

Stick it Where??--Public Attitudes toward Carbon Storage

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ABSTRACT

The fossil energy cycle continues to impose a large number of significant effects on health and the environment. The release of carbon to the atmosphere is one of the major concerns. Efforts to reduce and atmospheric carbon releases should be pursued with an awareness of the objectives of environmental organizations (and to a less-organized degree, the general public) to continue to reduce all of the major impacts associated with our dependence on fossil energy.

Expanded reliance on efficiency, renewable energy sources and lower-carbon fuels are the methods favored by nearly all environmental groups to reduce atmospheric carbon releases. Carbon storage has received little attention to date in most of these groups. Their reaction to the concept will certainly include attention to the economic and technical viability of the approach. For example, groups will object to carbon separation methods that involve a significant energy penalty--both because such a penalty increases upstream impacts associated with extraction and transportation of fuels and because a large penalty increases the moral hazard posed by potential non-trivial leak rates from carbon storage sites. And nearly all groups will react negatively to consideration of the ocean as a storage site.

However, a likely larger challenge for carbon storage proponents will be to convince environmental groups and the public that the storage option will not crowd out continued emphasis on efficiency and renewables as response measures.

Equally important will be avoiding a syndrome where a carbon storage research program is used as a rationale for delaying adoption of policies to achieve near-term reductions in carbon emissions. Thus, if increased expenditures on carbon storage come at the expense of support for efficiency and renewables, the likely reaction of environmental groups will be to oppose carbon storage. Similarly, some groups are likely to suspect that fossil energy firms' support for the storage concept is a gambit to slow down changes in policy rather than a serious response to global warming.

Stated positively, to maximize the possibility of a neutral or positive reaction from environmental groups to expanded carbon storage research, proponents should embrace a policy that pursues a portfolio of responses, including continued support for efficiency and renewables. In addition, environmental groups are likely to view storage research more positively to the extent that they perceive the option as a means of garnering support for policies to achieve deeper and faster reductions in atmospheric carbon releases than otherwise would be possible.

Stick it Where??--Public Attitudes toward Carbon Storage

Thank you for inviting me to talk about the attitudes of environmental groups and the public to storing carbon emissions from fossil fuel use. As we know, there is increasing interest in government and the private sector to develop carbon storage as a technique for mitigating man-made climate change. However, there is little awareness of the technique among environmental groups and almost no awareness in the general public. While there are a number of technical problems that must be surmounted if carbon storage is to be a viable element of a climate change response program, equally important is an understanding of the conditions for public support of a significant carbon storage program. A failure to evaluate the dimensions of public reaction to a proposal for a large-scale carbon storage program could be as damaging to the concept's prospects as a failure to address major technical aspects of a storage program. In my opinion the private sector and the new administration in Washington are making large errors in this regard.

The public and environmental groups will view the issue of carbon storage through the lenses of energy policy and environmental policy. By developing an energy "plan" that emphasizes increased production of some of the dirtiest fossil fuels at the expense of efficiency, renewable energy sources and environmental protection, the administration and its industry supporters are creating controversy that will spill over and affect all proposals that are promoted by the same coalition of forces, including carbon storage. The very thing that makes carbon storage attractive to many professionals in the energy industry, government and some academic departments—the ability to continue use of cheap and abundant fossil fuels, particularly coal—will be seen as a negative feature by environmental groups and the public unless the government and business change their approach. If more coal use means more overall environmental and health damage and less reliance on efficiency and renewable energy sources, then environmental groups will fight any concepts that enable that future, including carbon storage, and the public will at best be conflicted.

Before discussing some of the technical and programmatic concerns with various carbon storage options, I want to explain why it is important to pursue carbon storage as part of a portfolio of carbon management efforts. The environmental community, and to a lesser extent, the general public, holds the view that the life-cycle impacts of fossil fuel use as our principal energy source are large and harmful. There is good reason for this view: it happens to be an historical and current fact. While techniques have been developed to reduce the impacts of fossil fuel use, they have been deployed too sparingly. And there is good reason to believe that there will be a significant irreducible minimum environmental impact from fossil fuel use in the future.

Accordingly, it is safe to generalize that the environmental community advocates an energy future that relies much more on maximizing efficiency and increasing our use of renewable energy resources. With thoughtful policies, I believe that many in the environmental community can be convinced that some significant reliance on fossil fuels is plausibly compatible with our health and ecosystem protection aspirations. But under the best of circumstances, the attitude toward fossil fuel enabling technologies like

carbon sequestration will be cautious. And we are not operating today in the best of circumstances. Quite the opposite, energy policy has become one of the most polarizing issues on the national scene today.

While carbon storage techniques are applicable to any carbon-containing fuels, including biomass fuel, I will focus on coal in my remarks because I think the full life-cycle impacts of coal use demonstrate best the need for a multi-pronged effort to address the effects of our energy system on climate change. Let me start with a reminder of the obvious: carbon emissions from coal combustion are an important impact but are only one impact of coal use in our economy. The stream of impacts begins with extraction and includes transportation, conversion, and “disposal” of wastes, both solid and gaseous.

People who are concerned about expanding our reliance on coal hold those views for a number of reasons, starting with the impacts of coal extraction on the landscape. According to government statistics, coal mining has contaminated more than 12,000 miles of US streams and rivers from heavy metals, acid mine drainage and polluted sediments. These long-term sources of pollution kill fish, vegetation and wildlife. Some of these wastes can persist for centuries. Over the last 30 years, only half of the millions of acres of land that coal mining has disturbed have been reclaimed to even minimum standards. More than 264,000 acres of cropland, 135,000 acres of pasture, and 128,000 acres of forest have been lost. The potential cost for cleaning up spoiled lands runs in the tens of billions. More recently, the practice of mountaintop removal has galvanized more communities into opposing destructive mining practices. Coal companies throughout Appalachia are removing entire mountain tops to expose the coal below. The wastes are generally dumped in valleys and streams.

Mountaintop removal mines use very large explosive charges that shake and crack homes, destroy wells, and roll huge rocks onto people’s homes, cars, property, and public roads. In some areas, residents are concerned about having their children wait outside for the school bus. In West Virginia, more than 300,000 acres of hardwood forests (half the size of Rhode Island) and 1,000 miles of streams have been destroyed by mountaintop removal strip mining. Just one mountaintop removal mine can denude up to 10 square miles and pour hundreds of millions of tons of waste material into as many as 12 ‘valley fills.’ Some of these ‘valley fills’ are 1,000 feet wide and a mile long. Many of these practices run in direct opposition to the Surface Mining Control and Reclamation Act, which Congress passed in 1977. In October of 1999, a federal judge ruled that entombing streams under millions of tons of earth violates the Clean Water Act and federal coal mining law. However, state and federal agencies, often staffed by former coal industry workers, have done little to enforce these laws. And last month an appeals court ruled that citizens could not enforce the mining law in federal court, sending them back to the tender mercies of the state courts.

Even potentially more benign methods of extracting coal-related energy, such as coal-bed methane, are being brought into disrepute due to shortsighted practices by industry. Rather than manage these operations with care, too many coal-bed methane (CBM) are operating like get-rich-quick artists, creating unnecessary damage to the land and rivers.

Instead of handling the wastewater from the CBM process carefully, producers are often just dumping it on the ground and into rivers and streams, producing a campaign of citizen opposition that might never have occurred had they incorporated wastewater management into their business plans. Other effects of current practices include toxic hydrogen sulfide leaking into streams, smoldering underground fires, and methane jets spurting above ground. Boaters paddling down the popular Animas River in the Colorado's San Juan Basin are greeted with signs that read: "Danger. Harmful levels of hydrogen sulfide are seeping from the ground in this area," adding that the highest concentrations "can cause eye and lung irritation, along with headaches and nausea even with brief exposure."

Western ranchers, frequently at odds with environmentalists, have been some of the first and loudest critics of coal bed methane mining. Some have seen artesian wells dry up after producing thousands of gallons a minute for generations. Others have seen pine and cottonwood trees die near their homesteads. In Wyoming, ranchers claim that high-sodium water from coal bed mining dumped into the Powder River has prevented them from using its waters to irrigate alfalfa and hay for their cattle.

Before mentioning air pollution, let me touch on land and water impacts from the disposal of solid coal combustion wastes. Management of these large-volume wastes leaves much to be desired and new citizen groups have formed just to reform how coal combustion wastes are handled. More than 75% of the scrubber sludge and coal ash is dumped into quarries, lagoons, unlined landfills and abandoned mines with too few safeguards. On average, that dumping amounts to over 100 million tons a year. Waste created by a typical 500-megawatt coal plant contains more than 125,000 tons of ash and 193,000 tons of sludge if the plant is scrubbed for sulfur.

Despite the fact that the wastes contain a witches' brew of heavy metals like lead, arsenic, cadmium, selenium, chromium, molybdenum, beryllium, and other toxins, these wastes are exempt from hazardous waste handling rules, thanks to effective industry lobbying in Congress and before the EPA. EPA officials don't know even such basic information as the number or location of most dumps taking the power plant wastes. And they haven't made an effort to find out, even though the number of dumps is estimated at 600.

The anecdotes are not pretty. Waste from a North Carolina coal plant dumped into Lake Belews reportedly has wiped out 16 of the 20 fish species in this popular fishing site and made two of the remaining species sterile. In Texas, the state recently began warning people not to eat fish caught at three popular recreation areas after toxic levels of selenium from ash dumped by nearby coal plants contaminated the fish. And in Indiana, Illinois and North Dakota, high sulfate and chloride levels in once-drinkable ground water near power plant dumpsites have made the water saltier than seawater. However, industry lobbyists again pressured EPA last year into abandoning plans to improve management of these wastes, just two months after the EPA Administrator told Congress her agency would upgrade regulation of power plant wastes. As with other battles, these

short-term “victories” for the coal industry have just created new cadres of citizens who associate coal with harm to their health and the environment.

Air pollution from coal has been notorious since well before the time of William Blake’s “dark satanic mills.” While we have technology to significantly reduce conventional pollution from current coal plants, most of today’s generators have evaded clean-up, legally or illegally. As a result, coal-fired power plants are responsible for two-thirds of U.S. sulfur dioxide pollution, about one-quarter of nitrogen oxides pollution and about one-third each of mercury and carbon dioxide pollution. Seemingly not content with these statistics, the coal industry is lobbying Congress and the administration for further exemptions from clean air laws.

In a particularly shortsighted effort, the coal industry has drafted bills, now pending in the Senate, that provide for sweeping new exemptions from the Clean Air Act, ironically under the banner of “clean coal technology.” But the technology specifications that make a plant eligible for both taxpayer subsidies and clean air exemptions under these bills are clean only in an Orwellian sense. The bills do not require projects to meet state-of-the-art emission performance standards even for conventional pollutants, let alone carbon dioxide. Indeed, projects are eligible for subsidies and clean air waivers even if they increase air pollution. For example, clean air provisions are waived if a project simply produces “coal combustion byproducts that are capable of obtaining economic values significantly greater than byproducts produced on the date of enactment of this Act.” Those of you who are taxpayers may wonder why you should help pay for a project that provides “significantly greater economic value” to the investor to start with. Those of you who are breathers may wonder why a clean air exemption is appropriate.

The coal industry and the administration seem to think that by labeling a proposal “clean coal,” they will garner political support for coal expansion policies. I think this indiscriminate mislabeling is quite shortsighted. Coal is already associated with pollution and harm to the landscape; when the facts about alleged clean coal projects are disclosed, coal advocates will be associated with dishonesty as well. By applying the label “clean” to every coal project, the industry and the government will cause the few programs that really do deserve that label to be dismissed as propaganda.

If the coal industry wants to nurture an objective, perhaps accepting, attitude toward advanced coal technologies like gasification and sequestration, it must find a way support more rapid and more effective improvements in the environmental performance of the coal cycle, from extraction, through combustion and disposal of wastes. And it must discipline itself to reserve the term “clean coal technologies” to concepts that fit that description in fact. Government agencies and private researchers have important roles to play in this regard. Both publicly and behind the scenes, these institutions can send a message that the industry needs to build credibility through actions other than buying feel-good television and magazine ads. Actual improved performance and public industry support for pro-environmental policies will be much more effective in persuading the environmental community and the public that the coal industry and a healthy environment can coexist.

We are very much on the wrong track with the “clean coal technology” program in my view. The program had its origin in the mid-1980s as a means of diverting growing political support for a federal acid rain control program. It was effective in delaying enactment of an acid rain law by about five years. So-called “clean coal” grant programs have consumed several billion dollars of taxpayer money, much of it on projects of marginal to no value in my view. Now President Bush is advocating another \$2 billion subsidy to coal projects, with eligibility criteria so lax that much of this money will be wasted if it is appropriated. Worse still, the administration proposes to find these funds by cutting back support for efficiency and renewable energy programs.

President Bush’ budget would cut all but one energy efficiency program at the Energy Department. The lone exception is a proposal to increase spending on home weatherization – laudable in itself, but no justification for the other cuts. All other efficiency programs would be slashed by \$180 million –nearly 30 percent. The effect would be to cripple efforts to develop new efficiency technologies for buildings, industries, and transportation.

This past Saturday, President Bush said his plan would include new appliance efficiency standards and other measures to save energy but his budget would cut funding for setting appliance efficiency standards by more than half, from \$9.4 million to \$4.4 million. Deep cuts of up to 48% are also made in funding for improving state and local building codes, and for R&D in the building and industry, and transportation sectors.

The president’s energy budget also would chop nearly \$100 million from renewable energy programs. It would cut more than \$84 million – nearly 50 percent – from funds for better solar, wind, hydropower, and geothermal technologies, which would help meet our energy needs with virtually no pollution.

Energy Secretary Spencer Abraham says the president’s budget would merely cut programs that have not produced a good return on investment. But the Energy Department’s standards for appliances, heating and cooling equipment, and other energy-guzzling machinery already have saved consumers and businesses some \$180 billion over the last two decades – more than \$200 for every dollar of federal money spent to develop them. In addition, Energy Department research has helped cut the cost of wind power by 10-fold, from 40 cents per kilowatt-hour in 1980 to 4 cents today. It is difficult to imagine more productive investments, or any that provide such positive returns for the environment.

Judged by the index of CO₂ pollution, the new administration is striking out every time it comes to the plate. In addition to a CO₂–maximizing budget proposal, the administration recently rolled back a new air conditioner efficiency standard set by the Clinton administration. The weaker substitute standard will cost homeowners \$730 million a year in higher electric bills. The extra electricity required by less efficient air conditioners will require nearly 50 new power plants by the year 2020. And over the

next two decades, the power plants generating the extra electricity will emit nearly 67 million more tons of CO₂ pollution.

Before the air conditioner rollback, the President hit into a double-play, in one letter that reneged on a campaign promise to control CO₂ from power plants and that walked away from the negotiations to develop acceptable rules for the international Kyoto global warming agreement. He took both of these actions with no analysis. I repeat, with no analysis. This fact is remarkable, given the importance of these actions. Even though his Secretary of State had sought and received from our allies, a delay in the next round of Kyoto negotiations so that a policy review could be conducted, the president announced his rejection of Kyoto with the review barely underway. His action on power plants did not say that proposed limits on CO₂ were too steep or too rapid—he simply declared them bad as a policy matter, again without asking his administration to conduct any analysis.

The coal industry reportedly worked very hard to pressure the administration into these hasty decisions on CO₂ and the industry is now aggressively lobbying for another anti-environmental policy. On May 3, to great fanfare, the National Coal Council submitted a “report” to Secretary Abraham urging a reversal of policy on enforcement of Clean Air Act pollution control requirements for modified power plants. While the National Coal Council is a federal advisory committee and thus subject to a requirement for balance, about 80% of its members represent coal producers, coal shippers or coal-burning electric generating companies. The report it issued was in fact a three-page executive summary of a report not yet completed. Why the haste? Because the Coal Council wanted to get a recommendation from an apparently public-minded advisory body into Secretary Abraham’s hands before the administration’s energy plan went to the printers.

The Council’s recommendation was that the government should adopt an interpretation of the Clean Air Act that would allow old, grandfathered power plants to upgrade their generating equipment without being subject to requirements to install more advanced pollution controls, even if the upgrade projects would increase emissions. To produce this recommendation, the Coal Council assembled a special panel that included five electric companies that have been sued by the Department of Justice and a number of states and environmental groups, including NRDC, for making precisely these types of upgrades without controlling emissions. This panel apparently felt comfortable in assigning the lead author responsibilities to an individual who just happens to be a lawyer representing one of the defendants in these cases. Not surprisingly, the draft report and its conclusions read very much like the defendant’s briefs.

In the normal course of affairs a judge would resolve legal disputes like these but coal industry lobbyists are attempting to prevent this by pressing for the administration to pull the plug on these cases. Vice-president Cheney has announced that EPA will be directed in the administration energy plan to review the program and reportedly the Department of Justice will be instructed to review the pending cases themselves. Such a step would represent a startling interference by the White House with enforcement of the law.

I mention this catalogue of developments to demonstrate the obstacles that exist to a cooperative effort to explore broad new approaches to reconciling coal use with the health and environmental objectives of our country. Programs to develop carbon management strategies that are predicated on the continued use of coal cannot focus just on the technical aspects of those management options. Program participants must pay as much attention to how the policy process is managing the entire chain of impacts associated with coal use. If this is not done, the efforts of all of you to develop effective carbon management options for coal will encounter opposition and controversy that result from the confrontational approach to energy policy that we find ourselves in today.

Having made these points, I will offer some of my thoughts on the carbon storage concept itself. First, a note on terminology: I use the term “storage” rather than “sequestration” because the permanence implied by the latter term presupposes the outcome of the research effort that remains ahead. It may well be shown that some storage approaches are sufficiently permanent to deserve the term “sequestration” but public confidence in the objectivity of the investigators will be enhanced if we avoid prejudging the issue.

A major emphasis on reducing the energy penalty associated with capture and handling of CO₂ is warranted for at least two reasons. First, a large energy penalty means more tons of coal must be extracted and transported, with the impacts I have sketched earlier. Second, a large energy penalty increases concerns about even modest leak rates from storage sites. Unless there is a robust proof that nearly all CO₂ will remain in storage sites for the hundreds, perhaps thousands of years that elevated atmospheric CO₂ concentrations may persist, a significant energy penalty will mean that we are transferring our CO₂ emissions and their negative impacts to future generations.

Next, a word on the type of storage that should be explored. In my opinion, the program scope should be limited to geologic storage sites beneath land masses. With respect to Howard Herzog, whose work is impeccable, to the extent I am competent to judge such matters, I think it is a mistake to carry out further experiments on ocean disposal of CO₂. Environmental groups will have profound misgivings about both the effectiveness the ocean as a storage medium and the impacts on ocean ecosystems of large-scale CO₂ disposal. Particularly in the early years of developing untried approaches to environmental management, the environmental community and at least some sectors of the public will be concerned that a research program will be a “camel’s nose under the tent,” leading to pressure for deployment over their objections. If ocean disposal remains part of the carbon storage program agenda, I believe concerns about that option will spill over onto the land-based geologic disposal program as well. To be candid, most environmental advocates do not have a basis to trust either of the principal institutional advocates of carbon storage programs: the private sector energy firms or the Department of Energy. Taking ocean disposal off the table would be an important confidence-building step. I understand this may be easier said than done, particularly given the high interest the Japanese government has in the ocean option. Nonetheless, my advice is to focus on land-based options.

A great deal of care must be taken with the program to characterize land-based storage sites. Environmental groups and likely the public will want assurances that our information about storage sites is comprehensive and the potential for surprises has been minimized by well-designed research and exploration programs. Efforts should be made to produce information that explains to policymakers and interested lay readers why we should have confidence that the answers provided by proposed research and development programs will be comprehensive and reliable. More important, such explanatory materials should be reviewed by independent experts with no interest in the success of the effort to assure that the assertions in the materials have a solid basis.

Performance criteria need to be set both for storage sites and, perhaps more important, for the site characterization protocols used to determine whether particular sites will meet performance criteria. Because these are highly technical undertakings, it will be challenging to provide useful information to lay persons about these efforts. The government institutions that are given responsibility to set performance criteria must be perceived as lacking a conflict of interest. While the Geological Survey and the Department of Energy must be involved in these programs, I believe the Environmental Protection Agency must be given authority to decide on performance criteria. This may be seen as a bias on my part but I think it is a bias the public and environmental community will share.

To conclude, I want to go back to the broader context that will shape the reaction of the environmental community and much of the public to carbon storage proposals. There are a number of conditions that I believe could promote a positive attitude by environmental groups to a carbon storage program. First, we will ask whether a bigger carbon storage RD&D program will increase the prospects of early commitments to meaningful constraints on greenhouse gases or the opposite. If a carbon storage program is perceived as likely to be used by industry or government as a justification for additional delay in making a strong policy commitment—this is how the “clean coal technology” program was used in the 1980s—then environmental groups will work against it. But let’s suppose industry leaders and government were to acknowledge that the threat of climate change warrants immediate commitments to reduce emissions below business as usual in the near term, combined with deeper reductions in succeeding periods and that they proposed carbon storage as a means of achieving such deeper reductions. This is a scenario that would likely encourage a positive attitude to carbon storage from environmental groups.

Second, environmental groups will be concerned about the impact of the carbon storage option on other approaches that we believe must be major elements of a sound response to climate change: increased reliance on energy efficiency and renewable energy sources. If carbon storage is seen as likely to be embraced by industry lobbies as the silver bullet that allows policymakers to ignore efficiency and renewable energy programs, then the environmental community will oppose it. But if industry and government give not only lip service to efficiency and renewable energy but also apply their considerable political muscle to increasing the resources dedicated to these other programs, then an interesting coalition might be formed: a coalition that advocates increased support to a portfolio of

approaches, including advanced coal gasification, carbon storage research, along with incentives for efficiency and renewable energy. Not only would such a portfolio enhance the political support for carbon storage, it would also enable a more parsimonious use of whatever sites might be proven acceptable for carbon storage by reducing the volumes of CO₂ that needed to be stored.

As I have sketched above, the events of the year 2001 up to now have not moved us in the right direction in our search for a policy that can be broadly supported by industry, government, environmental groups, and the public. And the administration's energy plan is likely to intensify controversy. But the ingredients for agreement are discernible. What we need is the wisdom and vision to assemble those ingredients into an approach all can support.