Cleaning Up Black Carbon Provides Instant Benefits Against Global Warming

August 20 2009, By Robert Monroe

Villagers in Khairatpur, India, a location of Project Surya, examine a new clean-burning stove. Scripps scientists hope to replace cooking methods that produce large amounts of black carbon with cleaner alternatives on a large scale. Photo courtesy Douglas Varchol

(PhysOrg.com) -- The world could buy time to forestall disastrous environmental and geopolitical climate change effects by using existing technologies to curb emissions created through diesel and solid biomass fuel burning, according to an article co-authored by Scripps Institution of Oceanography at UC San Diego climate and atmospheric scientist V. Ramanathan.

Writing in the September/October issue of *Foreign Affairs* magazine with Jessica Seddon Wallack, director of the Center for Development Finance at the Institute for Financial Management and Research in Chennai, India, Ramanathan concludes that full implementation of existing emissions-control technologies could offset the warming effects of one to two decades of carbon dioxide emissions. A dedicated effort

would not only allow more time for creation of effective carbon dioxide-reduction regulations but would also have enormous public health and economic benefits, the authors said.

"Focusing on reducing emissions of black carbon and ozone precursors is the low-hanging fruit: the implementation is feasible, and the benefits would be numerous and immediate," Wallack and Ramanathan write.

Ramanathan said that he and his coauthor approached *Foreign Affairs* with the concept for the article based on his calculations in a 2008 paper that society has already crossed the threshold at which damaging effects of climate change are assured. He also approached Wallack, a policy expert, to suggest ways of presenting the challenge and possible responses that reach audiences that could implement new regulations and effect initiatives to make cleaner technologies more accessible.

"It became clear to me that we have to go beyond just reducing CO_2 to hedge against unmanageable climate change," Ramanathan said.

"Black carbon and ozone are technologically and politically tractable targets for immediate policy action," added Wallack. "The challenge is raising awareness of their impacts on climate and development and knowledge about the relatively straightforward steps that can be taken to reduce emissions."

Black carbon is a form of carbon that absorbs light and is most commonly produced by people as diesel exhaust or soot from wood- or dung-burning fires. Ozone is a gas created by reactions among other gases such as carbon monoxide and methane frequently produced by human activities. At lower levels of the atmosphere, it is a greenhouse gas with a warming effect equal to about 20 percent of that of carbon dioxide.

Both black carbon particles and ozone gas remain in the atmosphere for periods of only weeks to months, as opposed to the centuries that carbon dioxide remains in the atmosphere. The authors argue that mitigation measures targeting black carbon and ozone would therefore produce immediate climate benefits. Additionally it would help alleviate damage to respiratory health in humans caused by black carbon smog, the fourth-leading cause of premature death in developing countries. Crop yields would be aided by ozone-removal efforts since the gas damages plant cells and disrupts chlorophyll production.

Wallack and Ramanathan further point out that technologies to reduce black carbon and ozone already exist. The authors cite a finding from an American non-profit research organization that shows that retrofitting one million tractor-trailers with diesel particulate filters would produce effects equal to removing 5.7 million cars from the road. The main challenges, according to the authors, lie in motivating adoption of technologies to reduce diesel emissions and making technologies to burn biomass fuels more efficiently accessible around the world. These are more akin to development challenges than traditional environmental policies.

“I hope that this will gain a place on the global environmental agenda as a high priority complement to ongoing efforts to reduce CO_2 emissions,” Wallack said. “More importantly, we hope that greater knowledge of the climate, health and agricultural benefit of reducing these two pollutants will reinforce the fact that environmental and economic or development considerations are often aligned."

“By highlighting the work of Wallack and Ramanathan, we are introducing Foreign Affairs readers to black carbon emissions as a serious policy issue to tackle with potentially dramatic near-term results,” said Managing Editor Gideon Rose.

Ramanathan said that these mitigation measures could serve to hedge against the full effects of global warming caused by greenhouse gases. They will also offset the acceleration of global warming that can occur when the atmosphere is cleaned of reflective particles such as sulfates from coal combustion that have an atmospheric cooling effect.

Diesel exhaust and cooking with biomass fuels both have net warming effects, though the magnitude of biomass burning's warming effect is not well understood. Ramanathan is currently studying the net warming effect of biomass burning as part of Project Surya, an effort to measure the effect of replacing traditional cooking methods in rural India with cleaner-burning alternatives. Wallack and UCSD Rady School of Business Professor Vish Krishnan are also participating in Project Surya to identify ways to remove bottlenecks to larger-scale adoption of technologies for cleaner burning of renewables.

"Our finding provides a tremendous incentive to help the over 3 billion people who live on less than $2 a day and are forced to cook and heat their homes with biomass fuels such as dung, crop residues and firewood," Ramanathan said.

Provided by University of California - San Diego (news : web)

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