Mitigating GHGs in Developing Countries

REDUCTIONS IN GREENHOUSE GAS EMISSIONS (GHGs) and, hence, emissions of particles and ozone precursors in four major cities—Mexico City, Mexico; São Paulo, Brazil; Santiago, Chile; and New York City, USA—were found by L. Cifuentes and colleagues to be associated with large benefits to public health (*Science's* Compass, Policy Forum, "Hidden health benefits of greenhouse gas mitigation," 17 Aug., p. 1257). Co-benefits from measures that will reduce GHG emissions, health and otherwise, are likely to be largest in those countries that do not have emission reduction obligations in the Kyoto Protocol (*1*). We have illustrated this through a study in China.

China is of particular interest, as the largest producer and consumer of coal in the world. Despite success in reducing CO_2 levels, the country might surpass the present leading emitter, the United States, within some decades (*2*). In our study, we assessed the effects of measures to improve energy efficiency in coal combustion in Shanxi Province, the main coal- and coke-producing province in China. This area is one of the most polluted in the world, with typical annual concentrations of total suspended particulates of 300 to 700 micrograms per cubic meter in cities. By including reduced health impairment, we estimated that the net costs of the measures considered were negative in all cases (*3*). In addition to health effects, damage to crops (e.g., due to ozone and regional haze) and materials (due to SO_2 and ozone) may be reduced (*4*).

The position taken by the United States, that developing countries should have emission obligations, is in our view unreasonable as long as those countries' emissions of GHGs per capita are much lower than in the United States (about one-seventh in China). Nevertheless, it is important to increase the interest in mitigating GHG emissions in developing countries. One way to do this is through the Clean Development Mechanism (CDM). Fortunately, simplified modalities and procedures for small-scale CDM projects (such as the type of energy efficiency measures considered in our work) were decided on at COP-6, part 2, in Bonn, Germany (16 to 27 July 2001). Such projects are likely to meet the dual objective of CDM, that is, to promote sustainable development in host countries, and improve global cost-effectiveness through assisting developed countries in meeting their Kyoto targets.

The Taiyuan Iron and Steel Company is a large consumer of coal. It is the largest industrial enterprise in Taiyuan and the largest polluter. Several energy-saving measures have improved the situation in recent years and there are plans for further improvements, which should have large effects on emissions of both GHGs and local pollutants.

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Response

SEIP AND COLLEAGUES ARE NO DOUBT CORRECT that the scope and extent of the benefits of GHG mitigation might be even greater in other countries than was found in our analyses of the four cities we considered. In addition, consideration of agricultural and other outcomes, such as those mentioned by Seip *et al.*, would have reinforced our point that there are hidden public health benefits to be derived from going forward with GHG mitigation. The cities and outcomes we chose were intended to be illustrative of the many potential immediate and local related health benefits that might be derived from readily available GHG mitigation measures. A more comprehensive analysis of GHG mitigation at a national and international level would include ecological, agricultural, and many other benefits not considered in our focused urban case studies.

In our Policy Forum, we acknowledged that we underestimated the hidden health benefits of GHG mitigation because we restricted our analysis to air pollution in the four selected cities and to available coefficients of the human health responses. For instance, we did not quantify increases in children's hospital admissions or medical visits in New York City because of the lack of city-specific impact coefficients, although findings in other cities indicate that such effects are occurring. There are many other health effects that we did not assess. As an example, the World Health Organization reported that traffic-based air pollution in developed countries increases developmental defects, allergies, lung cancer, and emergency response time (*1*). One study has found that currently

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permitted levels of air pollution also increase DNA damage from volatile organic compounds, decrease renal function, and reduce testes volume in adolescents (*2*). A fuller accounting of the potential health and ecological impacts of GHG mitigation that would include such benefits, as well as those noted by Seip *et al.*, would further strengthen the conclusions in our Policy Forum (*3*).

Seip *et al.*'s criticism about the "unreasonable" U.S. GHG position is perhaps best addressed by Donald Kennedy's recommendation in his Editorial "Going it alone" (17 Aug., p. 1221), that "As a lone player, the United States can restore some credibility with its friends and trading partners by demonstrating a serious commitment to mitigating the global warming problem." We agree with Kennedy that there is a need for U.S. action on this issue. As we have recently seen, if we don't all cooperate to address the world's problems, then they will end up on our own doorsteps. That is true with terrorism, and it's also the case with other global threats, like climate change.

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Short-Term Trials and Long-Term Effects

IN THEIR POLICY FORUM "PLACEBO-CONTROLS in short-term clinical trials of hypertension," S. M. Al-Khatib and co-authors demonstrate with meta-analysis that the use of such controls is not associated with an increased risk of serious adverse events for participants in these studies (*Science*'s Compass, 15 Jun., p. 2013). They say that this supports the use of such trials from an ethical standpoint.

There is an important caution not emphasized by the authors. They were only able to focus on short-term outcomes in their analysis. They indicated that there is ample evidence to demonstrate that the use of placebo in long-term studies is not safe. What remains unknown is whether there might be longer term consequences of participation in a short-term, placebo-controlled trial. Most short-term studies do not follow the participants for long-term outcomes. There are, however, some studies that have suggested the possibility of longer term effects. One such study by Geleijnse and colleagues showed long-term effects of restricting dietary sodium during the first 6 months of life (*1*). Children in the lower sodium group still had significantly lower systolic blood pressure than those in the control group after 15 years of followup, despite being on an unrestricted diet except for the first 6 months of life during the clinical trial. Similarly, the Diabetes Control and Complications Trial/Epidemiology of Diabetes Intervention and Complications Research Group showed that HbA1c levels between the former intensive therapy and control groups were similar for 4 years after the study was completed (*2*). Despite similar HbA1c levels during the first 4 years after the intervention trial, the reduction of risk in the progression of retinopathy and nephropathy resulting from the previous 6.5 years of intensive therapy persisted.

"What remains unknown is whether there might be longer term consequences of participation in a short-term, placebo-controlled trial."

These findings suggest that long-term followup of individuals who participate in short-term clinical trials of antihypertensive medication is warranted in order to be sure that the conclusions presented by Al-Khatib and colleagues are valid.

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