

## Geological Storage Risk Mitigation: The Way Forward

By Brad Handler, Lindene Patton and Siddhant Kulkarni

This paper is the last in a series that identified the operational, financial and business model risks through the lifecycle of a geological storage project. These papers then discussed steps that are being taken to mitigate each risk, as well as to ensure that adequate funds are available to pay for closure and for environmental damages should any occur. In addressing these risks, this series averred that the regulatory landscape appears adequate to address them.

For developers looking to mitigate various business risks, the landscape is still evolving. As was discussed in detail in the *Financial Risk Management* paper, commercial insurance policies covering environmental liability and revenue (credit) reversal risk are emerging. Obstacles remain, however. In part this is because developers appear to be seeking a tenor for policies that differs significantly from normal insurance industry practice. This is aggravating what was already somewhat challenging for insurers given (1) the relative youth of the CCS industry, which accordingly gives the insurance industry little historical/actuarial data to work with; (2) the human and financial capital constraints within the insurance industry; and (3) the relative inexperience — as in, the limited operating history of any sort, let alone in CCS — of approximately 30% of the developers themselves.

The implications for this last point are two-fold. First, newly formed entities are more challenging for insurers to support as operating competency in general is harder to establish. Second, these entities are often seeking to raise funding through Project Finance-type mechanisms; this type of financing is more dependent on an exit strategy, relative to ongoing operating companies, in order to satisfy investors that similarly do not fully understand geological storage.

The landscape for risk mitigation over the very long term is evolving as well. As discussed in the *Long Term Stewardship Risk Mitigation* paper (the *LTS paper*), environmental liability transfer from developers to government is premised on the view that that indefinite retention of liability is a deterrent. Actions taken at the state level in the U.S. have created a patchwork of rules that relieve developers' liabilities to varying degrees and after differing periods following injection site closure.

The *LTS paper* acknowledged the related concern about moral hazard, but argued that the many regulatory requirements, plus the imposition of some form of “tipping fee” on the stored CO<sub>2</sub> to create a Trust, obviates such concerns. The tipping fee creates a pool of funds for a public entity to use for ongoing monitoring and to address any damages associated with CO<sub>2</sub> leakage — the risk

of which should have already declined from the injection period and should continue to decline over time.

This concluding paper considers options to help reconcile these challenges, and so attract more capital, and spur more CCS project development. The recommendations distill to (1) flexibility on the part of developers, for example to work within the insurance industry's constraints, and (2) that the (federal) government should be willing to assume liability, particularly for very long term environmental liability.

The discussion below is organized to first address potential action by project developers, then the insurance industry, and then government.

## WHAT PROJECT DEVELOPERS CAN DO

Developers of geological CO<sub>2</sub> storage have various options to handle the financial risks associated with their projects. As prescribed by either the EPA or states with the authority to approve Class VI-based projects (i.e., have been awarded primacy), developers must establish adequate Financial Assurance (FA) to ensure that sites can be closed and any environmental damage remediated; this FA can be established in various ways, as was discussed in the *Financial Risk Management* paper. As is also discussed in that same paper, a developer also has options to mitigate the revenue (tax or carbon credits) reversal risk to the storage project business model.

To the extent a developer seeks to secure commercial insurance for FA or for revenue credits, then it is incumbent on the developer to work actively with insurers — and to start such engagement earlier in the project development cycle than is typical with infrastructure development projects — to allay insurer concerns.

Further, it appears likely that developers will have to settle for shorter insurance periods. The authors' communications with insurance industry representatives have made it clear that policies with a tenor beyond three years are meaningfully more difficult for insurance issuers (or that longer tenors must be offset by lower capital commitments). That would suggest that developers must accommodate to a model in which they assume the additional risk, including price risk, of having to renew insurance policies throughout the life of the project.

With respect to the impact(s) in the capital markets of having newly formed companies drive project development, further study is warranted. Such study could assess investor conditions and risk tolerance, for example, and thus bring more context to the questions of how much, or what form of, risk mitigation is required.

## WHAT THE INSURANCE INDUSTRY CAN DO

The insurance industry is working to figure out how it can accommodate the requests to help support new climate technologies, including CCS. As noted in the *Financial Risk Management* paper, policies are being introduced by brokers and “provisional” contracts to FA requirements have been placed, but it is as yet unclear how much insurer (and reinsurer) capital is available to support such contracts.

A different sort of example is the ongoing work being done by the Geneva Association (GA), an international body comprised of insurers and reinsurers. The body recently provided project developers (and the insurers themselves) with a framework to evaluate specific insurance options. This [Insurance Readiness Framework](#) addresses the risks across dozens of parameters in seven categories: Technology, Project & Organization, Legal & Financial, Physical (Climate), Business Interruption & Supply Chain, Long Term, and ESG.

At a recent GA forum, members considered the need to educate actors across the ecosystem (but presumably especially project developers) how “to speak” to insurers, i.e. how (and when) to provide insurers with information that allows the insurers to perform due diligence and offer coverage. And the body encouraged its insurer members to collaborate to assist in providing coverage for climate tech innovation, including CCS; one benefit of such collaboration is to help offset the insufficient engineering talent across these insurers, which makes it more challenging for them to perform adequate risk engineering.

Beyond working with developers to manage the new product/technology risks, the insurance industry can participate in raising additional capital, to lessen the constraints in specialty-dedicated financial and intellectual capital described in the *Financial Risk Management* report. One such approach may be to foster development of alternative sources of capital, including Insurance Linked Securities (ILS)<sup>1</sup>, that is tied to or includes CCS. ILS issuance emerged in the mid-1990s, and has been used primarily by insurers to raise funds to support coverage of natural disasters. [ILS buyers have included](#) pension funds, sovereign wealth funds, multi-asset investment firms and funds, endowments, and family offices<sup>2</sup>. Notably, corporates have also issued ILS directly, raising the prospect of a different form of capital markets’ support for CCS projects. The insurance industry, given its ties with alternative capital buyers, can assist in both considering the contours of ILS and facilitating development of initial products.

## HOW GOVERNMENT CAN HELP

The public sector has and continues to provide support to project developers to spur more investment in CCS. The largest program, in terms of breadth and of projects and intended dollar size, is the tax credit offered under section 45Q of the U.S. Internal Revenue Code. More targeted federal government programs include CarbonSAFE, which is seeking to foster storage sites for 50+ million tons of CO<sub>2</sub> from industrial sources, and the Department of Energy’s Carbon Dioxide Removal Purchase Pilot Prize, which is offering CO<sub>2</sub> removal credit purchase agreements worth up to \$35 million.

---

<sup>1</sup> Per a [McKinsey report on the topic](#), “[a]lthough alternative reinsurance capital grew to account for 15 percent of the total reinsurance capital allocation in 2021 — up from 6 percent in 2011 — it remains a largely untapped pool of capital, with alternative reinsurance capital representing less than 1 percent of the global alternative assets under management (AUM)”

<sup>2</sup> It should be noted that the ILS market has underperformed other securities markets over the last few years as the increased frequency and severity of natural catastrophes resulted in losses for investors.

Yet, as discussed in this series, the never-ending retention of liability for developers points to a conflict in policy relative to these supportive measures. Enacting provisions for the federal government to assume such liability post site closure, i.e., for the LTS phase, would be more consistent from a policy perspective — and this paper series argues it can be done in a way that does not compromise the government’s commitment to responsible environmental stewardship.

Within any such arrangement for LTS, the amount of “tariff” or “tipping fee” to fund government’s LTS management Trust can also be considered. As addressed more fully in the *LTS paper*, several states’ tipping fees of \$0.7-\$0.10 do not seem unreasonable given assessments of worst case environmental damages and the benefits of spreading the risk across a portfolio. That said, it is important that any LTS phase structure include provisions to regularly review operating experience across the global CCS industry regularly to help inform if the tipping fees are set correctly, i.e. to not under- or over-fund such a Trust.

Further evaluation of how government might help private actors and the insurance industry address liability coverage, including during operating phases, for CCS projects is warranted. Such consideration could take several forms. Presumably forms of support could include the government being willing to assume “first losses” under certain circumstances and/or losses above a certain limit, including what is available in Funds collected by tipping fees<sup>3,4</sup>. In this way (i.e., creating a tiered liability structure), government could engage in a form of public/private partnership with the insurance industry. As with any form of government assumption of liability, established practice must be deployed to ward against creating moral hazard conditions, as well as to limit the overall amount of government support to what is deemed necessary to catalyze projects.

## CONCLUSION

This series of papers has sought to contextualize the risks in geological storage and to highlight that engineering and financial management practices in place today can substantially mitigate those risks. The degree to which liability “sticking points,” such as securing environmental liability insurance or relieving liability decades after project site closure, will dampen the pursuit of CCS projects is difficult to calibrate. However, to the extent liability is an overhang for projects, the mechanisms exist to provide relief in a way that does not let developers off the hook. Implementing these mechanisms can also send strong messages — to those opposed to CCS and sources of capital alike — regarding government and industry confidence in CCS and the important role it must play in meeting carbon reduction targets.

---

<sup>3</sup> Subject to the restrictions imposed by the U.S. Anti-Deficiency Act, see 31 U.S.C. § 1341 see <https://www.law.cornell.edu/uscode/text/31/1341> or <https://www.gao.gov/legal/appropriations-law/resources> or <https://uscode.house.gov/view.xhtml?path=/prelim@title31/subtitle2/chapter13/subchapter3&edition=prelim>

<sup>4</sup> Whereas the *LTS paper* specifically considers tipping fees to fund governments’ long term management Trusts, a tipping fee is also an EPA-accepted means to satisfy FA requirements during operating phases.

## **ABOUT THE AUTHORS**

### **Brad Handler**

#### **Payne Institute Program Manager, Sustainable Finance Lab, and Researcher**

Brad Handler is a researcher and heads the Payne Institute's Sustainable Finance Lab. He is also the Principal and Founder of Energy Transition Research LLC. He has recently had articles published in the Financial Times, Washington Post, Nasdaq.com, Petroleum Economist, Transition Economist, WorldOil, POWER Magazine, The Conversation and The Hill. Brad is a former Wall Street Equity Research Analyst with 20 years' experience covering the Oilfield Services & Drilling (OFS) sector at firms including Jefferies and Credit Suisse. He has an M.B.A from the Kellogg School of Management at Northwestern University and a B.A. in Economics from Johns Hopkins University.

### **Lindene E. Patton**

#### **Partner at Earth and Water Law, L.L.C., an adjunct professor at the George Washington University School of Law**

Lindene E. Patton is a partner at Earth and Water Law, L.L.C., an adjunct professor at the George Washington University School of Law; and a real estate agent licensed in Virginia and Maryland. She is a transactional attorney with extensive experience in the business of insurance, InsurTech, environment and data technology, including IP, privacy and related compliance matters. She is a globally recognized expert in risk management, data, resilience and related risk management solutions, insurance policy and other financial services product development, including insurance supporting energy transition technologies like CCS.

Before joining E&W Law, LLC she served as Global Head of Hazard Products for Corelogic; Chief Climate Product Officer for Zurich Insurance Group, and division general counsel for a large global insurer, as well as associate general counsel for engineering and land fill design companies.

### **Siddhant Kulkarni**

#### **MS Student, Mineral and Energy Economics, Colorado School of Mines**

Siddhant is a student researcher at The Payne Institute at Colorado School of Mines. Currently pursuing his M.S in Mineral and Energy Economics, his research focuses on the commercial and insurance side of CCS projects and their risk management, as well as government incentive programs and schemes promoting the use of renewable energy. Additionally, he holds a B.S Honors in Economics from Symbiosis School of Economics, Pune. He is dedicated to advancing energy transition to renewables while addressing the various societal challenges that may come with it.

## ABOUT THE PAYNE INSTITUTE

The mission of the Payne Institute at Colorado School of Mines is to provide world-class scientific insights, helping to inform and shape public policy on earth resources, energy, and environment. The Institute was established with an endowment from Jim and Arlene Payne, and seeks to link the strong scientific and engineering research and expertise at Mines with issues related to public policy and national security.

The Payne Institute Commentary Series offers independent insights and research on a wide range of topics related to energy, natural resources, and environmental policy. The series accommodates three categories namely: Viewpoints, Essays, and Working Papers.

For more information about the Payne Institute please visit:

<https://payneinstitute.mines.edu/>

or follow the Payne Institute on Twitter or LinkedIn:



**DISCLAIMER:** The opinions, beliefs, and viewpoints expressed in this article are solely those of the author and do not reflect the opinions, beliefs, viewpoints, or official policies of the Payne Institute or the Colorado School of Mines.