

PROGRAM ON ENERGY AND SUSTAINABLE DEVELOPMENT



Working Paper #87 August 2009

FINESSES AND GAME-CHANGERS IN FRONTIER PROJECT DEVELOPMENT: THE CASE OF CARBON CAPTURE AND STORAGE

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PESD gratefully acknowledges substantial core funding from BP and EPRI.

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Finesses and Game-Changers in Frontier Project Development: The Case of Carbon Capture and Storage

Robert A. James¹

ABSTRACT

Project development is particularly challenging in "frontier" environments where alternative technologies, conflicting laws and agencies, and uncertain benefits or risks constrain the knowledge or decisions of participants. Carbon capture and storage ("CCS") projects by means of geologic sequestration are advanced in such an environment. In these circumstances, entrepreneurs can seek to employ two distinct types of tools: the game-changer, being an improvement to the status quo for all those similarly situated, generally achieved through collective or governmental action; and the finesse, being an individualized pursuit of an extraordinary project that is minimally affected by a given legal, business or technological obstacle. These techniques are illustrated in the case of CCS as to ownership of property rights, carbon dioxide ("CO₂") transportation economics, liability for stored CO₂ following the closure of injection wells, inter-agency and federal-state conflicts, competing technologies, and uncertain economic or legal incentives. The finesse and the game-changer should also be useful concepts for creative solutions in other applications.

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The business and legal aspects of developing a complex commercial project are formidable even when the industry, technology and transactional settings are well established. These tasks become more difficult when the project in question has a "frontier" element that is not mature when multiple new technologies are evolving and being tested, the legal regime or relevant agencies have not been defined, the benefits or liabilities are unclear or uncertain, or the other parties and economic terms necessary for a successful project are not identified by the time that a commitment must be made by one or more actors.

An extreme example of frontier development is the effort being undertaken at present to plan, obtain entitlements and funding, and negotiate agreements for carbon capture and storage ("CCS") projects. CCS is a collective term for a family of technologies and processes that capture carbon in the form of carbon dioxide ("CO₂") before, during or after production or combustion of coal, oil or natural gas and then "sequester" it, so that it does not add to atmospheric greenhouse gas concentrations.² Carbon sequestration can be accomplished by various means, including biological (increasing forestation, or spurring algae growth), industrial (using the CO₂ to produce building materials or food products) and geologic (injecting the CO₂ deep underground).³ The focus of this article is on geologic CCS—capturing CO₂ from coal and natural gas used in electric power generation and injecting it into subsurface zones, such as the pore space within depleted oil and gas reservoirs, coal seams, or saline aquifers.

CCS is a frontier field in virtually every relevant technological and economic respect. Although some aspects of each step in the capture, transport, injection and storage process have been developed over the years, particularly in connection with enhanced oil recovery ("EOR") applications, the optimal technologies and equipment are still emerging and require additional research, entailing significant time and expense.⁴ The currently available techniques and facilities are generally uneconomic when evaluated strictly on their own merits under existing energy tariffs and other pricing arrangements, and most would require some combination of subsidies and penalties in order for a for-profit entity to justify a commercial-scale investment. Yet apart from research grant and loan programs, at present there are few outright subsidies, only

² U.S. Dep't of Energy, Fossil Energy, Carbon Sequestration R&D Overview, http://www.fossil.energy.gov/sequestration/overview.html (all sites last visited June 16, 2009).

³ See id.; U.S. Dep't of Energy, Fossil Energy, Terrestrial Sequestration Research, http://www.fossil.energy.gov/sequestration/terrestrial/index.html; U.S. Dep't of Energy, Fossil Energy, Geological Sequestration Research,

http://www.fossil.energy.gov/sequestration/geologic/index.html.

⁴ HIRANYA FERNANDO ET AL., WORLD RESOURCES INSTITUTE, CAPTURING KING COAL: DEPLOYING CARBON CAPTURE AND STORAGE SYSTEMS IN THE U.S. AT SCALE 10-15 (2008).

limited opportunities to pass costs along to other parties in value chains, and (in the U.S.) no clear carbon emission ceilings or taxes whose avoidance could justify a major CCS project.⁵

Beyond the technological and direct economic considerations, CCS faces substantial and widespread legal uncertainties and adversity. There is no consensus on which federal, state and local agencies will assert jurisdiction over CCS projects and what roles each will play.⁶ The public reaction to CCS has not been battle-tested, so developers and regulators are not yet confident how the general public and particular interest groups will react—to risks associated with CO_2 transfer and injection activities, to long-term toxicology and seismicity risks, or to the higher electricity costs that the expensive investments required to reduce and capture power-plant CO_2 emissions will necessarily entail.⁷ And the answers to some very basic legal questions are frustratingly vague in many states and countries: Which surface or subsurface real property owners need to consent to injection and storage? Is eminent domain available if a co-owner of a property right necessary for CO_2 transportation or storage withholds consent? Who bears the liability, and must monitor conditions and furnish security, for any escape or migration of CO_2 after the injection activity has long ceased?⁸

Under these circumstances, it is not surprising that detractors of CCS as a path to reducing greenhouse gas emissions are able to state that "clean coal" does not yet exist and may never come into fruition.⁹ Indeed, given the current challenges it would be quite surprising if CCS projects had nonetheless already achieved commercial scale.

⁵ Recent U.S. energy legislation proposed by Rep. Waxman and Rep. Markey would newly establish a cap-and-trade program for carbon dioxide. *See* Title II and Title VII of the American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. (as passed by the House of Representatives June 26, 2009).

⁶ For the views of one set of state agencies, *see* INTERSTATE OIL & GAS COMPACT COMM'N [hereinafter IOGCC], ROAD TO A GREENER ENERGY FUTURE, OVERVIEW: CO₂ STORAGE: A LEGAL AND REGULATORY GUIDE FOR STATES 4 (2007), *available at* http://iogcc.myshopify.com/products/co2-storage-a-legal-and-regulatory-guide-for-states-2008.

⁷ FERNANDO ET AL., *supra* note 4, at 10-15 (2008). *See also* Alexandra B. Klass & Elizabeth J. Wilson, *Climate Change and Carbon Sequestration: Assessing the Liability Regime for Long-Term Storage of Carbon Dioxide*, 58 EMORY L.J. 108, 117-19 (2008).

⁸ See generally Mark A. de Figueiredo, Property Interests and Liability of Geologic Carbon Dioxide Storage: A Special Report to the MIT Carbon Sequestration Initiative (2005), available at http://sequestration.mit.edu/pdf/deFigueiredo_Property_Interests.pdf.

⁹ *See, e.g.,* Greenpeace, Unmasking the Truth Behind "Clean Coal," http://www.greenpeace.org/seasia/en/asia-energy-revolution/dirty-energy.

CCS is by no means the first form of frontier project development driven by the hope or expectation of changes in technology, economics and law, even within the energy industry. The development of sulfur dioxide scrubbers in the 1970s is a good example.¹⁰ Other examples include the recent waves of liquefied natural gas ("LNG") production, driven as much by mandates to monetize natural gas associated with crude oil production as by short-term worldwide demand for gas imports.¹¹

It is possible to imagine developing a frontier project by encountering and heroically surmounting each of the stated problems, one after the other or simultaneously. But that would nearly be impracticable even with the adequate financial resources and no expectation of sharing in the benefit conferred on others from any resulting improvements. It would be even more difficult for an actor to seek to obtain proprietary rights in the improvements and derive returns from their use by others.

My experience, as a lawyer counseling developers of a variety of frontier energy projects, is that private entrepreneurs potentially have two very powerful but distinct means of dealing with uncertain or adverse technological, economic and legal conditions. One is what I call the *game-changer*—a modification of the status quo so that a choice of technology is made, an economic benefit or penalty is locked in, or a legal rule, inter-agency dispute, or liability rule is clarified or improved. Game-changers are usually accomplished by government decisions, usually spurred by collective agreement or advocacy. In order to produce a permanent and widespread change in conditions affecting a sector, private actors often combine in joint ventures or broader trade associations. They lobby governments and non-governmental organizations to achieve some form of legislation, regulation or other action of a government or standards organization that definitively removes or mitigates the prior uncertainty or adversity.

¹⁰ See generally Varun Rai, David G. Victor & Mark C. Thurber, *Carbon Capture and Storage at Scale: Lessons from the Growth of Analogous Energy Technologies* (Program on Energy and Sustainable Development at Stanford University, Working Paper No. 81, 2009), *available at* http://pesd.stanford.edu/publications.

¹¹ According to the Energy Information Administration, "the combination of higher natural gas prices, lower LNG production costs . . . and the desire of gas producers to monetize their gas reserves" set the stage for increased LNG trade over the past decade. The costs of liquefying, transporting, and regasifying LNG have fallen significantly over the past 20 years, while long-term contracts have become increasingly flexible and the entrance of more market participants has led to increased competition, ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, THE GLOBAL LIQUEFIED NATURAL GAS MARKET: STATUS AND OUTLOOK 9–10, 40–54 (2003), *available at* http://www.eia.doe.gov/security/infragas.html. *See also* Rai, Victor & Thurber, *supra* note 10 (analyzing the factors that propelled early development of the LNG industry).

Changing the game usually requires cooperation among a wide swath of actors. Some participants will insist either on developing and winning the support of the public or some key constituency, or on verifying evidence of successful progress on project components. Each such additional requirement entails cooperation, and therefore some compromise; sharing of information, and therefore some loss of proprietary rights; and time and money, and therefore some loss of competitive advantage for leading projects and proponents.

Aptly, there is room for an entirely different technique to be employed, a tool that I have come to think of as a hallmark of the frontier energy project entrepreneur. I refer to this technique as the *finesse*—the identification and development of a project that does not contest the legal, business or technological challenge or modify the status quo, but that instead happens to be minimally affected by the challenge compared with other projects. The finesse does not necessarily deny the obstacle, or strive to change it; instead, one finesses by seeking out the extraordinary project that suffers least by it. Finesses are essentially the product of an individualist rather than a collectivist outlook. An entrepreneur finesses by spotting and pursuing an opportunity that radically simplifies a given problem presently bedeviling the entrepreneur's competitors.

There may be some tension between a party's simultaneous pursuit of individualist and collectivist strategies. One concern is that one-off projects may involve sharp dealing that adversely affects the reputation and credibility of other sector participants. Individualized solutions should not be confused with attempts at evading legal or contractual obligations, or with exercises in misrepresentation. Another concern is the extent to which individual initiatives can speed or slow the evolution of the industry. Finesses may advance the cause of changing the game, by demonstrating the commercial feasibility and public acceptance of a new product or technology; alternatively, they may retard the progress of collective efforts, as a result of cherry-picking, free-rider and holdout effects. Successful entrepreneurs and stakeholders should recognize that pursuing game-changers is necessary for long-term business development, even as single projects are advanced in the short term absent such shifts in the legal or regulatory regime.

In general, finesses and game-changers should not be mutually exclusive. And in any event, I believe that in practice, entrepreneurs do employ both techniques in many project development applications, including but certainly not limited to energy facilities and environmental improvements. These concepts may help to explain how actors engage both in unilateral "end-runs" or "wire-arounds" for their own account, and in collective efforts benefiting all those similarly situated. Specific finesses and game-changers are introduced in this paper by discussing how both techniques are being pursued in connection with geologic CCS for power generation.

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PROPERTY RIGHTS ISSUES FOR INJECTION AND STORAGE

Lawyers have puzzled over the property laws of various jurisdictions, especially in the U.S. and the United Kingdom, governing the ownership of rights to the subsurface pore space into which CO_2 would be injected and stored. In situations where mineral or water rights interests have been severed from the fee interest, does the holder of the subsurface interest own these spaces, or the right to inject CO_2 into them, or are they and such rights part of the residual property interest of the surface rights holder? In the CCS literature there is extensive discussion of many arcane points, such as majority rules and minority rules, an American Rule and an English Rule, rules that apply when the mineral interest is subsequently transferred.¹² Although the predominant outcome is that the surface rights owner controls the injection and storage rights, there are exceptions and contrary decisions.¹³

The game-changer here is, of course, legislation. The Interstate Oil and Gas Compact Commission ("IOGCC") has recommended that states where the ownership allocation is unclear enact statutes vesting in the surface rights owner the right to inject CO_2 into the pore space.¹⁴ States with substantial coal production and EOR interests, such as Wyoming and North Dakota, have recently passed versions of such an act.¹⁵ Private actors are collaborating in New Mexico and other states to propose similar bills.¹⁶

¹² See, e.g., de Figueiredo, supra note 8 at 6-7, available at

http://sequestration.mit.edu/pdf/deFigueiredo_Property_Interests.pdf; Elizabeth J. Wilson & Mark A. de Figueiredo, *Geologic CO₂ Sequestration: An Analysis of Subsurface Property Law*, 36 ENVTL. L. REP. 10116 (2006). *But see* Ian J. Duncan, Scott Anderson & Jean-Philippe Nicot, *Pore Space Ownership Issues for CO₂ Sequestration in the U.S.*, 1 ENERGY PROCEDIA 4427 (2009) (contesting the relevance of the American Rule and English Rule to CO₂ injection issues), *available at* www.sciencedirect.com.

¹³ See generally de Figueiredo, *supra* note 8 at 7-9, *available at* http://sequestration.mit.edu/pdf/deFigueiredo_Property_Interests.pdf; IOGCC, *supra* note 6, at 19.

¹⁵ See H.B. 89, 59th Leg., H.R. Budget Sess. (Wyo. 2008) available at

¹⁴ IOGCC, *supra* note 6, at 22.

legisweb.state.wy.us/2008/Enroll/HB0089.pdf; S.B. 2139, 61st Leg. Assemb. (N.D. 2009), *as amended by* H.B. 57 (Wyo. 2009) (confirming the dominance of the mineral estate for purposes of exploration and production), *available at* http://www.legis.nd.gov/assembly/61-2009/bill-text/senate-bill.html; *see also* S.B. 2095, 61st Leg. Assemb., Reg. Sess. (N.D. 2009), *available at* http://www.legis.nd.gov/assembly/61-2009/bill-text/senate-bill.html.

¹⁶ See OIL CONSERVATION COMM'N, NEW MEXICO ENERGY, MINERALS, NAT. RESOURCES DEP'T, CARBON DIOXIDE SEQUESTRATION: INTERIM REPORT IDENTIFIED STATUTORY AND

An inherent difficulty with relying on such statutes, however, is that they may transform ownership contestants into tort plaintiffs or regulatory intervenors. Even if the mineral or water rights owners have no legal title to the space, they may be adversely affected or fear some future adverse impact from the injection of CO_2 . The CO_2 may migrate to communicating reservoirs and interfere with production elsewhere.¹⁷ Movement along faults may change the zones in which the CO_2 is stored, or CO_2 might escape through improperly plugged and abandoned wells.¹⁸ In some states the "negative right of capture" may insulate the injector against such claims.¹⁹ But such claimants might move their controversy from the courthouses into the hearing halls of administrative agencies and the council rooms of local governments. In those forums, contestants may seek to block or delay development of a project that, regardless of abstract title rights, they feel may injure their current or future interests.

The development and financing of natural gas storage facilities provide instructive analogies. Such facilities, including salt-dome caverns and depleted pore spaces, are subject to rules that are quite similar to those that appear to apply to CO_2 storage.²⁰ In the natural gas storage setting, a common practice is to obtain consents from surface and subsurface owners alike where legally and economically feasible.²¹

REGULATORY ISSUES 6-7 (June 27, 2007), available at

www.emnrd.state.nm.us/OCD/documents/InterimReportCO2Sequestration.pdf.

¹⁷ WORKING GROUP III OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, IPCC SPECIAL REPORT ON CARBON DIOXIDE CAPTURE AND STORAGE 12-18 (Bert Metz et al. eds., 2005) [hereinafter IPCC SPECIAL REPORT ON CARBON DIOXIDE CAPTURE AND STORAGE], *available at* http://www.ipcc.ch/ipccreports/srccs.htm.

¹⁸ Klass & Wilson, *supra* note 7, at 118.

¹⁹ See, e.g., R. R. Comm'n of Tex. v. Manziel, 361 S.W.2d 560, 568 (Tex. 1962) (under the "negative rule of capture," no liability if substances are injected into a geological formation but migrate, displacing more valuable substances on neighboring property). See also Mark de Figueiredo & Adeeb Fadil, *Emerging Property and Liability Issues for Carbon Sequestration*, Bloomberg Law Reports, Sustainable Energy 4 (2008).

²⁰ Elizabeth J. Wilson & Mark A. de Figueiredo, *Geologic CO₂ Sequestration: An Analysis* of Subsurface Property Law, 36 ENVTL. L. REP. 10114, 10121-23 (2006); Thomas A. Campbell, Robert A. James & Julie Hutchings, *Carbon Capture and Storage Project Development: An* Overview of Property Rights Acquisition, Permitting, and Operational Liability Issues, 38 TEX. ENVTL. L.J. 169, 172-74 (2008).

²¹ See, e.g., Campbell, James & Hutchings, *supra* note 20; Application of Lodi Gas Storage, L.L.C. for a Certificate of Public Convenience and Necessity for Construction and Operation of Gas Storage Facilities, Decision No. 00-05-048, Application No. 98-11-012, 2000 Cal. PUC LEXIS 394, Administrative Law Judge Opinion for the Public Utilities Commission of the State of California at 14 (May 18, 2000). Even in the absence of clarifying legislation, the finesse for CCS, both to establish pore space injection and storage rights and to foster good relations in the permitting and entitlement process, is thus to obtain as many consents as possible. The ultimate finesse in this setting is to identify a project that has as few stakeholders as possible—for example, a project on federal land where the mineral rights are held by the federal government or by the project developer itself (for example, an oil and gas exploration and production company).

Economic and Legal Issues for \mbox{CO}_2 Transportation Facilities

The technology and economics associated with CO_2 transportation are well known, thanks to years of experience with naturally occurring CO_2 transmitted via pipeline in EOR applications in West Texas, New Mexico and the Rockies. CO_2 must be highly compressed to prevent corrosion, raising some sensitive engineering and risk management challenges.²² There are also economic challenges, because a pipeline company will not build such a line or carry one on its balance sheet without some financial assurance that tariffs for CO_2 shipment will continue to be paid for the useful life of the investment. Such assurances are difficult enough for a line transporting natural gas produced in mature fields to large population centers. They are more essential for a line that must be built on the assumption that one end lies at a power plant that with confidence will continue operating and capturing CO_2 , and the other end lies at an injection location that with confidence will continue to be a preferred sink for the carbon.

 CO_2 transport also raises peculiar legal issues. Some state eminent domain statutes for private carriers were drafted with only oil and gas pipelines in mind, and do not necessarily encompass CO_2 pipelines.²³ Again, the IOGCC has recommended a game-changer in the form of a statute confirming the availability of eminent domain for this purpose.²⁴

The chief finesse in the field of CO_2 transportation is the selection of CCS projects that entail no transport at all. Thus, the proposed Hydrogen Energy California and Clean Energy Systems power generation projects near Bakersfield in the California Central Valley sit directly on top of

²² IOGCC, *supra* note 6, at 5, 30, 115-16.

²³ See id. at 25-27, 33-34; ICF INTERNATIONAL, INGAA, CARBON SEQUESTRATION AND STORAGE: DEVELOPING A TRANSPORTATION INFRASTRUCTURE, 78-81, 88, 92 (2009), available at http://www.ingaa.org/cms/31/7306/7626/8230.aspx; see also Montana Energy and Telecommunications Interim Committee Report (Dec. 10, 2008) (stating that there is no consensus on whether or not eminent domain in Montana should cover CO₂ pipelines), available at http://www.ccsinthewest.net/2b.html.

²⁴ IOGCC, *supra* note 6, at 11, 25, 33-35.

or adjacent to the depleted reservoirs or saline aquifers that are the potential carbon sinks.²⁵ Similarly, the original site of one of the Hydrogen Energy project proponents was an oil refinery in southern California that is adjacent to a large depleted oil field operated by the City of Long Beach.²⁶ This co-location sidesteps at once the eminent domain conundrum, the technological issues and the project finance issues, all without changing the rules of the pipeline development and finance game in any respect. Other projects, such as the Trailblazer project near Sweetwater, Texas, lie adjacent to existing CO₂ pipelines.²⁷ This is also a finesse that removes a critical piece of legal, economic and technological uncertainty from those that the entrepreneur necessarily faces.

LIABILITY FOR STORED CO_2 AFTER WELL CLOSURE

Many observers believe that the truly critical obstacle to large-scale CCS development is the current uncertainty over when and whether the operator of the injection wells and storage facilities would be relieved from liability for the migration, release or toxicological effects of the stored CO₂ after the successful, agency-approved closure of the injection wells themselves.²⁸ Programs of long-term monitoring, measurement and verification ("MMV") have been proposed by regulators as a substitute for liability, or as an additional burden regardless of liability release.²⁹ The IOGCC has proposed that well operators be released from such liability, as a general presumption, ten years after well closure.³⁰ The U.S. Environmental Protection Agency ("EPA") has suggested a general presumption that MMV activities would continue for 50 years after well closure, with the warning that the actual period could be either less than 50 years or much longer, and without necessarily releasing the operator from liability.³¹

Both proposals contemplate that sooner or later there will be a game-changer—in the form of insurance, surety bond products, or financial security made possible by contributions into a fund by members of some segment of the energy industry (either the oil and gas companies owning

³⁰ IOGCC, *supra* note 6, at 11, 35.

²⁵ *See* Hydrogen Energy California Factsheet, http://www.hydrogenenergycalifornia.com; Clean Energy Systems, http://www.cleanenergysystems.com/overview/dev_testing.html.

²⁶ Press Release, BP Alternative Energy, BP and Edison Mission Group Plan Major Hydrogen Power Project for California (Feb. 10, 2006), *available at*

http://www.bp.com/genericarticle.do?categoryId=9024973&contentId=7026309.

²⁷ See Tenaska Trailblazer Energy Center,

http://www.tenaskatrailblazer.com/howitworks.html.

²⁸ *See, e.g.,* IOGCC, *supra* note 6, at 11-12, 34-35.

²⁹ Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO₂) Geologic Sequestration (GS) Wells, 73 Fed. Reg. 43,492 (July 25, 2008) (to be codified at 40 C.F.R. pts. 144 and 146) [hereinafter Proposed Class VI UIC Regulations].

³¹ Proposed Class VI UIC Regulations, 73 Fed. Reg. at 43,519-20.

such storage facilities, or the power generators that are the generators of the sequestered CO_2).³² This fund would serve as the recourse for damage caused after the time period during which the well operator has liability. If the fund were exhausted, the presumption is that such liability would be cut off, or that the government would assume or indemnify the operator against any further liability.³³ This, in rough terms, is the model of the Price-Anderson Act as enacted for the nuclear power generation and services industries.³⁴

The Markey-Waxman environmental and energy bill making its way through Congress at present contains a series of initiatives, managed through EPA, that would address some of the legal concerns that are believed to impede CCS development.³⁵ One CCS research program is to be funded by a modest assessment against power generators using fossil fuels.³⁶ Some participants may have in mind that, at some point in the future, this assessment could be ramped up to provide a funding level necessary to induce legislators to provide an ultimate time limit and monetary ceiling on CCS liability. This form of liability cutoff is of course a game-changer; it would require great amounts of intra- and inter-industry cooperation, and would confer widespread benefits upon CCS project developers and their financers. However, no such cutoff exists or is expected in the near future.

In the meantime, the opportunity for a finesse is afforded by highly motivated states with strong interests in maintaining the vitality of their coal production, coal-fired or gas-fired power generation, and EOR oil production industrial sectors. When the U.S. Department of Energy ("DOE") sought expressions of interest for the FutureGen zero-emissions power project,³⁷ the

³⁶ *Id.* at § 114(d).

³² *Id.* at 43,520-22; IOGCC, *supra* note 6, at 29-30.

³³ IOGCC, *supra* note 6, at 29.

³⁴ See Price-Anderson Nuclear Industries Indemnity Act of 1957, 42 U.S.C. § 2210. The Price-Anderson Act, as extended and expanded by the Energy Policy Act of 2005, requires nuclear plant operators to contribute to a \$10 billion fund that provides a secondary level of insurance coverage in the event of a major nuclear incident. Any claims in excess of \$10 billion would be covered by the federal government. (Nuclear plant operators are also required to purchase around \$300 million in private insurance, out of which they must first pay claims arising from any accidents at their site.)

³⁵ American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. §§ 111-14, 813.

³⁷ The unitary FutureGen project—an advanced coal-fired power plant that will combine the use of integrated gasification combined cycle technology (IGCC) with CCS technology was recently revived with over \$1 billion in funding from the Department of Energy. The project had been shelved in 2008. *See* Press Release, Office of Public Affairs, U.S. Dep't of Energy, Secretary Chu Announces Agreement on FutureGen Project in Mattoon, IL (June 12, 2009),

candidate states offered to assume liability to encourage the early adoption of CCS technology within their borders. Illinois offered an indemnity corresponding to a strong policy of private insurance,³⁸ while Texas offered to have a state entity take legal title to the gas once sequestered, presumably carrying with it all accompanying liabilities.³⁹ In California, DOE's regional partnership WESTCARB has offered to purchase the captured CO_2 from the small-scale version of the Clean Energy Systems plant, so the government will take on the burdens of sequestration from that point forward.⁴⁰

Government assumptions of liability, in the absence of industry funding, will not likely be offered indefinitely, and may be most favorably extended to early entrants. (A New Mexico agency recently questioned whether the state should offer a liability assumption for a commercial-scale plant, even at the present stage when commercial projects have not yet gone forward.⁴¹) Many finesses are perishable in this sense. In deciding whether to undertake a

available at http://www.futuregenalliance.org; Ben German, DOE Revives FutureGen, Reversing Bush-Era Decision, N.Y. TIMES, June 12, 2009, available at

http://www.nytimes.com/gwire/2009/06/12/12greenwire-doe-revives-futuregen-reversing-bush-era-decis-47303.html.

³⁸ In Illinois, the insurance would be obtained from private carriers, but at the state's – not the operator's – expense. Clean Coal FutureGen for Illinois Act, 20 ILL. COMP. STAT. 1107/25 (2007), *available at*

http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=2896&ChapAct=20%26nbsp%3BILCS%2 6nbsp%3B1107%2F&ChapterID=5&ChapterName=EXECUTIVE+BRANCH&ActName=Clea n+Coal+FutureGen+for+Illinois+Act. All sections of the Clean Coal FutureGen for Illinois Act are scheduled to be repealed on December 31, 2010.

³⁹ An Act Relating to the Ownership and Use of Carbon Dioxide Captured by a Clean Coal Project, H.B. 149, Leg. Sess. 79(3) (Tex. 2006), *available at*

http://www.legis.state.tx.us/BillLookup/History.aspx?LegSess=793&Bill=HB149. The law transfers title and property rights of all carbon dioxide sequestered by clean coal projects to the Railroad Commission of Texas. However, this transfer of title to the state "does not relieve an owner or operator of a clean coal project of liability for any act or omission regarding the generation of carbon dioxide performed before the carbon dioxide was captured." *Id.* at § 119.002.

⁴⁰ West Coast Regional Carbon Sequestration Partnership (WESTCARB), Factsheet for Partnership Field Validation Test (Rev. 1-28-2009), *available at* www.westcarb.org/pdfs/PhaseIII_Factsheet.pdf; *see also*

http://www.cleanenergysystems.com/technology.html.

⁴¹ See OIL CONSERVATION COMM'N, NEW MEXICO ENERGY, MINERALS, NAT. RESOURCES DEP'T, *supra* note 17, at 18-19. A bill in the New Mexico Senate regulating ownership of pore space under surface land died in March 2009. *See* Ownership of Pore Space under Surface Land, S.B. 208, 49th Leg., 1st Session (N.M. 2009), *available at*

finesse of this type, the entrepreneur must weigh the advantages of the early-adopter incentive against the "pioneer" risks associated with low economies of scale and technological and legal uncertainty.

CONFLICTS AND OVERLAPPING REGIMES OF REGULATORY AGENCIES

The salvoes are only beginning to be fired by the various federal and state regulatory bodies over the governance of CCS projects. The IOGCC has suggested that oilfield experience is critical and nominated its own member commissions for leading roles.⁴² EPA has asserted its authority over CO₂ injection into all forms of reservoirs, currently stemming (somewhat incongruously) from the Safe Drinking Water Act ("SDWA") and the rulemaking authority conferred on EPA by that act.⁴³ The U.S. Department of Transportation has authority over the safety aspects of CO₂ pipelines,⁴⁴ but the U.S. Federal Energy Regulatory Commission has so far declined to regulate the economic or development aspects of such facilities.⁴⁵ State public utility commissions and state environmental agencies have both been active in the CCS field, and this overlapping activity creates the possibility of conflicts between regulators seeking to advance commercial, environmental and technological policies.⁴⁶ Local water districts have become apprehensive

http://www.nmlegis.gov/lcs/_session.aspx?Chamber=S&LegType=B&LegNo=208&year=09. Another bill that would grant surface owners severable title to the underground storage space was introduced in February 2009, but it also died. *See* Carbon Dioxide Sequestration Enabling Act, H.B. 790, 49th Leg. (N.M. 2009).

⁴² IOGCC, *supra* note 6, at 12.

⁴³ See Safe Drinking Water Act, 42 U.S.C. §300f *et seq.* (1974); Proposed Class VI UIC Regulations, 73 Fed. Reg. 43,492.

⁴⁴ Robert R. Nordhaus & Emily Pitlick, *Carbon Dioxide Pipeline Regulation*, 30 ENERGY L.J. 85, 94 (2009). However, the Surface Transportation Board (STB)—an independent federal administrative agency within the Department of Transportation that is responsible for the economic regulation of certain common carrier interstate transportation under 49 U.S.C. §15301(a)—has not given any indication as to its authority over CO₂ pipelines. *Id.* at 88-92.

⁴⁵ Under the Natural Gas Act, FERC has the authority to approve the construction of interstate natural gas pipelines and to purchase subsurface property for natural gas storage. *See* Natural Gas Act, 15 U.S.C. § 717, *et seq.* (1938). However, FERC has specifically disclaimed any authority to regulate the interstate transportation of CO₂. *See* Nordhaus & Pitlick, *supra* note 44, at 89-90. The Bureau of Land Management, on the other hand, has claimed authority under the Mineral Leasing Act to impose common carrier obligations on certain CO₂ pipelines that cross federal lands. *Id.* at 93-94.

⁴⁶ *See, e.g.*, California Public Utilities Commission,

http://www.cpuc.ca.gov/PUC/energy/Climate+Change/070411_ghgeph.htm; California Environmental Protection Agency & California Energy Commission,

http://www.energy.ca.gov/ghg_emissions/index.html; Texas Commission on Environmental

about CCS injection into any aquifers, even those that are too saline for economic recovery at present.⁴⁷

The game-changers here are legislative proposals, typically at the federal level, that would clarify the respective roles of EPA, FERC, and a number of state public utility, natural resources, and environmental agencies. The Markey-Waxman bill would confer additional authority on EPA for underground injection control ("UIC") regulation of injection wells beyond the authority granted in the SDWA.⁴⁸ State legislation may help resolve the tensions between public utility and environmental agencies and clarify the roles played by local governments in their regulatory or commercial capacities. Private actors are already working by themselves, and through a variety of existing and specially formed trade associations, to make their voice heard in this legislative and regulatory process.⁴⁹

In the meantime, the finesse in this context is to pursue projects that raise the least likelihood of regulatory conflict. A project exclusively sited on federal land could be a finesse that would minimize coordination problems with state agencies. Proposals are emerging for sequestration offshore, which could reduce the number of regulatory agencies and landowners with which the project entrepreneur must deal.⁵⁰ A project in which a government is a partner from a commercial standpoint may also insulate the project somewhat, following the typical European structure.⁵¹

(No. EPA-HQ-OW-2008-0390-0181.1), available at www.regulations.gov.

⁴⁹ *See* OIL CONSERVATION COMM'N, NEW MEXICO ENERGY, MINERALS, NAT. RESOURCES DEP'T, *supra* note 16, at 18-19.

⁵⁰ See, e.g., Amy Coombs, An Ocean Trap for Carbon Dioxide: A New Jersey Plant Is Planning to Put Ocean-floor Carbon Sequestration to the Test, MIT TECHNOLOGY REV., May 14, 2009, available at http://www.technologyreview.com/energy/22650.

Quality & Railroad Commission of Texas,

http://www.tceq.state.tx.us/permitting/waste_permits/uic_permits/RRCT_wells.html.

⁴⁷ See, e.g., Public Comment submitted by Thomas W. Curtis, Deputy Executive Director, American Water Works Association (AWWA), re Proposed Rule for Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide Geosequestration Wells (2008)

⁴⁸ American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. §§ 111-14,
813.

⁵¹ Sleipner, a major CCS project operated by Norway's StatoilHydro, follows this model. *See*

http://www.statoilhydro.com/en/TechnologyInnovation/ProtectingTheEnvironment/Carboncaptu reAndStorage/Pages/CarbonDioxideInjectionSleipnerVest.aspx.

A more elaborate finesse may be to transport CO_2 captured in one jurisdiction into a jurisdiction where the rules are clearer or more favorable. Gas laden with sulfur is produced in North Dakota but shipped across the border to the Weyburn field in Canada, which has favorable experience and regulations with respect to sour methane transportation, injection and storage.⁵²

SELECTION OF CCS TECHNOLOGY

Many techniques are being studied and deployed for efficient CO_2 capture. On the precombustion side, there are integrated gasification combined cycle ("IGCC") and hybrid IGCC processes.⁵³ On the post-combustion side, there are a variety of amine scrubber processes and catalytic processes.⁵⁴ There are processes that capture CO_2 during the process of combustion, as with oxyfuel combustion.⁵⁵ Entrepreneurs face the risk that they will select today a technology that is later seen to be less efficient, more costly, or less preferable from a regulatory standpoint.

A game-changer in this respect would be a regulatory directive to proceed with a given technology. At some point this is what occurred with scrubber technology.⁵⁶ Such a "winner selection" seems far off for CCS. Game-changers on a more modest scale may include the opportunities for widespread cooperative research and development agreements and grants, loans and loan guarantees, such as those currently being administered by DOE—especially as a result of the stimulus legislation, the American Recovery and Reinvestment Act.⁵⁷ The new stimulus includes some \$3.4 billion for grants and tax credits in the fossil fuel area, including \$1.5 billion for large-scale industrial CCS projects, \$1 billion to revive FutureGen, and \$800 million for clean coal initiatives.⁵⁸

⁵⁵ *Id.* at 122-30.

⁵⁶ See Rai, Victor & Thurber, supra note 10, at 13-17.

⁵⁷ U.S. Dep't of Energy, Implementation of the American Recovery and Reinvestment Act of 2009, http://fossil.energy.gov/aboutus/budget/stimulus.html.

⁵⁸ American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115, 139 (2009) [hereinafter Recovery Act]. To date, the Recovery Act funding relevant to CCS has come in three major forms. First, DOE issued a Funding Opportunity Announcement (FOA) to spur investment in industrial carbon capture and sequestration and clean technology. DOE is allocating up to \$1.32 billion for large-scale, non-electric power generation, industrial CCS projects, and up to \$100 million for innovative concepts for beneficial use of CO₂. *See* NATIONAL ENERGY TECHNOLOGY LABORATORY, U.S. DEP'T OF ENERGY, FUNDING OPPORTUNITY

⁵² I am grateful to Dale Simbeck for suggesting this example. *See* Weyburn, http://www.encana.com/operations/canada/weyburn; Dakota Gasification Company, http://www.dakotagas.com/CO₂_Capture_and_Storage/index.html.

⁵³ IPCC SPECIAL REPORT ON CARBON DIOXIDE CAPTURE AND STORAGE, *supra* note 17, at 130-140.

⁵⁴ *Id.* at 113-22.

The finesse for a developer on this subject is to select a technology that has greater amounts of flexibility, especially if it is more reversible than other processes. A conversion from coal to a different fuel, for example, could turn out to be a one-way street; if a better coal gasification technology comes along, it may not be possible to return the plant to a fuel with a higher carbon content. A finesse might be the development and selection of a coal-based technology that is modular, or one that does not depend on massive economies of scale. Indeed, economies of scale may not arise if the scale all occurs at once, rather than sequentially over longer periods of design development and feedback from actual experience.⁵⁹

DOMESTIC GENERATOR ECONOMICS—STATE AND FEDERAL

The foundation of project development and finance is the ability of the owner to recoup its investments and recover compensation for the risks and time value of money it has incurred. Recoupment can occur in many guises, including use of the CO_2 in EOR applications to produce salable products; passing on the costs to purchasers of electricity generated using the carbon fuel; qualification for government incentive payments or guaranties; and avoidance of penalties that would otherwise be imposed as a result of carbon emissions.

In the utility context, one key means of recoupment at the state level is to obtain regulatory approval to pass through the incremental CCS costs to the ratepayers. Here, the game-changer is industry-wide approval of such pass-throughs. The finesse is an individualized approval driven by the initiative of the developer of a particular early-stage project, such as the combination of

ANNOUNCEMENT NO. DE-FOA-0000015, RECOVERY ACT: CARBON CAPTURE AND SEQUESTRATION FROM INDUSTRIAL SOURCES AND INNOVATIVE CONCEPTS FOR BENEFICIAL CO2 USE (June 8, 2009), *available at* http://fossil.energy.gov/aboutus/budget/stimulus.html. Second, DOE issued a FOA allocating \$800 million of Recovery Act funds to the existing Clean Coal Power Initiative for advanced technology coal-fired power generation. *See* NATIONAL ENERGY TECHNOLOGY LABORATORY, U.S. DEP'T OF ENERGY, FUNDING OPPORTUNITY ANNOUNCEMENT NO. DE-FOA-0000042, AMENDMENT 005 TO THE FINAL FOA NO. DE-PS26-08NT43181, RECOVERY ACT: CLEAN COAL POWER INITIATIVE—ROUND 3 (June 9, 2009), *available at* http://fossil.energy.gov/aboutus/budget/stimulus.html. Finally, DOE announced that it intends to allocate \$1 billion of Recovery Act funds to revive the FutureGen initiative as a single-facility project in Illinois. *See* Press Release, Office of Public Affairs, U.S. Dep't of Energy, Secretary Chu Announces Agreement on FutureGen Project in Mattoon, IL (June 12, 2009), *available at* http://www.futuregenalliance.org.

⁹ See Rai, Victor & Thurber, supra note 10, at 5-6, 22.

legislation and regulatory approvals obtained in Illinois in connection with the Taylorville hybrid IGCC power plant proposal.⁶⁰

The other fundamental requirement for progress on CCS projects is that an explicit or implicit price of carbon be established at the federal level that induces power project owners, and the public utility commissions, to make or approve investments on CCS developments. By definition, such carbon prices (whether expressed as ceilings with tradable entitlements or as taxes) are game-changers effected through collaborative means, not individual finesses. Even though the caps or taxes are in the first instances detriments to the private parties' economics, the industry participants will affirmatively associate in trade associations or ad hoc advocacy groups, in order to develop and propose rules that would apply to a broad number of similarly situated carbon sources.

INTERNATIONAL GENERATOR ECONOMICS—COPENHAGEN AND BEYOND

Project developers will also have their eyes on developments regarding climate change regulation globally. Carbon entitlements may ultimately trade on broad markets including the U.S. After the contentious discussion at a United Nations scientific and technological advisory meeting in Poznań, Poland, the Clean Development Mechanism ("CDM") under the Kyoto Protocol remains presently unavailable to carbon sequestered in CCS projects.⁶¹ But the CDM will be the subject again of conversations at the upcoming Copenhagen Climate Change Conference and the ensuing round of treaty and protocol negotiations.⁶²

⁶⁰ See Clean Coal Illinois, Making Clean Coal a Reality in Illinois, http://www.cleancoalillinois.com/index.html; Press Release, Tenaska, Environmental Appeals Board Denies Sierra Club Appeal, Grants Taylorville Energy Center Final Air Permit (Jan. 31, 2008), available at http://www.tenaska.com/newsItem.aspx?id=28.

⁶¹ See Robert A. James, *Current Challenges for Carbon Capture*, Bloomberg Law Reports, Sustainable Energy (March 2009). For press coverage on the heated debate at the Poznań Climate Summit, *see* CCS: Fictitious Mitigation Stumbles,

http://www.cseindia.org/equitywatch/fictitious_mitigation.htm; Peter Wilson, *Brazilians Kill off Aussie Led Proposal on Carbon Capture at Poznan Climate Summit*, THE AUSTRALIAN, Dec. 11, 2008, *available at* http://www.theaustralian.news.com.au/story/0,25197,24782914-

^{26040,00.}html. For the parties' positions, *see* Subsidiary Body for Scientific and Technological Advice, United Nations Framework Convention on Climate Change, Submissions from Parties (2008), *available at* http://unfccc.int/resource/docs/2008/sbsta/eng/misc10.pdf.

⁶² See United Nations Framework Convention on Climate Change, Carbon Dioxide Capture and Storage in Geological Formations as CDM Project Activities,

http://cdm.unfccc.int/about/ccs/index.html; http://unfccc.int/2860.php; *see generally* United Nations Climate Change Conference, Copenhagen, http://en.cop15.dk/.

The dialogue at Poznań suggests that full favorable treatment of emission reductions achieved via CCS must await greater participation by the remaining players, notably the U.S. and China. Former White House Chief of Staff John Podesta has suggested that many key climate initiatives are awaiting a bilateral climate summit between these two powers.⁶³ This would be a game-change of a "Great Game" magnitude. Finesses at the multi-national organization and international relations levels may be difficult to effect, even for the most clever entrepreneur. But the creative attempts so far to exploit unintended consequences of the CDM suggest that players will continuously seek ways to use the international treaty entitlements for their own purposes.⁶⁴

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CONCLUDING REMARKS

Many discussions of the challenges for CCS project development can be reduced to circularities. If we only had clearer regulatory standards, we would have more projects from which we could make better technology judgments; but if we only had more technological experience, we could expect to see clearer regulations. If we had a high carbon tax or aggressive carbon cap, we could expect advancement and deployment of CCS technology; but without the practical availability of CCS projects, it may be politically difficult to institute the taxes or caps in the first place. Ultimately, without progress on either side of the circle, the opportunities grow for detractors to assert not only that "clean coal" does not currently exist, but also that it will never happen. Finesses and game-changers are distinct types of attempts to break the circularities and to make individual or collective progress.

I obviously am displaying some sentimental affection for the finesse, by which the entrepreneur may extract a successful project from an otherwise hostile environment. More broadly, the entrepreneur shares some features of the trickster identified in many myths and cultures. As illustrated in Lewis Hyde's work *Trickster Makes This World: How Disruptive Imagination Creates Culture*, such resourceful characters faced constraints imposed from above or without, yet somehow found ways to achieve their goals, even when others could not follow their path.⁶⁵

⁶³ Remarks at the Climate Change as Cultural Change International Conference in Essen, Germany (June 9, 2009), *available at*

http://www.americanprogress.org/issues/2009/06/podesta_germany.html.

⁶⁴ See Michael Wara, Measuring the Clean Development Mechanism's Performance and Potential, 55 UCLA L. REV. 1759 (2008).

⁶⁵ Tricksters are individuals, in either contemporary societies or mythic or earlier cultures, who make "a way out of no-way" by overcoming rules at the boundary of accepted or customary practices or exchanges. *See* LEWIS HYDE, TRICKSTER MAKES THIS WORLD: HOW DISRUPTIVE IMAGINATION CREATES CULTURE, 204, 277 (1998). Hyde has decried the contemporary "money

The fact that many of these mythic entrepreneurs did not themselves reap the benefit of their insights⁶⁶ only strengthens the metaphor, because that happens to business entrepreneurs with alarming frequency as well.

I hope that the finesse and game-changer ideas are helpful in understanding the individual and collective ways in which private actors respond to frontier uncertainties and adversities. I have confined my remarks in this paper to CCS project development, so that my examples are as concrete and focused as possible. But I believe experienced observers may find the concepts useful in describing creative solutions to complex problems across a broad range of economic, technological, legal and political applications.

culture" that impairs and demeans the artist in society (*see* LEWIS HYDE, THE GIFT: HOW THE CREATIVE SPIRIT TRANSFORMS THE WORLD (rev. ed. 2007)), and notes that market transactions can be associated with deception and trickery (HYDE, TRICKSTER MAKES THIS WORLD at 207, 329)—associations that I deny are characteristic of the finesse (*see* page 9 *supra*). There are undeniably some creative aspects of the broad development (and decline) of economies and economic models (*see* JOSEPH SCHUMPETER, CAPITALISM, SOCIALISM AND DEMOCRACY (1942)). Creative skills are similarly required for the structuring and development of enterprises and individual projects, whether in the energy sector or elsewhere (*see* Ronald J. Gilson, *Value Creation by Business Lawyers*, 94 YALE L.J. 239 (1984); MICHAEL RAY & JOHN RENESCH, THE NEW ENTREPRENEURS: BUSINESS VISIONARIES FOR THE 21ST CENTURY (1994)).

⁶⁶ Prometheus saw that man lacked the offensive or defensive body features of the wild animals, and therefore secured for man's benefit the use of fire (albeit at some personal discomfort to the thief himself). Dædalus, with no means of leaving his prison island by land or sea, fashioned wax wings that offered him and his son Icarus an airborne escape (provided the operator strictly observed upper and lower altitude limits). *See* HYDE, *supra* note 65, at 34-35; ROBERT GRAVES, THE GREEK MYTHS 144-45, 312-13 (rev. ed. 1960).