Societal Benefits from Reductions in Emissions of Methane and Black Carbon

Drew Shindell

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Society faces multiple problems arising from the emission of pollution into our atmosphere, including wide ranging impacts on both public health and climate change. Swift and large reductions in carbon dioxide emissions are vital if we are to avoid the worst consequences of climate change in the longer-term, for example from 50 to 100 years from now. At the same time, we are already experiencing effects of climate change that go well beyond global warming, such as shifts in rainfall patterns, rising sea levels, and more intense storms and heatwaves. Hence in parallel, reductions in emissions of other pollutants, including methane and black carbon (also referred to as soot) merit immediate, forceful action as these improve air quality while simultaneously slowing the rate of climate change over the next several decades.

Air pollution is literally killing people. It is the leading environmental cause of premature death, leading to ~7 million premature deaths per year (outdoor and indoor) globally [1]. Air pollution in the US causes about 135,000 premature deaths, 180,000 non-fatal heart attacks, 150,000 cases of hospitalization for respiratory and cardiovascular disease, ~130,000 emergency room visits for asthma, 18 million lost work days and 11 million missed school days [2]. Many of the compounds contributing to air pollution also drive climate change [3].

Multiple, peer-reviewed scientific studies have shown that aggressive reductions of those air pollutants that cause warming, in particular methane and black carbon, can reduce the rate of warming over the next several decades by approximately half [4-6]. A strategy to quickly and dramatically reduce these pollutants hence complements efforts to reduce carbon dioxide, as carbon dioxide reductions have little effect over the next few decades due to how long this gas stays in the atmosphere, which can be hundreds to thousands of years, and the time it will take to change human systems so that they generate less carbon dioxide. Slowing near-term climate change would benefit those already suffering from the impacts of climate changes. It would also improve the chances for both biological and human systems to adapt to the pace of change. Benefits of black carbon reductions are especially large in and near snow and ice covered regions such as the Arctic or the Himalayas.

At the same time, in comparison with projected emissions based on current legislation worldwide, an analysis of one approach to implementing these reductions showed that the improved air quality under such a strategy could save ~45 million lives and increase crop yields by about 1 billion metric tons due to

ozone reductions [4,7,8]. China, India and the United States are projected to see the largest gains in crop yields due to the cleaner air, with over 100 million tons of increased yield in the US. The economic value of the benefits of methane emissions reductions is well above the typical costs of emissions controls, which are less than $250, and sometimes emissions reductions can even be made at a cost savings [9]. Though hydrofluorocarbons (HFCs) do not directly cause poor air quality, curtailing the rapid growth in emissions of these compounds can provide substantial benefit in terms of reducing near-term climate change [6].

Thus efforts to control emissions of methane, black carbon (and co-emissions) and HFCs can provide multiple, large benefits to society. Since neither the damages attributable to climate change nor those due to degraded air quality are incorporated in our current economic markets, emissions reductions are a textbook example of a societal good that could benefit from government intervention. In part this is because the damages due to air pollution are not paid by the emitter, so that there is no economic incentive for emissions reductions, even in cases when emissions controls would be less expensive than the damages they would prevent. The damages are instead paid by those who bear increased health care costs and food prices. The emissions reduction measures described in prior work [4] along with use of low-global warming substitutes instead of HFCs can greatly reduce the damages from climate change over the next few decades while saving tens of millions of lives and hundreds of millions of tons of crops in comparison with business as usual, all at relatively modest cost.

In particular, reducing methane emissions from the oil and gas industry, coal mines and municipal waste and black carbon-related emissions from diesel vehicles, cookstoves, kerosene lighting and small industries such as brick kilns and coke ovens have been identified as actions that would provide great societal benefits [4,5,9-11]. In addition, the Arctic is extremely sensitive to the warming climate, and emissions of black carbon and other particles (or particle precursors) can have an especially large impact there [12,13]. Hence the specific actions in the Super Pollutants Act of 2014 to target many of these activities, to reduce emissions from polar shipping and to encourage use of low-global warming HFC substitutes are, based on the scientific evidence, likely to lead to substantial societal benefits on multiple fronts. The bill's efforts to promote financing would also address an important barrier to implementation [5,9].

Emission reduction efforts targeting these pollutants are currently being pursued by many nations, intergovernmental and non-governmental organizations, especially via the Climate and Clean Air Coalition. Additional US leadership in this area could help inspire others to step up their activities to put into place these urgently needed emissions reduction measures, all of which are developed and in use but need to be much more widely applied to reap the full potential societal benefits. International success in reducing emissions of methane, black carbon (and co-emissions) and HFCs would provide clear benefits to the public. Success could demonstrate that emissions can indeed be successfully reduced through concerted action across

government, industry and civil society for the sake of protecting the climate (at least in part). Success would also highlight how consideration of the full environmental consequences of emissions, including both climate change and air pollution, can guide development and implementation of optimal solutions to both problems.

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