drawing strong conclusions. Given this caveat, and by using the best available information, the scenarios indicate that with implemented and expected measures, both PM2.5 and BC emissions increase from 2010 to 2030, mainly due to increased economic activity (fuel combustion etc.). Of the measures that are implemented to abate emissions, the absolute majority are trade-off measures (inducing short-term warming). The scenarios suggest a large potential to implement PM2.5 emission reduction measures characterised as co-beneficial with black carbon. By 2030 the scenarios suggest that it is technically feasible to reduce 23% of the 2030 PM2.5 emissions with emission reduction measures ensuring co-beneficial BC emission reductions (61% of 2030 BC emission levels). A full implementation and enforcement of a ban on open burning of agricultural waste is the emission reduction measure with largest co-benefit potential for the four EECCA countries. The measure with second highest potential is a quicker introduction and use of pellets stoves and rejuvenation of other wood-fuelled household stoves.

Also the scenario assumptions for the non-EU Balkan countries and Turkey would benefit from a consultation with national experts. Given this caveat, the scenarios suggest that PM2.5 emissions decline between 2010 and 2020, with but insignificant effect on black carbon. Between 2020 and 2030, PM2.5 emissions are however expected to increase as a cause of increased combustion of fuels, and as for the period 2010-2020, the abatement of PM2.5 is anticipated to be done with measures that do not have any significant effect on black carbon. Given the climate policy scenario supporting the scenarios, technically available emission reduction measures by 2030 that also ensures effective BC emission abatement include cleaner coal-fuelled heating stoves and bans on trash burning. All in all, between 2020 and 2030 the scenarios suggest a technical potential to implement measures that would reduce 2030 PM2.5 emissions with 21% whilst still ensuring co-beneficial black carbon emission reduction (60% of 2030 emissions).

Further, the best available data and scenarios show that the Convention parties that both have ratified the Gothenburg protocol and have obligations to reduce PM2.5 emissions, to a large extent have implemented PM emission control measures that also ensures BC control during 2010-2020. The coming 10-year period is expected to have the same tendency. For these two time periods, only 20% and 10% respectively of the expected PM2.5 emission reduction are achieved by using PM2.5 measures that induce trade-offs with BC. In other words, for this group of countries, there is not an urgent need to pay extra attention to measures that abate both PM2.5 and black carbon emissions. It is however expected that by 2030, co-beneficial emission reduction measures are available that would reduce 2030 PM2.5 emissions with 20% and black carbon with 35%. A full-scale effective ban on agricultural waste burning and increased utilization of new wood-fuelled stoves and pellet stoves can be highlighted as high-potential measures.

[3] Stohl, A., et al. (2015). "Evaluating the climate and air quality impacts of short-lived pollutants." ACP 15(18): 10529-10566.; Klimont, Z., et al. (2017). "Global anthropogenic emissions of particulate matter including black carbon." ACP 17(14): 8681-8723; Amann, M., et al. (2018). Progress Towards the Achievement of the Eu's Air Quality and Emissions Objectives.

[4] MTFR = Maximum Technical Feasible Reduction

[5] https://www.unece.org/index.php?id=52975