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Global Warming

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A common view shared by many scientists is that the current global warming rate will continue to accelerate. Rapid warming in recent decades has been driven mainly by non-CO₂ greenhouse gases (GHGs), such as chlorofluorocarbons, CH₄, and N₂O, not by the products of fossil fuel burning, CO₂ and aerosols, the positive and negative climate forcings of which are partially offsetting. The growth rate of non-CO₂ GHGs has declined in the past decade. If sources of CH₄ and O₃ precursors were to be reduced in the future, the change in climate forcing by non-CO₂ GHGs in the next 50 years could be near zero. Combined with a reduction of black carbon emissions and plausible success in slowing CO₂ emissions, this reduction of non-CO₂ GHGs could lead to a decline in the rate of global warming, reducing the danger of dramatic climate change. Such a focus on air pollution has practical benefits that unite the interests of developed and developing countries. However, assessment of ongoing and future climate change requires composition-specific long-term global monitoring of aerosol properties (Hansen et al., 2000).

The global surface temperature has increased by about 0.5°C since 1975, a burst of warming that has taken the global temperature to its highest level in the past millennium. There is a growing consensus that the warming is at least in part a consequence of increasing anthropogenic greenhouse gases (GHGs). GHGs cause a global climate forcing, i.e., an imposed perturbation of the Earth's energy balance with space. There are many competing natural and anthropogenic climate forcings, but increasing GHGs are estimated to be the largest forcing and to result in a net positive forcing, especially during the past few decades. Evidence supporting this interpretation is provided by observed heat storage in the ocean, which is positive and of the magnitude of the energy imbalance estimated from climate forcings for recent decades (Hansen, Sato, Ruedy, Lacis, & Oinas, 2000).

We suggest equal emphasis on an alternative, more optimistic, scenario. This scenario

focuses on reducing non-CO₂ GHGs and black carbon over the next 50 years. Our estimates of global climate forcings indicate that it is the non-CO₂ GHGs that have caused most observed global warming. This interpretation does not alter the desirability of limiting CO₂ emissions because the future balance of forcings is likely to shift toward dominance of CO₂ over aerosols. However, we suggest that it is more practical to slow global warming than is sometimes assumed.

Business-as-usual scenarios provide a useful warning about the potential for human-made climate change. Our analysis of climate forcings suggests, as a strategy to slow global warming, an alternative scenario focused on reducing non-CO₂ GHGs and black carbon (soot) aerosols. Investments in technology to improve energy efficiency and develop nonfossil energy sources are also needed to slow the growth of CO₂ emissions and expand future policy options. A key feature of this strategy is its focus on air pollution, especially aerosols and tropospheric ozone, which have human health and ecological impacts. If the World Bank were to support investments in modern technology and air quality control in India and China, for example, the reductions in tropospheric ozone and black carbon would not only improve local health and agricultural productivity but also benefit global climate and air quality (Hansen et al., 2000).

Works Cited

Hansen, J., Sato, M., Ruedy, R., Lacis, A. & Oinas, V. (2000). Global warming in the twenty-first century: An alternative scenario. *Proceedings of the National Academy of Sciences USA* 97: 9875-9880.