Making carbon dioxide sequestration feasible: Toward federal regulation of CO₂ sequestration pipelines

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1. Introduction

At present, approximately 50% of the United States’ base load electrical energy requirements are met by coal-fired resources (ASME, 2005). While substantial expansion of renewable energy resources will eventually diminish reliance on coal resources, coal-fired power plants provide base load energy resources twenty-four hours per day, seven days a week, all year long. Base load power plants provide energy even when the wind is not blowing or the sun is not shining. While all power plants have the ability to generate a fixed amount of output, or “capacity,” expressed in megawatts, technologies vary as to the amount of their capacity which can be delivered over time, such as over a calendar year; this is also known as their “capacity factor.” Base load plants, such as coal-fired, nuclear and many natural gas-fired power plants, achieve very high capacity factors (nearly all of their capacity can be delivered over time subject to normal maintenance, scheduled outages or equipment failures). Some plants, such as certain natural gas-fired power plants, can be “cycled” (i.e., turned on or off, or their output can be increased or decreased on short notice to match peaking loads), will have lower capacity factors but can be matched more precisely to the demands of energy consumers.

Wind and solar plants, on the other hand, typically have much lower capacity factors (even if they have the same overall total “capacity”), because their output cannot be load-matched and their energy output is dependent on environmental factors. As a result, a utility serving a load must blend base load, peaking and renewable resources to meet load requirements, and cannot meet its load requirements solely on the basis of current wind or solar technologies. In many regional markets, both energy (a plant’s actual, delivered product) and capacity are tradeable commodities with an economic value, with the renewable energy facilities providing less value in the capacity markets. Indeed, electric utilities are generally required to maintain substantial capacity reserves to serve expected load, and renewable resources do not generally qualify to meet these capacity requirements.
As a result, and without regard to the relative merits of coal-fired power versus other sources of base load power (e.g., nuclear or natural gas-fired power plants), considering (1) the United States’ large native coal resources, (2) the lower cost of coal fuel against other base load technologies, and (3) the substantial existing investment in coal-fired power plants, it is likely that coal-fired power plants will for many decades continue to comprise a substantial part of the United States’ energy generation portfolio. Indeed, the United States will have to make policy choices regarding which base load resources to pursue, as oil, coal, nuclear and natural gas fuels each have their own economic and environmental benefits and drawbacks.

Against this backdrop, both the private and public sectors have begun to look closely at various technologies to address the high carbon footprint of traditional coal combustion technologies. In the United States, the average emission rate of CO2 from coal-fired power generation is 2.095 pounds per kilowatt hour, nearly double the 1.321 pounds per kilowatt hour for natural gas (DOE, 2000). Among the technologies receiving the most such attention to reduce CO2’s impacts is CO2 sequestration. CO2 sequestration involves capturing CO2 from the fuel, before, during, or after combustion, and then doing something with it to avoid its release to the atmosphere. While other greenhouse gases (e.g., methane) are more potent in terms of global warming effects per unit of mass, the CO2 emissions of industrialized economies are so great as to dwarf the contributions from other gases in terms of overall impact on global warming. Hence the focus on CO2 sequestration technologies. The size and impact of this challenge is daunting—while coal resources provide approximately half of the energy generated annually in the United States, coal-fired power plants emit almost 80% (1.8 billion metric tons per year) of the total CO2 emissions from power plants in the United States (DOE, 2000).

The magnitude of this challenge cannot be underestimated. Using the above production figures, coal-fired power plants in the United States emit approximately 900 billion cubic meters of CO2 annually.7 The current CO2 pipeline system, though, handles only 45 million metric tons of CO2 per year over 3500 miles of pipe (Nordhaus and Pitlick, 2009). Thus, to the extent that the United States has a policy goal of sequestering and transporting any appreciable fraction of CO2 emissions from coal-fired power plants, the required infrastructure investment will require at least a 40-fold increase.7 While such an undertaking presents obvious practical and economic challenges, it demonstrates that a new vision is required if the United States is going to develop a sequestration infrastructure to meet this challenge on any time frame that is reasonably coincident with reducing near- to medium-term impacts from global climate change.8 This article will focus on geologic sequestration, in which the CO2 is removed and then transported via pipeline to a location where it is either beneficially used (e.g., in enhanced oil recovery) or placed in long-term storage, in both cases in deep underground geologic formations that prevent its release to the atmosphere.

Geologic features are often similar to those in which oil or natural gas are also found, such as salt domes, coal seams not otherwise economic for mining, and similar structures. Although CO2 can be transported by truck or rail, pipeline transportation presents the most economic method for transporting large volumes of gas without indirect carbon emissions and associated handling requirements. This article will focus on geologic sequestration and the pipeline infrastructure that it will require in order to achieve our carbon reduction objectives.

CO2 has commercial uses in a variety of products and services, such as enhanced oil recovery (“EOR”), carbonated beverages, and other industrial processes. Small networks of CO2 pipelines already support these uses. However, this infrastructure largely serves existing EOR operations near the Gulf Coast and the Southwest, and almost none of these pipelines are located proximate to the bulk of the nation’s large coal-fired generation: the Midwest, East Coast, and Intermountain regions. As a result, and as discussed above, any substantial investment in carbon sequestration technologies is going to require a very large and rapid investment in CO2 pipeline infrastructure.

2. The problem: risks posed by the current regulatory structure

2.1. Current regulation of CO2 pipelines

2.1.1. State regulation

At present, CO2 pipelines are regulated individually by the states in which they are located, for the most part under the states’ common carrier regimes or statutory schemes that approximate common carrier requirements (Yarbrough, 2008). Almost all of the existing CO2 pipelines service EOR projects, although Michigan’s short pipeline is dedicated to a US Department of Energy CO2 sequestration demonstration project.11 EOR has been used for decades, and it involves a variety of technologies that are used to enhance the yields from mature oil fields. As one of the available EOR technologies, CO2-based EOR involves capturing CO2 from a man-made source or

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7 Very little oil, however, is used to make electricity—only about 1.5% of electricity generation, compared to 50% for coal, 20% from natural gas, 20% from nuclear energy, and the remainder provided by hydro and other renewables (Greenblatt, 2009).

8 The EPA’s website, last updated in December 2007, provides similar figures listing average carbon dioxide emissions as 1115 pounds per megawatt hour for natural gas and 2249 pounds per megawatt hour for coal (EPA 2007). The website relies on data from 2004–2005.

9 This figure was computed using the 2000 production figures referenced above (approximately 1.8 billion metric tons per year), and the conversion factors of 0.01 metric tons/kg, and 1.98 kg of CO2 per cubic meter at standard pressure and temperature.

10 In comparison, there are approximately 500,000 miles of natural gas and hazardous liquid pipelines throughout the United States (Parfomak and Folger, 2003).

11 The Michigan project, unsurprisingly, sequesters CO2 at an old EOR site using infrastructure and pipeline developed for EOR (USDOE, 2008).
naturally occurring reservoir, piping it tens or hundreds of miles away, and injecting it deep underground to extend production from mature oil fields. Traveling from the source to the injection site, the pipelines cross through federal, state, and private lands and often traverse state lines. Generally, state regulations allow CO2 pipeline companies to use eminent domain for securing necessary rights of way across state and private lands, a right sometimes conditioned on using the CO2 for tertiary oil recovery. This right of eminent domain turns upon the pipeline serving a “public use,” whether that use is demonstrated by the pipeline company or already embodied by state statute.

Although the states’ general public use regimes share a few similarities, the level and detail of regulation varies greatly from state to state. Ten states contain the bulk of the United States’ 3600 miles of CO2 pipeline: Colorado, Louisiana, Michigan, Mississippi, New Mexico, North Dakota, Oklahoma, Texas, Utah and Wyoming. Not surprisingly, states with a longer history of using CO2 for EOR have more specific laws regulating CO2 pipeline siting and rate-setting. For instance, Louisiana, New Mexico, Texas, and Mississippi (which collectively host the bulk of the existing CO2 pipeline infrastructure) have statutes that specifically address pipeline transportation of CO2.14 In Louisiana and New Mexico, CO2 pipeline company’s right of eminent domain is closely tied to statutory policies furthering EOR or the production of petroleum products for ultimate public benefit.15 Mississippi’s eminent domain statute, for example, has a section specifically granting oil, gas, and EOR-related CO2 pipelines the power of condemnation.16 In each of these states, given the close statutory relationship between CO2 pipelines and producing oil for public use, CO2 pipeline transporters can readily prove the “public use” prerequisite for right of way condemnation. Moreover, these states have interpreted “public use” broadly when contemplating eminent domain for any facilities related to producing natural resources, even for pipelines serving an intermediary role to a single, private customer.17

Other states fold CO2 pipelines into their common carrier statutes, which occasionally spill over into the relevant state public utility statutes. For instance, the Texas Natural Resources Code simply declares that CO2 pipelines operate as common carriers, the same as coal and crude petroleum transporters.18 Furthermore, Texas law explicitly states that the operation of common carriers—whether they carry coal, petroleum, or carbon dioxide—is a business in which the public is interested, and that common carriers enjoy the power of eminent domain.19 In Colorado, the corporations and eminent domain titles grant eminent domain power to all pipeline companies, regardless of what they carry.20 Additionally, Colorado public utilities statutes designate pipelines as “common carriers,” and hold that all common carriers are public utilities subject to regulation by the Colorado public utilities commission.21 North Dakota’s Public Utilities Code, too, regulates CO2 pipeline operators as common carriers with a statutory grant of eminent domain.22 By contrast, Wyoming declares a public interest in maximizing CO2 pipelines for EOR,23 and grants the right of eminent domain,24 but removes CO2 pipelines from any further association with public utility regulation.25

Finally, the states with the least amount of CO2 pipeline (Oklahoma, Michigan, and Utah) have little statutory authority for the siting and rate regulation for CO2 pipelines. Despite being a major oil producing state, Oklahoma has no statutes specifically dealing with CO2 pipeline siting or rate regulation.26 Neither does Michigan. Although Utah defines CO2 as an “other gas,” Utah law has no other law regulating “other gases.”27 These states, however, regulate oil and intrastate natural gas pipelines as common carriers with the right to eminent domain, and one would expect that CO2 pipelines are regulated accordingly.28

This disparate array of state regulation offers a variety of potential outcomes for companies interested in building an interstate CO2 pipeline. For the most part, current state law suggests that if a pipeline developer can show a “public use,” the developer can at least secure condemnation authority at some level. But proving public use and actually determining a right of way with certainty varies from state to state. For instance, some states require CO2 pipelines to obtain a certificate of public use from a dedicated pipeline authority.29 Some CO2 pipelines are regulated by oil and gas boards,30 and other states regulate CO2 pipelines through their general public utility commissions.31 Furthermore, some states have strong public use evidenced in legislation,32 and some states exclude CO2 pipelines from the public use statutorily granted to oil and gas pipelines.33 Moreover, state common law—applied by the state courts that ultimately must determine public use, if challenged—can be rooted in either a narrow or broad interpretation of the public use doctrine (Nichols, 2008). And finally, in some states, the “public use” associated with EOR may not

16 For instance, the New Mexico Attorney General issued an advisory opinion suggesting that private companies could utilize eminent domain for CO2 transportation, even when the CO2 would not be transported for use by the general public, but rather for use by private persons in the petroleum industry (New Mexico Attorney General 1984). Under U.S. Supreme Court law, the role of the court is limited where the legislature has enunciated a public use. (US Supreme Court Report, 1954). The New Mexico Attorney General further suggested that a common carrier designation may not be essential to exercising eminent domain, even though New Mexico law is generally restrictive in this context. (New Mexico Attorney General 1984). Following New Mexico Attorney General’s Report, 1956, finding the public use for oil pipeline traveling from oil field to refinery because “[f]the use is not rendered...private... by the fact that only a few persons will be served...[, and it is “immaterial that the company seeking to secure the...right of way has sold all of its gas to
19 Colorado explicitly recognizes that all pipeline companies are public utilities. Colo. Rev. Stat. § 40-9-102, 40-1-103.
21 See Wyo. Stat. Ann. § 37-5-201 (declaring “public interest” for additional pipelines to maximize price received for “associated natural resource[s]”, 37-5-107 (defining “associated natural resource” to include CO2 for EOR).
24 Oklahoma, however, has passed the Oklahoma Carbon Sequestration Act. Currently, this act provides little concrete guidance and requires further study to implement a comprehensive CO2 sequestration scheme. Okla. Stat. tit. 27A, § 3-4-101.
26 See, e.g., Okla. Stat. tit. 13 § 4 (broad definition of “common carrier”); tit. 52 § 8 (eminent domain for gas and oil pipelines); Mich. Comp. Laws § 483.5 (oil pipelines are common carriers); § 483.106 (intrastate natural gas pipelines are common carriers); § 483.102 (oil pipelines enjoy eminent domain); § 483.102 (intrastate natural gas pipelines enjoy eminent domain). But Michigan section 483.2a suggests that condemnation authority is limited to pipelines for petroleum or crude oil transportation only.
31 See N.D. Cent. Code § 49-18-11 (finding public use for oil, gas, and petroleum pipelines, but excluding CO2, which is specifically identified in the same title and chapter).
be transferable or otherwise applicable to a CO2 pipeline transporting CO2 to an underground sequestration facility not associated with EOR.32

Even where condemnation and right-of-way acquisition authority exists, the contours of that authority vary from state to state. Some states have adopted a variety of precise negotiation and appraisal procedures before a private company can employ eminent domain33; other states are less restrictive.34 Some states require pipeline companies to consider using existing rights of way before condemning private property.35 Similarly, some states declare a 50-foot right of way presumptively reasonable,36 some states declare 100 feet,37 and other states simply point to the condemnation scheme the state has authorized for railroads.38 Depending on the particular state, rate and service obligations can also vary.39

2.1.2. Federal regulation

Unlike the preemptive federal common carrier regulation of interstate natural gas pipelines,40 federal law provides no authority for condemning private or state property for interstate carbon dioxide pipelines. The Federal Energy Regulatory Commission (FERC), the agency responsible for regulating the siting and operation of natural gas pipe, has explicitly disclaimed jurisdiction over CO2 pipelines.41 Occasionally, however, CO2 pipelines cross federal land. In this scenario, the Bureau of Land Management (BLM) can choose to site CO2 pipelines under right-of-way provisions in either the Federal Land Policy and Management Act (FLPMA)42 or the Mineral Leasing Act (MLA).43 Currently, the BLM regulates CO2 pipelines consistent with the common carrier obligations placed on natural gas, siting CO2 pipelines under the MLA, which contains common carrier requirements (Parfomak and Folger, 2008).

Federal regulation over CO2 pipelines on non-federal land is limited to two specific areas: (1) the Surface Transportation Board (STB) has limited rate regulation over CO2 pipelines if a customer files a rate-related complaint, and (2) the Office of Pipeline Safety has safety and standards regulation over CO2 pipelines. Although it is somewhat of an open question, the STB (which regulates commodities “other than water, gas, or oil”) acts consistent with common carrier principles to ensure that CO2 pipeline rates are reasonable and non-discriminatory, but can only act when a complaint is filed (Parfomak and Folger, 2008, Yarbrough, 2008).44 As for safety, the Department of Transportation regulates CO2 pipelines through the Office of Pipeline Safety, often in conjunction with supplemental state safety regulations (Chaudhari et al., 2006).45

In part based on recognition of the risks and challenges under the current status quo, several pieces of federal regulations were introduced in 2007 to address issues associated with CO2 sequestration pipelines. The Carbon Dioxide Pipeline Study Act46 required the Secretary of Energy to coordinate with other interested federal agencies and study the feasibility of constructing CO2 pipelines. The Coal Fuels and Industrial Gasification Demonstration and Development Act provided incentives for pipeline construction by accelerating pipeline depreciation.47 America’s Climate Security Act,48 a later introduced and more comprehensive bill, incorporated the Carbon Dioxide Pipeline Study Act. Finally, the Carbon Capture and Storage Technology Act49 required sequestration projects to evaluate the most cost-efficient ways to integrate CO2 capture, transportation, and sequestration. Each bill remained pending when the 110th Congress ended, and none of the bills have been reintroduced for debate in the 111th Congress. The only bill addressing CO2 pipelines that the 110th Congress passed was the Energy Independence and Security Act,50 which requires the Secretary of the Interior to recommend legislation clarifying the jurisdictional choice between the FLPMA and MLA when CO2 pipelines are sited on federal land.

More recently, the American Clean Energy and Security Act of 2009 (the “Waxman-Markey Bill”), which the House passed in July, would require a report addressing any “barriers” to commercial-scale deployment of carbon capture and sequestration, including regulatory barriers that could be addressed by Federal legislation.51 While the remaining sequestration provisions are more detailed, they promote sequestration technologies and regulate geological sequestration sites—the bill is silent on pipelines.52

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33 See N.M. Stat. Ann. §§ 42A-1-4, 42A-1-5 (stating that property appraisals must be shown to condemnor, and that condemnor can invoke a technical right of appraisal); N.D. Cent. Code §§ 32-15-06.1, 06.2 (encouraging negotiation, setting forth appraisal procedures, and requiring condemnor to provide property owner with offers to property owner’s neighbors); Tex. Prop. Code § 21.0112 (requiring condemnor to distribute “Landowner’s Bill of Rights” before commencing negotiations).
34 See Okla. Stat. tit. 27 § 13 (requiring “reasonable efforts” to acquire property by negotiation, but providing few firm rules concerning negotiation process or appraisal).
35 See, e.g., Colo. Rev. Stat. § 3-8-1015.
37 N.D. Cent. Code § 49-09-01 (through applicable railroad right of way sections).
39 For instance, the states that explicitly place CO2 pipelines under their common carrier regimes have the corresponding restrictions on discriminating against customers and rates. See, e.g., N.D. Cent. Code § 49-19-11; Tex. Nat. Res. Code § 111.017(a). On the other hand, Colorado, a state without such explicit statutory designation, simply declares that rates must be “just and reasonable,” and sets maximum and minimum rates, Colo. Rev. Stat. § 40-3-101.
40 The Natural Gas Act vests in the Federal Energy Regulatory Commission (FERC) the authority to issue “certificates of public convenience and necessity” for the construction and operation of interstate natural gas pipelines. 15 U.S.C. § 717f. Although neither Congress nor FERC has directly designated natural gas pipelines as “common carriers,” natural gas pipelines may not discriminate in service or rates, and courts have held that natural gas regulation embodies core common carriage principles. 15 U.S.C. § 717f(c); See Assoc. Gas. Distris. V. FERC, 824 F.2d 981, 997-98 (D.C. Cir., 1987).
2.2. Regulatory risks from current regulation

Given the paucity of federal legislation, the potential problems with a patchwork of state regulations are self-evident. If a company were to attempt to develop a new CO2 pipeline from Illinois or Indiana to a Gulf Coast salt dome storage facility, for example, that company would have to obtain state and local approvals in four or five different states (depending on the route and destination), with potentially differing and conflicting siting standards, rate regulation, different scopes and methods of condemnation authority, and other conditions of approval. As the supply of CO2 starts to outpace its valuable uses (i.e., when CO2 changes from a commodity to a waste material), states with less developed statutory regimes may find it difficult to address CO2 pipelines under their existing laws. In order for such pipelines to have common requirements, numerous states would have to modify their existing regulatory programs to harmonize them with other states, and many states that do not presently have any regulatory structure for such pipelines would have to pass legislation and promulgate regulations in order to do so. In this environment, constructing such pipelines would, by definition, take longer and pose more development risks than a single federal approval process that preempted state siting.

Similarly, on an ongoing financial basis, even though a customer might contract with the pipeline to transport CO2 from Illinois to Louisiana, the rates the company could charge for that service might vary over the different portions of the route that fall within different states, creating (1) uncertainties for the pipeline company in the ability to recover the capital and operating expenses of such pipelines in such a way as to make investment in such companies subject to greater risk than investing in company with a single and consistent rate structure administered by a single entity, and (2) uncertainties for the customer because of the potential for differential rates and “pancaked” rates if an interstate CO2 transportation system is composed of interconnected intrastate pipelines. The risk of differential financial regulation alone would make access to the capital markets difficult for companies developing such pipelines, and for their power plant or CO2 removal company customers. That risk would be exacerbated by potentially differing siting requirements, differing permit conditions, multiple state utility commission proceedings, and other multiple public participation processes such siting requirements would entail, leading to higher transaction costs and potentially conflicting requirements.

2.3. Environmental risks from current regulation

Under federal law, any “major federal action” requires compliance with the National Environmental Policy Act (“NEPA”). Under NEPA, before any federal agency can approve a project, it must first conduct an environmental assessment and, if necessary, prepare an environmental impact statement (“EIS”) to determine what the significant effects would be from the project and assess potential mitigation measures. This analysis would be documented in the federal agency’s official record of decision, and would then be subject to review in federal court. Although many states have a state version of NEPA (US Department of Energy, 2009), many other states do not—including many states in the Midwest and Gulf Coast, which would be charged with siting and regulating new CO2 pipelines. Potentially, a pipeline could be routed through states that, if all lacked any form of state NEPA, would result in such a facility being constructed without a comprehensive assessment of its environmental impact. Even though these facilities would be helping to reduce our carbon footprint, the pipelines themselves have the potential for environmental impacts that warrant study and consideration in the permitting process.

If a pipeline were routed through several states, one of that had a state NEPA and others that did not, the process could itself result in differing conditions of approval, route alteration, and similar effects that could increase the cost and complexity of building and operating the pipeline. Many state NEPAs do not, for example, routinely permit the state to consider extra-territorial effects, but even if they did, they may not be able to enforce conditions of approval requiring mitigation measures outside their jurisdictional boundaries.

Requiring such projects to be reviewed under NEPA (even as compared to state NEPAs) confers potentially substantial environmental benefits from federal agency coordination. For example, if a project may have an impact on a species that is listed as endangered or threatened under the federal Endangered Species Act (“ESA”), a federal agency can conduct a consultation under Section 7 of the ESA to assess and mitigate impacts to the species, which is then reflected in the EIS and ROD. In the absence of federal review, the project proponent would be required to obtain an incidental take permit under Section 10 of the ESA, which is a much more complex and time-consuming process. As a result, project proponents do receive incidental benefits when subject to a federal permitting program.

2.4. Co-location risks

In addition to the regulatory risks associated with multiple state regulations, there is also a more practical issue that could be addressed by comprehensive federal regulation. To facilitate siting (and address any associated environmental impacts), many CO2 pipeline project developers would seek to co-locate their pipelines in existing pipeline rights-of-way currently being used by other pipelines, such as existing oil and natural gas pipelines, or other utility corridors such as long-distance transmission lines. Using existing corridors would reduce the costs associated with securing or condemning real property interests, would reduce the effects

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(footnote continued)

55 42 USC. § 4332 (requiring environmental impact statement for legislation and other major Federal actions).

56 Id.

57 Currently, the states, territories, and districts that have enacted environmental planning requirements similar to NEPA are California, Connecticut, District of Columbia, Georgia, Guam, Hawaii, Indiana, Maryland, Massachusetts, Minnesota, Montana, Nevada, New Jersey, New York, North Carolina, Puerto Rico, South Dakota, Virginia, Washington, and Wisconsin. For a compilation of these states, along with links to more detailed information, see the Department of Energy’s website at State Environmental Planning Information, http://ceq.hss.doe.gov/nea/regs/states/states.cfm (last visited Feb. 16, 2009).

58 States that lack any NEPA-type environmental planning regulation include Alabama, Arkansas, Iowa, Illinois, Kentucky, Louisiana, Michigan, Missouri, Mississippi, Ohio, Tennessee, and Texas. Each of these states could be implicated in the construction of a large-scale CO2 pipeline system for transporting CO2 from the Midwest to sequestration or EOR use in the Gulf Coast.

59 For instance, under the California Environmental Quality Act (“CEQA”), CEQA does not apply to “[a]ny project or portion thereof located in another state which will be subject to environmental impact review pursuant to [NEPA] or similar state law of that state.” Cal. Pub. Res. Code 21080(b)[14].

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58 16 U.S.C. § 1533(a) (stating consulting obligations of federal agencies and Secretary of Interior).

59 Id.

60 As mentioned above, Colorado’s public utility code already contemplates this. Colo. Rev. Stat. § 38-1-101.5. Depending on how strongly Colorado decided to enforce its policy, the state could force an interstate CO2 pipeline through an existing corridor to minimally disrupt Colorado citizens, but at the expense of an unnecessarily meandering interstate pipeline.
on neighboring property owners, and would reduce the overall environmental impacts.

However, there are potential challenges to co-location that could be addressed by federal legislation, particularly for co-location with federally regulated natural gas pipelines and interstate electric transmission lines. In many cases, the rights-of-way and franchise agreements that natural gas pipelines and transmission companies have negotiated are either specific to their linear facilities and do not permit co-location of other facilities, or they are vague with respect to what rights are granted and create uncertainty about whether co-location is permissible without consent. In connection with financing any CO2 pipelines, potential lenders and equity investors will be very interested in confirming that the pipeline has all the necessary real property interests (including condemnation authority and the contractual provisions of the federal Safe Drinking Water Act (Federal Register, 2008)).

In the long run, it is unlikely that, as the United States begins to remove CO2 from its coal-fired power plants, the oil extraction industry’s need for EOR will keep up with the increasing supply of CO2. In fact, while increasing efficiency of oil extraction confers an environmental benefit, there is a long-term policy tension between increased hydrocarbon production as a general matter and reducing the nation’s carbon footprint. Therefore, over the long term (toward 2050 and later this century), it is likely that the bulk of the CO2 transported via pipeline will be destined for long-term geologic sequestration unrelated to EOR.

While either a commodity-based or a waste-based approach is a defensible basis for regulation, there are potential collateral consequences if the CO2 is considered disposal of a waste product. If CO2 is considered a waste product, then what is being provided by the pipeline company is a waste transportation service that may or not be subject to regulation under state utility jurisdiction, depending on the state.63 For states that regulate CO2 pipelines under common carrier regimes, or frame public use in terms of EOR, treating CO2 as a waste turns upside down the existing and longstanding justifications for condemnation authority.64 In the absence of state utility or common carrier jurisdiction, an unregulated pipeline company would face even more difficult permitting and development challenges.

The same situation is true for the sequestration facilities themselves. Although this article focuses on CO2 pipeline transportation, the disposal facilities face similar consequences if the CO2 is considered a waste product. As mentioned above, the EPA has taken the view that emplacement of CO2 in geologic formations is subject to the underground injection control provisions of the Safe Drinking Water Act. Similarly, while at present commercial natural gas storage facilities are commonly regulated under public utility statutes, the same may not be true for CO2 storage facilities where there is no commerce in the emplaced gas. As such, these facilities may not qualify for state utility regulation.65

In many states, a certificate of public convenience and necessity (or similar certificate of public use) from the appropriate state agency is preemptive of local permitting for utilities.66 Under the current regulatory programs, it is by no means clear that pipeline transportation of CO2 not destined for EOR would qualify for public use certificates.66 If such a pipeline were not

2.5. Other regulatory observations
In addition to the siting, environmental review and rate regulation issues presented by these pipelines, there are two additional issues that must be addressed as part of a national move toward geologic sequestration of CO2. First, there is the question of whether these pipelines are transporting a product or commodity with a commercial value, or a waste product for disposal. Perhaps surprisingly, a case can be made for either—with very different regulatory outcomes.

2.5.1. CO2: commodity or pollutant/waste?
First, as noted above, CO2 is a commercial product and has a variety of commercial applications. As a result, the existing network of pipelines is and should be considered as a network of commodity pipelines. However, as the United States moves toward large-scale CO2 sequestration, the question of whether CO2 is a commodity or a waste may depend on the method of sequestration chosen. If the end use is EOR, then the question is similar to how gas is used in the current pipeline system and could be considered a commodity subject to common carriage as it is currently regulated. If the end use is long-term geological storage without any EOR use, however, then arguably it is nothing more than a waste product requiring permanent disposal. This is already the case in Michigan, for example, which currently deposits CO2 into an abandoned EOR project.

Under current federal environmental regulation, the Supreme Court recently concluded that CO2 was a “pollutant” as that term is used in Title I of the federal Clean Air Act.65 It is likely that the current administration will seek to extend that interpretation to stationary source emissions as part of the regulatory underpinnings of its carbon reduction initiatives. Long-term underground storage of a “pollutant” sounds a lot more like waste disposal than commodity storage, especially since by 2050 nations could be burying five to ten billion tons of CO2 every year, well in excess of our capability for beneficial use (Heller, 2005). Similarly, the EPA has taken an initial view that it can regulate geologic sequestration pursuant to the underground injection control provisions of the federal Safe Drinking Water Act (Federal Register, 2008).

63 A related point is whether or not transporting CO2 via pipeline would be considered a service or a “good” under Article 2 of the Uniform Commercial Code. Philip Marston, a well-known CCS commentator, notes that, although courts have previously considered CO2 a “good,” regulation requiring CCS from coal-fired electricity plants could turn CO2 removal and transportation into a “service” because CCS would be a necessary process without which the plant could not lawfully operate. Because it is unclear whether CO2 derived from CCS would be a good or a service, buyers and sellers may face uncertainties with respect to warranty and disclaimer obligations (Marston and Moore, 2008).

64 For instance, California’s Wild Goose natural gas storage facility is regulated by the California Public Utilities Commission (including the granting of public use certificates) to “provide firm and interruptible storage services at market-based rates,” and includes limits on daily natural gas injections and extractions (California Public Utilities Commission, 2009). Similarly, the Railroad Commission of Texas oversees natural gas storage to ensure Texas consumers enjoy a continuous supply of natural gas (Texas Railroad Commission, 2009).

65 But see Tex. Nat. Res. Code Ann. § 111.022 (stating that pipeline companies must get express permission of local governing body to use or lay its pipes along or under a public street or alley).

66 For instance, because the terms of the Louisiana and Mississippi eminent domain statutes are closely tied to EOR production, it is unlikely that a pipeline company carrying CO2 destined for a different use could enjoy the statutory grant of eminent domain. See La. Rev. Stat. Ann. §§ 12:1032(10) (specifically limiting eminent domain to purposes associated with enhanced oil recovery); Miss. Code Ann. § 11-27-47 (same).

61 For example, although co-location would be an important factor to reduce the cost and environmental impact, only one state has so far required such pipeline proponents to consider co-location. See Colo. Rev. Stat. § 38-1-101.5.

deemed to qualify for public use certificates, then it would have to obtain entitlements from all the local jurisdictions within the state rather than preemptive state jurisdiction. Such pipelines would not likely qualify in many states for condemnation authority, which would make them difficult to site and potentially more expensive.\footnote{Under current law, the converse could also pose policy issues. If instead the CO2 were treated as a commodity rather than a waste gas stream, it could undercut the positions taken by the USEPA and various states regarding other forms of CO2 regulation. And, if the classification were dependent on the actual use (i.e., if CO2 destined for enhanced oil recovery were treated as a commodity while that destined for disposal services. As part of the contractual arrangements and in order to insure adequate pipeline capacity, the generation company requires the pipeline to be sized appropriately and dedicated to its exclusive use, or at least makes any subsequent or additional use subject to capacity availability and possibly its consent.}

The pipeline company is then a single-customer pipeline, and as such, also may not qualify for common carrier classification under state law, as state laws normally require the carrier to serve the “public” (as has been historically interpreted to be the case when transporting CO2 coincides with EOR). Detached from natural resource development, courts may take a longer look at whether a single-customer pipeline in fact serves a public use. Such a company would have many of the same issues as the “waste disposal” company discussed above, in terms of local permitting jurisdiction and possibly the absence of condemnation authority. While depending on the state law involved, if the generation customer were itself a public utility, the pipeline company (carrier) might be able to claim that it is serving the utilities’ ratepayers, thereby creating an indirect public use. However, such an indirect, tangential nexus to public use may not suffice for that purpose, and in any case would not likely suffice in respect of any independent, non-utility generation company customer.

This argument becomes even more complex if, as is distinctly possible, different power generation companies contract with a single company to install and operate the CO2 removal technology. Because of project finance opportunities available to the technology providers, a transaction could be structured (as has been done for other pollution control technologies) for the generator to contract with a CO2 removal company, pursuant to which the generation company pays the removal company a particular sum of money for CO2 removal services over a period of time. This revenue stream, if creditworthy, can become the basis for a nonrecourse project financing of the CO2 removal technology. The transactional contracts would include all the agreements for the design, construction and operation of the removal system, including contracts for the transportation and eventual disposal of the CO2. All these agreements, in order to serve as part of the collateral for lenders, would need to be with creditworthy entities and have appropriate financing provisions.

Under such a structure, the removal company, if it contracted with a pipeline company to transport CO2 from multiple removal facilities, may well face the same obstacle to traditional state common carrier regulation even though the power plants were owned by different entities—because the removal units themselves would be owned by the same entity or its affiliates. The result would also be a single-customer pipeline system that presents “public use” issues. While a system comprised of multiple power generators and multiple carbon removal companies would not necessarily present the same problem, such a system would exist only in a mature carbon removal and sequestration market. It will not exist initially; in a nascent carbon removal and sequestration market, these facilities will likely be constructed by a small number of entities and because of the finance structures dictated by the capital markets, will likely present the single-customer issues discussed in this article, at least in the critical early years of this infrastructure’s development.

In light of these challenges, both in terms of siting, operational and permitting conditions, capital markets access, environmental reasons and transactional challenges, the current arrangement of individual state utility regulation is unlikely to serve as the basis for a robust CO2 pipeline industry to develop in a way that will allow multiple technology providers, pipeline companies and sequestration companies to develop in a capital and resource-efficient manner.

3. The solution: preemptive federal regulation of CO2 sequestration pipelines

As discussed above, there are very substantial challenges presented by the current regulatory structures for CO2 sequestration pipelines that will greatly complicate our ability to scale up such a pipeline system should the United States choose to make a substantial investment in CO2 removal from its fleet of coal-fired power plants. A regulatory structure like that in effect for natural gas pipelines would solve the majority of these concerns while creating few additional problems for the industry. Such a program would consist of the following elements: (1) vesting exclusive siting jurisdiction in an appropriate federal agency (similar to the FERC’s siting for natural gas pipelines), (2) continuing Office of Pipeline Safety management over safety and technical issues, (3) providing for condemnation authority for such pipelines (whether they have single or multiple customers), consistent with the existing scope of condemnation authority granted to natural gas pipelines, (4) rate regulation with appropriate access and tariff...
were developed to serve a narrow purpose (Kelliher, 2008). However, the current 3600 miles of CO2 pipelines preemptive programs to regulate various industries. Indeed, the regulatory oversight program. (1) it would provide for a one-stop entitlement process at the federal level, thereby streamlining the entitlement process (particularly for single-customer pipelines), (2) the pipelines would be subject to NEPA (and if appropriate, would be able to take advantage of the Section 3 consultation requirements of the ESA and similar federal agency coordination processes designed to mitigate environmental impacts), (3) there would be consistency in rates, avoiding “pancaking” and other financial risks arising from multiple jurisdictions with financial regulatory authority over such pipelines, (4) co-location of facilities would be more likely and would result in overall lower development and construction cost, less impact to local communities and lower environmental impacts, and (5) the unified regulatory structure would facilitate efficient access to the capital markets and the efficient allocation of resources in private project finance transactions because of the certainty provided by a single regulatory oversight program.

Congress has traditionally been reluctant to use federally preemptive programs to regulate various industries. Indeed, the current program has been defended by various agencies as sufficient (Kelliher, 2008). However, the current 3600 miles of CO2 pipelines were developed to serve a narrow purpose—EOR in specific locations. An expansion of the program by many multiples, at a cost of many billions of dollars, for carbon sequestration would represent a national program of nearly unprecedented scope, undertaken to serve a national mandate to reduce our carbon footprint. Such a major national initiative is precisely the sort of infrastructure program that would warrant a preemptive program specifically aimed at this subset of infrastructure facilities. Indeed, as discussed earlier in this article, the sheer magnitude of the sequestration task and the potentially limited time window in which to make any such changes, argues strongly in favor of a federally preemptive program.

However, there would be consequences to such a program: (1) existing pipelines would have to be grandfathered to remain under state regulation or promptly issued licenses upon effectiveness in order to avoid inconsistencies in regulation, (2) state and local control over siting decisions would be greatly diminished, as would the overall state role in the sequestration program (although state jurisdiction over the disposal facilities themselves would not necessarily be affected, subject to clarifying the application of relevant federal environmental statutes), and (3) there might be circumstances where a particular state’s regulation would be more protective of the environment or other issues than would a federal program. However, when one considers the purpose of a large expansion of CO2 sequestration—to further a national objective and commitment to reducing our carbon footprint—the ability of individual states to delay, obstruct or deny applications for such pipelines, or to regulate them in such a way (including inconsistent terms and conditions) as to make them either less economical or inefficient, would leave such a paramount federal interest at risk. As another supporting argument, one should consider the costs associated with such a pipeline program. The Congressional Research Service estimated the costs of such an expansion program to be substantial. For example, building a CO2 trunk line from North Carolina to the Gulf Coast and Appalachia, even if using existing rights of way, would cost approximately $5 billion dollars. Rising labor and materials costs are estimated to be at least $800,000 per mile of installed pipeline (Farmonak and Folger, 2008). In the absence of a coordinated, preemptive federal effort, competing state programs could drive the development costs (including the cost of raw materials and pipe stock) even higher, further impeding any national program to reduce carbon impacts and ultimately increasing the cost to the American public to achieve such objectives.

4. Conclusion

The United States is embarking for the first time on examining and reducing CO2 emissions in order to reduce global climate change impacts. Given the large amounts of CO2 emissions from coal-fired power plants, to the extent policymakers envision using geologic sequestration of CO2 to address any appreciable fraction of current and future CO2 emissions, the required infrastructure investment will be massive, and may be required over a limited period of time. In order for cost of CO2 sequestration pipelines to be borne efficiently by the private sector or utility ratepayers, and to accomplish these objectives in a timely fashion, the regulatory structures in place need to assure certainty, efficiency and predictability in the siting and regulatory process, in ratemaking requirements, and in the ability to obtain the necessary real property entitlement to construct such pipelines. The current system, while certainly functioning well over the existing pipeline network, is simply not structured to handle the development in a short period of time of perhaps 50,000 or 100,000 miles of these pipelines at a cost of many billions of dollars. The current system is not structured to attract private equity or debt capital investment, similar to the way the private sector has invested in our electric generation and natural gas pipeline infrastructure. A comprehensive federal program is ultimately what is required for this investment to be made on a timely basis and relying to the maximum extent on private sources of capital and the global capital markets.

As the United States moves towards a reduced carbon footprint, the nation will have to deal with the CO2 emissions from our large fleet of coal-fired, base load power plants. Geologic sequestration is a technology that will likely be a major part of the solution to this problem, and in order for that to happen, the United States will have to invest substantially in a massive increase of its CO2 pipeline transportation capacity. The current regulatory regime, consisting of state utility commission oversight and very limited federal regulation over rate complaints and pipeline safety, is likely to prove inadequate to support the massive infrastructure development required to

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68 An alternative form of federal regulation, such as that in place for electric transmission corridors, while preserving state feedback, is not likely to solve the
implement this objective in a timely and capital-efficient manner. This article recommends that Congress adopt legislation to provide for preemptive, federal licensing, rate regulation and oversight of these pipelines in order to provide the certainty and clarity that will give the private sector the certainty, predictability and confidence to invest in this very important part of our infrastructure.

References

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