ENVIRONMENT

Energy and Technology Policies for Managing Carbon Risk

Elements of a global carbon management strategy have been defined, paving the way to increased international actions to reduce global emissions starting this year.

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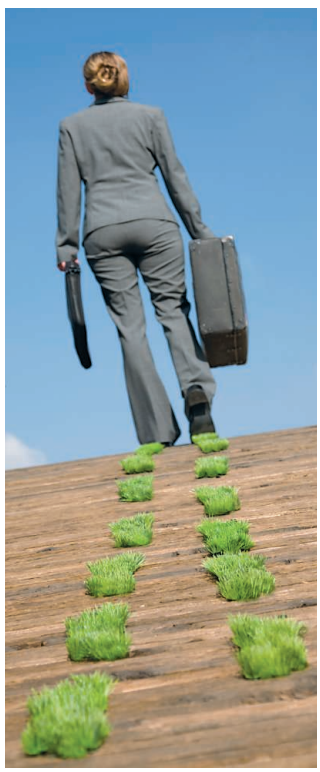
Despite some uncertainties, today's scientific and political consensus is that the level of global emissions of greenhouse gases (GHGs) needs to lead to atmospheric concentrations somewhere between 450 and 500 parts per million (ppm) (*1*) to avoid serious, if not catastrophic, effects on life and property. Achieving this goal poses some formidable challenges. There is inertia in the climate system (GHGs survive for generations), as well as in GHG-emitting capital investment. Furthermore, every economic sector and country emits. To meet these challenges, a broad range of actions will be required.

Mitigation Policy

To maintain public support for aggressive, cooperative action in achieving such reductions, we must return to and maintain long-term economic growth. Difficult economic times focus public attention on the "here and now" at the expense of the welfare of future generations. For example, the International Energy Agency (IEA) has recently estimated that renewables investment will fall 38% in 2009 (*2*). Policy frameworks will need to foster economic growth and demonstrate effectiveness to maintain public support. Mitigation policy should therefore emphasize measures that generate near-term reductions but provide incentives for reductions that take longer to accomplish.

The Kyoto Protocol was the first attempt to rein in GHG emissions with a binding agreement. It called for emission reductions in the developed world during the period 2008–12 and has been only marginally successful, mostly because the United States refused to ratify it. Under President Obama, the United States is now reengaging in negotiations with the goal of agreeing on the successor agreement by December 2009 at the international climate meeting in Copenhagen.

One way to encourage reductions is through command-and-control approaches by governments, for example, carbon performance standards for new power plants. Another approach is to levy a carbon tax, with the revenue devoted to promoting energy efficiency, renewable energy production, and Carbon Capture and Storage (CCS). However, most member governments of the Organization for Economic Cooperation and Development (OECD) have avoided both approaches, preferring a market mechanism.



A bumpy, but hope-filled, road to the Copenhagen meeting.

Many OECD governments, including the European Union (EU), Australia, and New Zealand, have adopted emissions trading for reducing emissions. In contrast to command-and-control approaches, the government's role in cap-and-trade is minimal. Essentially, the government sets a cap on total emissions, and generally, that cap decreases with time. The government also establishes market trading rules and an allowance registry, supervises the distribution of emission allocations to the various emitters, and enforces compliance. The process of staying below the cap is controlled by the "carbon market," where allocations are bought and sold in a way that minimizes costs of compliance. This type of carbon market has been used by several countries that have signed on to the Kyoto Protocol in order to meet their required emission reductions.

The advantage of cap-and-trade is that the marketplace (rather than governments) decides the optimum way to achieve the reductions, which ensures greater innovation and economic efficiency. Reservations about applying cap-and-trade to carbon emissions stem primarily from the concern that compliance costs are highly uncertain and that additional costs for energy may be particularly burdensome in today's economic climate. The recent financial meltdown certainly adds to the reservations about cap-and-trade. Furthermore, the allocation of emission permits can be contentious, as is setting the appropriate cap.

Some international experience exists. Starting in 2005, the EU established the Emissions Trading Scheme (ETS) and allocated permits to individual countries through a negotiation process. Countries then allocated permits to utilities and major industries. This experiment was not without its problems: The price of emitting a ton of carbon dioxide rose to over 30 euros (€), greatly exceeding the predicted price of 10 €, and then crashed to nearly 0 € because of an oversupply of permits. The current price is about 14 €. On the basis of the ETS experience, the European heads of state struck a deal in December 2008, deciding on 20% emissions reductions below 1990 levels by 2020.

Another weakness is that sectors that can prove they are facing serious competitive disadvantages (as is claimed by the steel, cement, and aluminum industries) can apply for exemptions to grant up to 100% free emission permits. Nevertheless, initial evidence indicates that the ETS did yield reductions, and the experience of the EU has been an invaluable lesson.

Other countries have either created or are in the process of creating cap-and-trade schemes. Norway is using emissions trading to meet its commitments for the initial Kyoto commitment period. The Norwegian scheme is linked to the EU ETS, allowing for trading between the two systems. Australia and New Zealand are establishing a system with broader GHG and sectoral coverage than the EU ETS.

In the United States, despite success with a cap-and-trade system for controlling sulfur emissions under the Reauthorized Clean

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Air Act of 1990, carbon trading has only been developed at the state level, through the Regional Greenhouse Gas Initiative (RGGI) and the Western Climate Initiative (WCI). Efforts to pass national trading legislation culminated in the Waxman-Markey Bill that passed the House (H.R. 2454). It sets the goal of reducing emissions by over 80% by 2050. This is critical legislation if 450 to 500 ppm stabilization is to remain a possibility, as the United States is the second largest global emitter of carbon dioxide from energy sources. Other major emitters cannot be expected to adopt aggressive measures in the absence of U.S. action.

Improving Energy Use

A carbon price is essential, but it will not be sufficient to meet climate change goals. In particular, improving the efficient consumption of energy will require use of both voluntary and command-and-control measures to overcome market failures and barriers. The IEA has documented the potential size of some of these market failures as they applied to principal-agent problems (*3*). One example of these is popularly called the "landlord-tenant" problem. In such cases, energy prices do not unambiguously signal to consumers the changed scarcity of goods, including environmental protection. This could cover in excess of 30% of electricity consumption in the residential sector.

From a climate perspective, this is particularly important, as energy efficiency is the most cost-effective near-term strategy. Given the long time-lags required for many capital investments, energy efficiency improvements offer the possibility of increasing energy services and reducing fossil-fuel use while the existing capital structure is transformed into a low-carbon one. National governments and the international framework developed in Copenhagen will need to provide incentives that fully exploit energy efficiency.

The technology development program will have to be broad in scope and directed at providing cost-effective pathways to markets rather than directing the choice of "key" technologies. The technology program will also have to be much larger than currently being pursued by major economies. There has been only modest response in the size of energy research and development (R&D) funding following the warnings from climate change science. For example, since the 2001 publication of the Third Assessment Report of the Intergovernmental Panel on Climate Change, funding has grown about 8%, whereas in response to the oil shocks of the 1970s, R&D funding grew from 1975 to 1980 by over 60% (*4*).

The current view is that no successful stabilization of atmospheric CO_2 concentration is possible without extensive applications of CCS (*1*, *5*, *6*), given large coal reserves in the United States, China, and other countries. In addition, there will be a need for renewable (e.g., solar, wind, geothermal, and biomass) and low-carbon energy technologies (e.g., nuclear). Fuels derived from lignocellulosic biomass and from algae could be deployed for both transportation needs and the production of power (e.g., in combination with fossil fuels).

Deployment of new and improved energy technologies and of CCS will require rigorous planning, disciplined implementation, and creative incentives. Much can be learned from earlier attempts (e.g., in Europe and in the U.S. states) that used policy tools such as the Renewable Portfolio Standard (RPS) to successfully overcome barriers to the initial use of new renewable technologies.

The *America's Energy Future* (AEF) report (*7*), recently released by the U.S. National Academy of Sciences, offers a blueprint of how various energy technologies can be compared in terms of cost, supply potential, ability to penetrate the market place, and environmental impacts, including GHG emissions. The AEF paradigm can be applied across countries and regions, leading to optimum combinations of technologies.

Institutional Arrangements

There is no shortage of international organizations. What is in shortage is the institutional mandate and focus on delivery of climate-friendly technologies to the key emitting countries and sectors. Integrating such a broad mandate into a single international organization like the U.N. Framework Convention on Climate Change (UNFCCC) risks creating a cumbersome and inflexible system. Instead, Copenhagen will need to empower new and existing organizations with specific tasks from capacity-building to facilitating cooperative R&D and policy implementation activities.

Existing technology cooperative arrangements like the Carbon Capture Leadership Forum and the International Partnership for a Hydrogen Economy, in addition to IEA Implementing Agreements, will continue to play important roles, and the Asian Pacific Partnership will continue to supplement the UNFCCC. However, new forms of cooperation between nations and between the public and private sectors will be needed to address different technologies and regional and national concerns. As the Consultative Group on International Agricultural Research played a key role in the green agricultural revolution, a new organization could play a role in adapting energy efficiency and renewable technologies to local circumstances in developing countries. Such regionally oriented approaches may well become part of the international institutional portfolio, as regional and local approaches within the IEA nations have played key roles in fostering renewable energy and energy efficiency. A particularly promising new approach for facilitating energy efficiency policy in the world's largest economies was launched in May 2009 at the G8 ministers' meeting in Rome (*8*). The International Partnership for Energy Efficiency Cooperation provides, for the first time, a policy-maker consultative forum on energy efficiency where energy efficiency policy experiences can be exchanged among those who can subsequently initiate implementation of the best policy practices.

The road ahead for climate change mitigation is indeed bumpy, and negotiations for the successor to the Kyoto Protocol will be long and difficult. Nevertheless, there is a strong sense that we will emerge with a global agreement to reduce nonrenewable carbon emissions. Such an agreement will certainly empower near-term emission reductions through both market-based and regulatory instruments. It will spur innovation and provide a policy framework that expands the geographic and sectoral application of a carbon market. The agreement will also enhance international cooperation on selected command-and-control instruments to redress market imperfections and to empower existing and new institutions to facilitate international adoption of low-carbon technologies.

References and Notes

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