Bridging the Finance Gap for Carbon Capture and Storage

January 2016

Introduction

The most recent report from the Intergovernmental Panel on Climate Change warned that, if GHG mitigation efforts are not undertaken, climate change could have pervasive and long-lasting impacts that include more frequent severe weather events, overall decreased agricultural yields, and flooding of coastal areas due to sea-level rise (*1*). The Third National Climate Assessment indicated that these impacts are already being felt, with the Northeast experiencing more extreme precipitation and the Southwest experiencing more droughts and wildfires (*2*). Business interests have also started to recognize the costs of delaying action on climate change. In its report, the Risky Business Project, a group which focuses on quantifying the economic risks of climate change, identified damage to coastal property and infrastructure, climate-driven changes in agricultural production and energy demand, and the impact of higher temperatures on labor productivity and public health as the most significant risks to businesses (*3*).

The implications of climate change are even being considered by the intelligence and defense communities, which have concluded that climate change could foster political instability by exacerbating competition for scarce resources (*4*).

While the U.S. and other industrialized countries are responsible for the majority of cumulative GHG emissions, the adverse effects of climate change will likely fall disproportionately on developing countries, which lack the financial resources and infrastructure required for adaptation (*1*).

A final incentive to adopt GHG mitigation measures is averting so-called “tipping points,” which are temperature thresholds that may lead to irreversible, large-scale changes, such as melting of Arctic sea ice and extinction of a large percentage of marine and terrestrial species (*5*). In this context, climate change mitigation can be viewed as an insurance policy to reduce the probability of worst-case scenarios (*5*).

Stabilizing GHG emissions requires reducing emissions from the transportation, industrial, residential and commercial, and electric power sectors. Many policy initiatives have focused on decarbonization of the power sector. Not only did it account for 28 percent of U.S. CO_2 emissions in 2013, making it the single largest CO_2 source, but it is also the most cost-effective sector to decarbonize, due to the number of low carbon electricity generation options available (*6*). The Energy Information Administration forecasts that in 2040, coal and natural gas will still provide 65 percent of U.S. electricity generation (*6*) Globally, it is estimated that coal and natural gas will constitute 55 percent of electricity generation in 2040 (*7*).

The implication of using coal and natural gas to meet energy demand in the next two decades is that much of the electricity-generating infrastructure and its associated emissions will be locked in, since large power plant installations are capital-intensive and long-lived.

TECHNOLOGY OVERVIEW

TECHNOLOGY STATUS

Demonstration projects that integrate CCS elements in a large-scale power plant facility are still in the early development phase, with SaskPower's Boundary Dam in Canada the first such project to become operational in October 2014 (*15*). As of February 2014, there were 21 active, large-scale CCS projects globally that collectively stored 40 Mt CO_2 per year (*16*), which amounted to only 2 percent of all CO_2

COSTS

TECHNICAL CHALLENGES

Research

TAX CREDITS

The Energy Policy Act of 2005 established tax incentives for CCS by adding Section 48A, which provided tax credits for advanced coal projects (defined as capturing and storing at least 65 percent of CO_2 emissions) and Section 48B, which provided tax credits for coal gasification projects (*38*). In addition, the Emergency Economic Stabilization Act of 2008 established the Section 45Q CO_2 sequestration credit, which amounted to $20 per metric ton of CO_2 stored in a saline formation and $10 per metric ton of CO_2 injected for EOR (*38*). To qualify for these tax credits, CO_2 emissions had to be measured at the source of capture and verified upon disposal or injection (*38*).

From FY 2006 through FY 2018, these tax credits are estimated to cost the federal government $2.3 billion; however

RECOMMENDATIONS

If the U.S. is to meet the program goal of cost-effective commercial deployment of CCS by 2025 and retain its standing as a global leader in CCS, the country needs policies to incentivize private investment and maintain deployment momentum in light of recent setbacks. It

Consider establishing a regulatory framework for CO_2 storage liability during the demonstration phase in which the federal government assumes liability after site closure and

While increased funding is difficult, two factors would make it more feasible. First, Congress has previously authorized funding for CCS that went unspent, due to technical and cost uncertainties that are to be expected for a technology in the demonstration phase. In addition, CCS has the potential to draw bipartisan support, because it has backing from both industry and environmental groups.

C. FOR STATE GOVERNMENTS

Consider low carbon portfolio standards to support the development of CCS along with other low carbon options.
A low carbon portfolio standard that mandated a certain percentage of electricity from low carbon energy sources, which would include not just fossil-fuel power plants equipped with CCS but also renewables or nuclear, would put CCS on equal footing with other low carbon energy sources. The renewable portfolio standard, which mandates that a certain percentage of electricity come from renewable energy, was instrumental to the development of the wind industry in the U.S., and a low carbon portfolio standard could prove equally critical for CCS. In addition to allowing CCS project developers to secure rate recovery for their investments, low carbon portfolio standards could allow states to comply with EPA regulations.

D. FOR CCS FINANCERS

Adopt a standardized model for quantifying the carbon storage liability risk so that it can be equitably allocated.
In order to allocate the risks posed by long-term CO_2 storage, a standardized methodology for calculating risk profiles for each storage site needs to be adopted by the project finance community. The ability of CCS financers to assess and price risk has been proven in other industries where there are low-probability, high-impact risks, such as the oil industry. A similar mechanism can be adapted for CCS. The results of one financial simulation model, which was based on standard risk assessment approaches used in the finance and insurance industries, indicated that the carbon liability risk amounted to less than 0.4 percent of the total estimated cost for a proposed CCS project (*46*).

***Develop tax equity financing strategies that allow firms to more effectively utilize carbon sequestration tax credits*.**
While tax credits are likely to be the easiest way for Congress to provide policy support for CCS, the low tax burdens of many CCS project companies means that these tax incentives are likely to have little impact. Therefore, there is an opportunity for CCS financers to develop strategies that allow CCS project companies to form partnerships with so-called tax equity investors, who do have sufficient taxable incomes and are able to utilize these tax credits (*12*).

E. FOR CCS PROJECT DEVELOPERS

Seek out creative business models that allow multiple revenue streams.
Having a diversified revenue stream reduces dependence on government subsidies and increases a project's chance of succeeding. NRG's Petra Nova CCS Project, which essentially allowed new infrastructure at an existing power plant to be paid for with additional oil production from the use of CO_2 for EOR, is an excellent example of a creative business model that offers NRG a greater return. This business model could be replicated for other fossil fuel-fired power plants near oil fields and even adapted for other cases where CO_2 can be beneficially used.

This paper was adapted from the work of Kathleen Wu, a chemical engineering graduate of Yale University, under the auspices of AIChE and the Washington Internships for Students of Engineering program.

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