A Breakthrough in Climate Change Policy?

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Scientific American, February 2000, pages 78-79.

(The figure included in the published version is omitted here; the text is identical)

As a result of human activities, the atmospheric concentration of carbon dioxide has increased by 31 percent over the past two centuries. According to business-as-usual projections, it will reach twice the preindustrial level before 2100. Although there is little doubt that this increase will noticeably transform the climate, substantial uncertainties remain about the magnitude, timing and regional patterns of climate change; even less is known about the ecological, economic and social consequences.

Despite these uncertainties, an international consensus has emerged regarding the importance of preventing runaway levels of carbon dioxide in the atmosphere. An effort to stabilize the concentration of carbon dioxide at even double its preindustrial level—generally considered the lowest plausible target—will require reducing global carbon dioxide emissions by about 50 percent from projected levels by 2050. Not surprisingly, such an extreme reduction will require a fundamental reorganization of global energy systems.

Most current assessments of greenhouse gas emissions assume that the reductions will be achieved through a mix of increasing energy efficiency and switching to nonfossil-fuel alternative energy sources, such as solar, wind, biomass or nuclear. In the accompanying article, “Capturing Greenhouse Gases,” the authors review a radically different approach: burning fossil fuels without releasing carbon dioxide to the atmosphere by separating the carbon emissions and burying them underground or in the deep ocean. We believe this approach—termed carbon management—has fundamental implications for the economics and politics of climate change.

Stabilizing the carbon dioxide concentration at 550 parts per million (ppm)—double the preindustrial level—is widely considered an ambitious target for emissions control. Yet this concentration will still cause substantial climate change. The resulting environmental problems, however, will most likely have only a small effect on the world’s overall economic output; rich countries in particular should emerge relatively unscathed. But the results for specific regions will be more pronounced, with some places benefiting and others suffering. For instance, although parts of the northern U.S. may enjoy warmer winters, entire ecosystems, such as the southwestern mountain forests, alpine meadows and certain coastal forests, may disappear from the continental U.S. These likely consequences—and more important, the possibility of unanticipated changes—are compelling reasons to try to stabilize concentrations below 550 ppm, if it can be done at an acceptable cost.

At present, the cost of holding concentrations to even 550 ppm through conventional means appears high, both in dollars and in other environmental problems. All nonfossil-fuel energy sources available today are expensive, and renewable sources have low

power densities: they produce relatively little power for the amount of land required. Large-scale use of renewable energy could thereby harm our most precious environmental resource: land. Although technological advances should reduce the cost of renewables, little can be done to improve their power densities, which are intrinsic to the sources.

So must we conclude that reducing carbon emissions without causing other unacceptable environmental impacts will deliver a massive economic blow? Not necessarily. The crux of the cost problem is predicting how fast money-saving technical advances might develop in response to a carbon tax or some other form of regulation. Notably, most economic models used today to assess the cost of reducing emissions assume that innovation proceeds at its own pace and cannot be accelerated by policy. Under this assumption, delaying efforts to cut emissions makes sense because it will allow time to develop better technology that will lower the cost of reductions. Under the contrary assumption—which we regard as closer to the truth—innovation responds strongly to price and policy signals. In this case, early policy action on climate change is advantageous, because it would stimulate the innovations that reduce the cost of making large emission reductions.

Carbon management may be just such an innovation. Certain carbon management technologies are already available and appear to be significantly cheaper than renewables for generating electricity. To achieve deep reductions in greenhouse gas emissions, however, society must also start using carbon-free fuels, such as hydrogen, for transportation. Here the relative advantage of carbon management over renewables is even greater than in producing electricity. Furthermore, these technologies offer one significant advantage over alternative energy sources: because they are more compatible with the existing energy infrastructure, we expect their costs to fall more quickly than those of renewables.

Carbon management weakens the link between burning fossil fuels and releasing greenhouse gases, making the world's economic dependence on fossil fuels more sustainable. This gives carbon management a crucial advantage: by reducing the threat to fossil-fuel industries and fossil-fuel-rich nations, carbon management may ease current political deadlocks. Stated bluntly, if society adopts carbon management widely, existing fossil-fuel-dependent industries and nations may continue to operate profitably both in present energy markets and in new markets that develop around carbon management, making them more willing to tolerate policies that pursue substantial reduction of atmospheric emissions.

Environmentalists, however, are likely to find carbon management profoundly divisive for several reasons. Carbon sequestration is only as good as the reservoirs in which the carbon is stored. The unfortunate history of toxic and nuclear waste disposal has left many reasonable people skeptical of expert claims about the longevity of underground carbon disposal. As researchers assess the safety of proposed carbon reservoirs both underground and in the ocean, they must address such skepticism evenhandedly.

Perhaps even more disconcerting for environmentalists, though, is that carbon management collides with a deeply rooted belief that continued dependence on fossil fuels is an intrinsic problem, for which the only acceptable solution is renewable energy. Carbon management was first proposed as "geoengineering," a label it now shares with

proposals to engineer the global climate, for example, by injecting aerosols into the stratosphere to reflect solar radiation and cool the earth's surface. Many environmentalists hold a reasonable distaste for large-scale technical fixes, arguing that it would be better to use energy sources that do not require such massive clean-up efforts.

Carbon management is a promising technology, but it remains unproved. And caution is certainly wise: the history of energy technologies is littered with options once touted as saviors that now play at most minor roles (for example, nuclear energy). Exploring the potential of either carbon management or renewable energy will require political and economic action now—that is, greater support for basic energy research and carbon taxes or equivalent policy measures that give firms incentives to develop and commercialize innovations that reduce emissions at a reasonable cost. It may be that carbon management will allow the world—at long last—to make deep cuts in carbon dioxide emissions at a politically acceptable cost. Indeed, for the next several decades, carbon management may be our best shot at protecting the global climate.

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