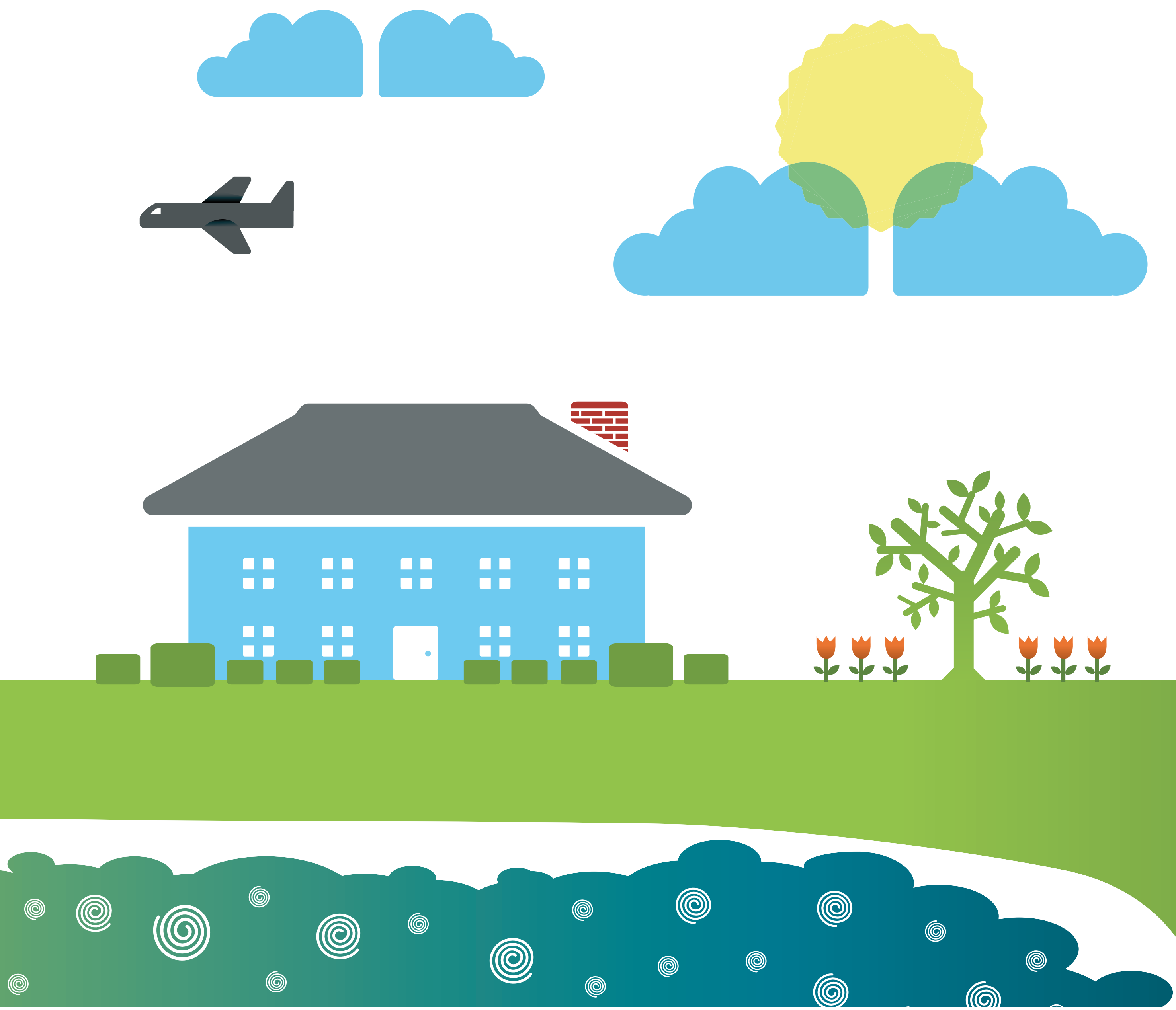
Capturing and Storing Carbon

Risks and Liabilities

By Frederick R. Eames and Brent Fewell

ACHIEVING THE DRAMATIC reductions in greenhouse gas emissions contemplated by pending legislation will require drastic changes in energy production and consumption. Managing the legal liabilities and risks associated with the development of new energy technologies will be key to the success of any climate change program. This is illustrated by the debate over carbon capture and storage (CCS).

The United States generates about half of its electricity by burning coal, and it has more than a 100-year supply at projected consumption levels. Because coal emits more carbon dioxide per BTU than other fossil fuels, many believe that use of CCS technology to separate the CO_2 from coal plant emissions, compress it into a liquid state, and then pump it underground for long-term storage, will be critical to a reliable and affordable supply of electricity. This article explores the legal liabilities and risks that create barriers to the development and deployment of this important technology.



MAJOR HURDLES

New coal-fired generating plants will be needed to satisfy increasing demand for electricity. There is substantial opposition, however, to building new plants that cannot accommodate CCS technology to prevent carbon dioxide from entering the atmosphere. But, as Duke Energy CEO Jim Rogers observed recently, "CCS as a magical technology that solves the carbon problem for coal plants is oversold ... There is a lot to learn, and it is going to take longer to figure it out than we think."

The hurdles to commercial use of CCS include technological, cost, regulatory, and liability issues.

The technology exists to capture, compress, transport and store CO_2 underground, but these processes have never been integrated. For commercial-scale application at a power plant, challenging technological issues exist at each step. For example, simply removing the CO_2 from the gas stream currently requires almost one-third of the plant's electricity output.

Once captured, the corrosive nature of liquefied CO_2 could require construction of a new pipeline system to transport it to underground injection sites. Storage of CO_2 in deep saline and other suitable formations would be on a scale dwarfing any prior experience in the context of enhanced oil and gas recovery. For comparison, the 2006 federal Toxics Release Inventory reported

236 million pounds of underground injections of all types. By contrast, a single average-sized coal-fired power plant (500 megawatts) will produce some 6 billion pounds of CO_2 annually. The United States has the equivalent of 630 such power plants.

CCS is expensive. Since one-third of a power plant's energy is needed to operate a CCS system with current technology, if CCS were installed universally today, a 16 percent increase in U.S. electricity production would be needed just to break even. Assuring the long-term integrity of underground storage sites will entail additional and largely unknown costs.

A variety of state and federal regulatory regimes complicate construction and operation of CCS facilities. For example, who owns the "pore space" in the deep geologic formations where the CO_2 would be stored, the surface owner or a subsurface owner? Is eminent domain authority available for construction of CO_2 pipelines across private property, and for sub-surface storage rights? Will the lead regulator for CCS-equipped plants, pipelines, and the injection and storage process be state or federal?

The premise for CCS is that CO_2 injected underground will remain there long-term. If it escapes, who is liable for property damage or other impacts? What if CO_2 migrates underground and contaminates water or oil and gas reserves? How does one calculate this liability?

TECHNICAL CHALLENGES

When mixed with water, CO_2 forms carbonic acid, which is corrosive and can compromise the integrity of traditional pipeline materials. During the capture and transportation of CO_2 to underground injection sites, the principal risks are pipeline or other technology failure and unanticipated CO_2 release.

If that does occur, the likelihood of harm to human health or the environment is low. The principal liability would be the cost of acquiring CO_2 credits or allowances to cover the unanticipated release. This is a risk that can be allocated through commercial contract terms.

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In contrast to the manageable risks of CO_2 capture and transportation, underground storage of massive quantities of CO_2 is an untried concept, raising a host of new issues. When CO_2 is injected into deep saline formations, the pressure differs dramatically depending on the characteristics of the underground formation. Depending on pressure, injected CO_2 will displace saline waters and minerals.

For example, the plume from 50 years of CO_2 injection from a 1,000 megawatt power plant could stretch 40 to 100 square miles. Some have expressed concern that migrating CO_2 could foul valuable mineral resources, cause pollution of underground freshwater aquifers by mobilizing metals, or occupy valuable storage space.

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This raises a whole host of legal and liability issues regarding impacts on subsurface water and minerals, and who would bear the liability for such impacts. How does a facility operator obtain property rights that address mineral displacements that stretch under perhaps thousands of surface owners?

As another example, consider that carbon dioxide is heavier than air. A CO_2 leak that pools in a low area could result in injury to the environment. Some think that pressure from injections could cause land to heave or subside, or trigger seismic events. Swiss homeowners claimed significant damages from seismic activity induced by injections for a geothermal project in 2006.

Property rights are the traditional province of the states. State law differs in critical respects as to sub-surface ownership, eminent domain, and other property rights, including what standard of liability applies. For example, to the extent that CCS is considered an abnormally or inherently dangerous activity under state law, a strict liability standard would apply in some states, meaning liability for damage associated with CO_2 releases would attach regardless of fault.

Because CCS is a key element of achieving federal climate change goals, the federal government will play an important role in resolving the uncertainties and risks created by state regulation in the future. However , the current federal regulatory structure already creates significant risks and liabilities for CCS technology. The Safe Drinking Water Act requires EPA to develop minimum federal standards for states to protect underground sources of drinking water through the Underground Injection Control program.

In addition, it provides EPA with broad emergency authority under certain circumstances to mitigate the risks of any "contaminant" that may enter an underground source of drinking water and that presents an "imminent and substantial endangerment" to human health. The term "contaminant" includes any physical, chemical, biological, or radiological substance or matter in water. This could include CO_2, any materials in the compressed CO_2 gas that is injected, or any subsurface materials that may be displaced by the injection of CO_2.

The Superfund law (CERCLA) imposes strict, joint, and several liability for "releases" of "hazardous substances." While CO_2 is not a hazardous substance by current definition, the Supreme Court's decision in Massachusetts v. EPA could lead the EPA to regulate CO_2 emissions under the Clean Air Act, which in turn could lead to liability under CERCLA for CO_2 releases. CERCLA provides for remediation in the case of releases, with cumbersome liability allocation and related litigation.

The storage and disposal of "hazardous wastes" are subject to The Resource Conservation and Recovery Act (RCRA). Although CO_2 is not currently regulated as a hazardous waste, the compressed CO_2 gas that is injected could contain small concentrations of other constituents that are subject to RCRA.

If RCRA is triggered, the government can compel remediation through that law's corrective action program, and citizens can file suit in situations that "may present an imminent and substantial endangerment to health or the environment."

The challenge for the federal government in the coming years will be to reconcile and simplify the many and often-conflicting federal and state legal regimes.

POST-CLOSURE LIABILITY

Since injection of CO_2 is to be permanent, CCS project proponents are interested in knowing who will be liable after closure of the CO_2 injection well, both in the initial post-operation closure period—10 to 30 years—and in the longer term, potentially hundreds of years. The uncertainty surrounding these liabilities has been rated by utility executives, financiers, and project developers as among the top current impediments to building a coal plant with CCS.

With proper site evaluation and engineering, the risk of a catastrophic event associated with operation of a carbon storage facility should be low. Furthermore, risks associated with underground injection of CO_2 will decline over time, as the CO_2 plume settles and mineralizes underground. But the market's appetite for covering the risk also will decline with longer periods of exposure. Private institutions will not set aside reserves over geologic time. Should a catastrophic event occur, liability could stretch beyond the capacity of risk management tools currently available in the markets, such as insurance and bonds.

In comparable situations where the market could not absorb enough risk to encourage private parties to undertake socially desirable activity, the government itself has stepped in, either by limiting liability or agreeing to cover the liability itself, as in the case of the Terrorism Risk Insurance Act. In order to promote financing of CCS projects, some have proposed two layers of government intervention, such as a modest charge on fossil fuels or energy output to capitalize a fund to cover potential CCS liabilities in the initial post-closure period, and a federal liability limitation to address catastrophic events over the longer term. Until there is a track record of safe storage of CO_2 in deep saline formations, the government may need to play a role to induce investment in CCS technology.

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How to finance and encourage development and deployment of CCS technology is an important issue in the legislative debate over climate legislation. Most proposals would divert a significant amount of the revenues derived from the auction of CO_2 allowances to fund CCS development and deployment.

But with respect to risk mitigation, the proposals are much more varied. Some would create authority for a federal agency to reconcile conflicting regulatory mandates, while others would authorize special insurance funds or liability caps to address long-term liabilities. Until both financing and critical risk and liability issues are resolved comprehensively, the promise of CCS technology will not be realized.

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Both authors represent the CCS Alliance, a group of entities working to assess and resolve CCS risk and regulatory issues.