Averting disaster: at what cost?

JEFFREY D. SACHS

Avoiding dangerous climate change will require considerable global efforts to reduce greenhouse gas emissions. A daunting challenge, but one that is practically and economically achievable, argues Jeffrey D. Sachs.

The basic economics of climate change have been explained clearly in the Stern Review[1]. The global business-as-usual (BAU) path, in which fossil fuel use continues unabated without reducing carbon emissions or capturing and sequestering them, will raise atmospheric concentrations of greenhouse gases during the coming decades to dangerous levels. The higher the greenhouse gas concentrations the greater the societal costs will be, in terms of more frequent and extreme droughts and storms, loss of biodiversity, declining crop yields, rising sea levels and much more[2]. Emissions can be averted, and thereby greenhouse gas concentrations can be reduced below the BAU path, at an extra cost to society. As long as the resulting social benefits exceed this abatement cost, then it should be adopted. The optimum pace and intensity of emissions reduction are found by balancing the additional costs of aggressive greenhouse gas stabilization against the incremental benefits of reduced climate change.

THE BARGAINING GAME

So far, so good. But the translation of these ideas into practice is extremely challenging, both conceptually and practically. The costs of reducing emissions are unknown, because their control will depend on a myriad of technologies that are potentially effective but not yet proved. The societal costs of climate change are known with even less precision. Moreover, both societal and abatement costs will vary widely across geographical space and across generations. At a conceptual level, there is an enormous bargaining game, marked by potential winners and losers, high uncertainty, potential side payments, tendencies towards free riding, and future generations who are not even at the bargaining table. The current generation plays its own hand, as well as that of future generations. Some might say the game is rigged.

For many concerned observers, the situation appears to be well nigh hopeless, simply too complex to reach an accord that bridges the diverse interests of rich and poor countries, and current and future generations. Moreover, implementation will depend on literally billions of individual decisions in the present and future, and these of course will be exceedingly difficult to align, even if the world can agree on a desirable path of emissions control. The prospects, for example, would seem to compare very poorly with the control of ozone depletion. In that case, the central challenge centred on phasing out the use of a single class of industrial compounds — chlorofluorocarbons (CFCs) — in the context of a limited number of industrial producers and users, and with good technical substitutes at hand.

HIGH-IMPACT APPROACH

Yet a closer look at this daunting challenge of climate change gives several important reasons to believe that a global agreement and implementation plan are much closer than they initially seem. First, perhaps two-thirds or more of the fossil-fuel-based emissions of carbon dioxide — the main greenhouse gas — depend on a small number of industries. Electricity generation and automobiles account for roughly half of the total emissions. Other high-emission industries include steel, petrochemicals, refineries and cement. A large proportion of non-fossil-fuel-based carbon emissions arise from tropical deforestation.

The highly concentrated nature of carbon emission sources suggests that the preponderance of abatement efforts could be addressed using a focused strategy, including:

- emissions reduction at power plants through a shift to non-carbon energy sources (such as wind, solar and nuclear) and through carbon capture and sequestration (CCS) for fossil-fuel-burning plants;
- high-mileage automobiles — of 100 miles per gallon (42 km per litre) or more —which use plug-in hybrids, light-weight materials and other technologies;
- high-impact energy efficiency by replacing incandescent bulbs with compact fluorescent bulbs, improving building insulation and using 'smart' motors and appliances that economize on electricity;
- emissions control in cement, petrochemicals and steel through CCS, improved boilers, stationary fuel cells, improved heat management and other technologies;
- direct 'air capture' of carbon dioxide and subsequent sequestration — a variant of CCS;
- reduced tropical deforestation through incentives to preserve the forest margin.

By focusing on selected high-impact sectors, the number of relevant decision makers can be reduced by several orders of magnitude. Rather than facing billions of individual decision points, the control efforts are focused on a few thousand power plants, a dozen or so global automobile manufacturers, and a few thousand large industrial units.

Smart incentives can be tailored to each sector, using a combination of industrial codes and standards, tradable permits,

carbon taxes and other regulatory tools. Emissions limits can be phased in to achieve predictability while avoiding costly shocks to global economies. Public policies can be set to ensure that the incentives across key sectors are at least roughly comparable, so as to equate the marginal abatement costs across transport, industry and buildings, and across countries.

This sort of targeted approach can avoid an unwieldy global emissions permit system that aims to cover millions of enterprises around the world, in a naïve extrapolation of the European Emissions Trading System. Such a system would be virtually impossible to negotiate and even harder to police. It would probably open the way for massive, arbitrary and politicized wealth transfers resulting from the allocations of carbon permits across countries and enterprises.

CONTROLLABLE COSTS

There is another crucial reason why success may prove to be easier than is now feared. With enough lead-time and policy consistency, the annual global costs of emissions abatement are likely to be relatively modest, on the order of 1% of the world's income, or perhaps less. If true, the inevitable wrangling across countries and generations can be muted, even solved, as the amounts at stake will be manageable on both financial and political scales. Rich countries will be able to afford both their own emissions control as well as co-financing of control in poorer countries as part of equitable cost sharing.

Of course, the absolute costs of global emissions abatement are likely to be significant. The world gross national product by mid-century could be $200 trillion or more (measured in today's dollars), compared with around $50 trillion today. An annual emissions abatement cost of 1% would therefore be $2 trillion, not a trifling sum, but one that would be manageable within a much larger and richer world economy. In fact, there are reasons to hope that the control costs could be held far below 1% of the gross national product, but the precise costs will of course depend on technologies that are still highly uncertain and on the decades-long trajectory of emissions control. The longer the world waits to begin serious emissions abatement, the more rapid — and more costly — the transition to a low-emissions global regime will be.

Given the crucial role of new, and yet-to-be proved technologies, one of the key goals for policy is public funding for research, development and diffusion of low-emissions technologies. An early focus, for example, should be on carbon-capture and sequestration, and plug-in hybrid automobiles. Market forces, left on their own, will under-invest in basic science, and a sole reliance on patents as the incentive for R&D will slow down the diffusion of successful technologies by granting their owners a temporary monopoly. These considerations, well known in public economics, suggest a central role for public financing of R&D.

A WORKABLE SYSTEM

If these reflections are roughly correct, they suggest three guidelines for global negotiations over emissions control. First, the world need not aim for comprehensive sector-by-sector control of carbon emissions, but for a focus on key sectors. Second, the world should not argue endlessly about perfect efficiency and perfect justice as the ultimate costs of emissions control are likely to be fairly modest, whereas the costs of delay could be extremely high. We should aim for a workable system, not a perfect system. Third, we should give an urgent focus on the development and diffusion of new technologies.

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Complex as this agenda will be, mitigating greenhouse gas emissions will be only part of the story. Climate change is already upon us and will intensify considerably even if we succeed in stabilizing and then reducing global emissions in the coming decades. Sensible policies must therefore not only mitigate climate change, but adapt to it as well, learning as best as possible how to live with the inevitable increases of water stress, crop failures, extreme storms, and other shocks that are on the way. The challenge of adaptation requires a separate and thorough strategy, and the global work on that has hardly begun.

Jeffrey D. Sachs is Director of the Earth Institute at Columbia University and Quetelet Professor of Sustainable Development

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2. IPCC Climate Change 2007: Impacts, Adaptation and Vulnerability; www.ipcc.ch/SPM13apr07.pdf.