The Road to Clean Energy Starts Here

Realizing crucial energy technologies will take more than just research and development By JEFFREY D. SACHS

The key to solving the climate change crisis is technology. To accommodate the economic aspirations of the more than five billion people in the developing countries, the size of the world economy should increase by a factor of four to six by 2050; at the same time, global emissions of greenhouse gases will have to remain steady or decline to prevent dangerous changes to the climate. After 2050, emissions will have to drop further, nearly to zero, for greenhouse gas concentrations to stabilize.

The overarching challenge is to make that transition at minimum cost and without economic disruption. Energy-saving technologies will play a pivotal role. Buildings can save energy at low capital cost, and often net overall savings, through improved insulation, efficient illumination and the use of heat pumps rather than home furnaces. Automobiles could, over time, reach 100 miles per gallon by a shift to plug-in hybrids, better batteries, lighter frames and other strategies. Of course, technologies such as heat pumps and plug-in hybrids partly reduce direct emissions by shifting from on-site combustion to electricity, so that low-emission power plants become paramount.

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Low-emission electricity generation will be achieved in part through niche sources such as wind and biofuels. Larger-scale solutions will come from nuclear and solar power. Yet clean coal will be essential. New combustion techniques, combined with carbon capture and sequestration (CCS), offer the prospect of low- or zero-emission coal-fired thermal plants. The incremental costs of CCS may well be as low as one to three cents per kilowatt-hour.

All these technologies are achievable. Some will impose real added costs; others will pay for themselves as lower energy bills offset higher capital outlays. Some estimates suggest that, as of 2050, the world will have to negate around 30 billion tons of carbon dioxide emissions a year at a cost of roughly $25 per ton, or $750 billion annually. But with a world economy by then of perhaps $200 trillion, the cost would be well under 1 percent of world income and perhaps under 0.5 percent, a true bargain compared with the costs of inaction.

Achieving these technological solutions on a large scale, however, will require an aggressive global technology policy. First, there will have to be market incentives to avoid emissions, in the form of either tradable permits or levies. A reasonable levy might be $25 per ton of emitted carbon dioxide, introduced gradually over the next 10 to 20 years. Second, there will have to be ample government support for rapid technological change. Patents can help spur private market research and development (R&D), but public funding is required for basic science as well as for the public *demonstration* and the global *diffusion* of new technologies. In sum, we need a strategy sometimes described as RDD&D.

In the past two years, the Earth Institute at Columbia University has hosted a Global Roundtable on Climate Change, involving leading corporations from around the world. These companies, including many of the largest power producers, are ready to reduce carbon emissions. They know that CCS must be a high priority. A new Global Roundtable Task Force on CCS seeks to promote the required RDD&D.

Fortunately, the European Union has already pledged to build at least a dozen CCS demonstration projects in Europe by 2015. But we will also need such centers in the U.S., China, India, Australia, Indonesia and other highly significant coal-power producers. In the low-income countries, this will require a few billion dollars; that is where the RDD&D investments of the high-income countries will be essential.

The CCS Task Force aims to break ground on one or more demonstration plants by 2010 in every major coal region. By 2015 this crucial technology can be proved and added to the bid to avert climate disaster. This model of RDD&D won't stop there. Harnessing technology to achieve sustainable energy will involve much of the global economy for decades. SA

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