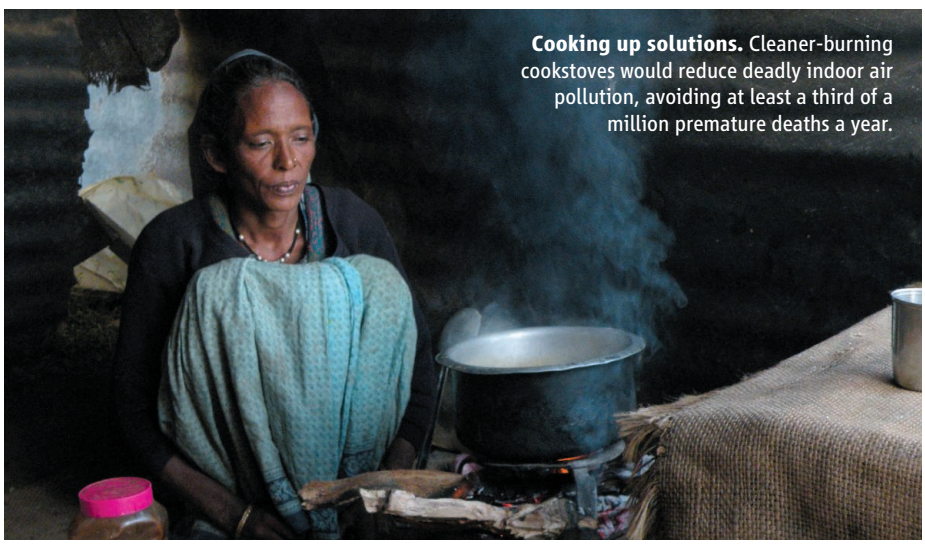
GLOBAL CHANGE

A Quick (Partial) Fix for an Ailing Atmosphere

The world's air could use a quick scrubbing. So a group of scientists has come up with 14 practicable approaches to doing just that. The researchers say the selected cleaning methods, described on page 183, would more than pay for themselves in lives saved and crop yields increased while cutting global warming to boot. "Technically, it can be done," says atmospheric scientist Mark Jacobson of Stanford University in Palo Alto, California, who was not involved in the work. "It's a question of will power."

Scientists and policymakers alike have long known how, in principle, to get a quick start on cleaning up the atmosphere: Stop the gush of short-lived pollutants. Carbon dioxide will remain in the atmosphere for centuries, warming the world all the while, but pollutants like soot and methane remain airborne just a few weeks and a decade or so, respectively. Stop their emissions and their concentrations would promptly start dropping, sharply.



Cooking up solutions. Cleaner-burning cookstoves would reduce deadly indoor air pollution, avoiding at least a third of a million premature deaths a year.

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And that would be a good thing. Inhaled soot, also called black carbon, kills or debilitates millions of people each year, while soot in the atmosphere tends to warm climate, mainly by absorbing more sunlight. Methane is a powerful greenhouse gas that also acts like a catalyst to produce ozone in the lower atmosphere, where it damages crops and people's lungs.

But how exactly should methane and soot pollution be controlled to do the most good at the least cost? Twenty-four researchers came together to get the best answer possible with today's science and existing technology. Led by climate modeler Drew Shindell of NASA Goddard Institute for Space Studies in New York City, the group included scientists from five different specialties located in 13 organizations in a half-dozen countries.

Using a relatively simple model, the group of 24 screened about 400 tried-and-true pollution control methods for methane and soot that would both reduce warming and improve air quality. Ranked by how much they reduced warming, the top 14 included seven methane reduction methods targeting sources ranging from coal mining and landfills to livestock manure and rice paddies. The soot-controlling methods target processes in which fuel is not completely burned. They would improve diesel engines, increase the efficiency of wood- or dung-burning cookstoves, and ban the burning of agricultural wastes, among other methods.

Next, the researchers looked at how much good their top-performing pollution control methods would do if phased in around the world from 2010 to 2030. They selected two scenarios describing how much greenhouse-stoking carbon would be emitted over coming decades: a business-as-usual case assuming no new carbon controls and a low-carbon future featuring stringent new controls. Various combinations of the methane and soot controls were also combined with the business-as-usual and low-carbon scenarios. Each resulting scenario then served as input to two different complex computer models. They calculated what chemical composition of the atmosphere—including soot and ozone—would result and what the climate effects would be. These results were then used to estimate health and agricultural impacts.

The benefits of controlling methane and soot emissions turned out to be considerable. Largely thanks to reduced methane emissions, global warming by 2050 would be reduced by about half a degree; global warming so far has amounted to about 0.8°C. The additional controls also ensure that the low-carbon scenario holds warming below the danger level of 2°C of warming, at least for the next 60 years. Methane controls would also keep ozone low enough to avoid annual crop losses of 30 million to 135 million metric tons in 2030.

The drop in outdoor air pollution, due largely to soot emission reductions, would avoid 700,000 to 4.7 million premature deaths each year. Indoors, more than one-third of a million lives would be saved annually in India and China alone. A total of at least a million lives saved a year compares with the 600,000 premature deaths from tuberculosis expected in 2030 or the 2.1 million deaths due to traffic accidents.

And the costs of all these benefits would be more than reasonable, the study finds. While on average it would cost less than $250 to prevent the emission of a metric ton of methane, the benefits for not emitting that ton of methane would run from $700 to $5000. The benefits of soot reduction are more uncertain, but "the bulk of the [soot] measures could probably be implemented with costs substantially less than the benefits given the large valuation of the health impacts," the authors write. And the health benefits of soot reduction would largely fall to the countries that spent to control their emissions. All in all, fully implementing these controls in the next 20 years may be ambitious, says lead author Shindell, and there are uncertainties. But "by showing the potential, [the study] highlights what could be done if society puts its mind to it."

Outside experts agree. Professor of environmental engineering and international affairs Denise Mauzerall of Princeton University finds that the study "makes a compelling case for higher controls. It's much more comprehensive than what has been done before. Giving specific recommendations on cost-effective controls is very instructive for policymakers." And "they're doing as good a job as you can do," says atmospheric scientist Joyce Penner of the University of Michigan, Ann Arbor. "The whole approach is exactly what we need." The trick, of course, will be convincing governments of that.

–RICHARD A. KERR

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