Siting Carbon Dioxide Pipelines

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SITING CARBON DIOXIDE PIPELINES

TARA K. RIGHETTI*

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Introduction

Last fall, the subject of oil pipeline siting was thrust into the spotlight. Protesters and police and private security employed by the Dakota Access Pipeline clashed in full media view. Social media accounts buzzed as constituents as diverse as activists, lawyers, nurses, and homemakers nationwide “checked in” at Standing Rock. “Water Protectors” were profiled in National Geographic and Vogue. Suddenly, it seemed,

everyone had an opinion on oil pipeline siting, including the adequacy of state approvals and federal oversight. There was widespread outrage that private oil pipelines could be developed over the objections of the local landowners and stakeholders most impacted by disruptions to land use and potential spills.\(^4\) Meanwhile, approximately 450 miles away and removed from the media frenzy, an application quietly proceeded for a federal right-of-way on a 16-inch carbon dioxide (“CO\(_2\”)”) pipeline.\(^5\) This pipeline would tie into a larger network intended to transport anthropogenic CO\(_2\) from a privately owned treatment plant to a larger trunk line where it would be transported to aging oil fields for injection as part of tertiary recovery operations.\(^6\) In addition to the federal right-of-way, the pipeline company would require permission to cross private lands—permission it could likely obtain, if needed, through the exercise of eminent domain.

More than 5,000 miles of high-pressure pipelines carrying CO\(_2\) traverse the western and southern United States primarily connecting natural and anthropogenic sources of CO\(_2\) sources to mature oilfields for CO\(_2\) enhanced oil recovery (CO\(_2\)-EOR).\(^7\) The majority of CO\(_2\) pipelines are point-to-point—connecting one privately held asset to another. CO\(_2\) is not transported or delivered for general use by the public—it is neither a heating nor transportation fuel. Accordingly, the pipeline network has developed in a highly localized and organic manner connecting reliable sources of CO\(_2\) to oilfields for CO\(_2\)-EOR.

However, there is a foreseeable need for a more flexible, integrated CO\(_2\) pipeline network. It is anticipated that there will be significant growth in CO\(_2\) transportation infrastructure in the coming decades. Demand for CO\(_2\) for CO\(_2\)-EOR purposes is only anticipated to grow.\(^8\) Additionally, should


\(^6\) Id.


\(^8\) See Vello Kuuskraa & Matt Wallace, *CO\(_2\)*-EOR Set For Growth as New CO\(_2\) Supplies Emerge, Oil & Gas J. (Apr. 7, 2014), http://www.ogj.com/articles/print/volume-
carbon capture, utilization, and storage (CCUS) be implemented more broadly as a climate-mitigation technology, transportation of additional volumes of CO$_2$ from anthropogenic sources to storage reservoirs will be necessary. Together, it is estimated that these technologies will necessitate between a three-fold and five-fold expansion of existing CO$_2$ transportation infrastructure within the United States in the next 30 years.\footnote{See J.J. Dooley et al., \textit{Comparing Existing Pipeline Networks with the Potential Scale of Future U.S. CO$_2$ Pipeline Networks}, 1 \textit{ENERGY PROCEdia} 1595 (2009), available at http://ac.els-cdn.com/S1876610209002100/1-s2.0-S1876610209002100-main.pdf?_tid=cc780c34-caee-11e7-abb6-00000acbd361&acdnat=1510850585_ae8a579226bf4eab6dec91db3f8e9b7 ("Between 11,000 and 23,000 additional miles of dedicated CO$_2$ pipeline might be needed in the United States before 2050.").}

The precise route of the pipelines may be impacted by a variety of factors under both state and federal law. Like oil pipelines and electric transmission lines, developers of CO$_2$ pipelines site infrastructure according to state law. Accordingly, state law determines whether, and under which circumstances, CO$_2$ pipeline companies may utilize eminent domain authority to acquire property along the pipeline route. States principally provide pipelines with this authority under two public interest justifications: 1) the development of natural resources; or 2) constructing and making available public access infrastructure through the imposition of common carrier requirements.

This paper analyzes the adequacy of the current regulatory framework for siting CO$_2$ pipelines with a goal towards building a CO$_2$ pipeline network that is flexible enough to serve both CO$_2$-EOR and CCUS purposes. Part I discusses carbon dioxide itself: its production and capture, its transport, and its current uses in CO$_2$-EOR and CCUS. Part II discusses state and federal regulations controlling the siting of CO$_2$ pipelines. Part III examines the process for permitting and acquiring right of way for CO$_2$ pipelines with a focus on state approaches to grants of condemnation authority to private developers of CO$_2$ pipelines. Specifically, the discussion compares the two principal methods states utilize to establish public interest for eminent domain for CO$_2$ pipelines. This exploration analyzes approaches adopted by states that utilize a public purpose justification based on natural resource development as contrasted with those requiring public use via common carriage mandates. Part III also considers the benefits and limitations of requiring common carriage, noting the unique technical and legal requirements of CO$_2$ transport for both CO$_2$-EOR
and CCUS. Part IV examines state siting in a broader context. It considers whether the patchwork of state siting requirements is an insurmountable hurdle to a growing and adaptable CO₂ transportation network and discusses proposals for federal siting regulation. The paper concludes that, at least for the time being, state siting is appropriate given the localized nature of CO₂ pipeline development and its impacts on landowners and the environment. However, the paper suggests that a public goods approach to siting and justifying eminent domain is preferable. A public use approach resolves ambiguity regarding condemnation authority of CO₂ pipeline developers under current statutes and constitutional provisions drafted principally with oil or natural gas in mind. Further, through common carrier requirements it may be possible to assure that CO₂ pipeline infrastructure developed utilizing eminent domain for CO₂-EOR can later be integrated into a broader, national pipeline network to accommodate CCUS.

I. CO₂ – Capture, Transport, and Use

CO₂ is concurrently and variably considered a by-product, a pollutant greenhouse gas (GHG) capable of threatening public health and subject to regulation under the Clean Air Act, and a valuable commodity essential to improving oil production. This would seemingly generate an obvious


12. See MONT. CODE ANN. §§ 82-11-111(9), 82-10-301 through -302; (West, Westlaw through 2017 Sess.); OKLA. STAT. tit. 27A, § 3-5-101(1) (West 2010) (“Carbon dioxide is a valuable commodity to the citizens of the state, particularly for its value in enhancing the recovery of oil and gas and for its use in other industrial and commercial processes and applications.”); Paul Parfomak & Peter Folger, Carbon Dioxide (CO₂) Pipelines for Carbon Sequestration: Emerging Policy Issues, CONG. RES. SERV. (2007), http://research.policy archive.org/18606.pdf; Best Practices for: Geologic Storage Formation Classification,
synergy—GHG produced from the burning of fossil fuels could be captured, rather than emitted, and then stored underground as part of commercial CO₂-EOR operations. Yet, despite shortages in CO₂ for CO₂-EOR operations, this has rarely been the case historically. Almost all of the CO₂ used in enhanced oil recovery is produced from natural sources underground, and almost all the CO₂ generated by industrial processes and power generation is emitted into the atmosphere. This paradox results from several reasons, including the fact that most anthropogenic CO₂...
capture technologies have not innovated to efficiently and economically address supply needs. Natural CO$_2$ is often purer and is less expensive to produce in sufficient volumes than the capture and processing of anthropogenic CO$_2$. It may also be subject to less regulation. However, this paradigm is unlikely to last. As natural reservoirs are depleted and tertiary recovery of oil becomes more prevalent, and as CO$_2$ capture technologies advance, an increase in the use of anthropogenic CO$_2$ will be necessary to meet CO$_2$ demand for EOR. These technologies may become more commercially driven due to tax or other incentives. Concurrently, the geologic injection and storage of anthropogenic CO$_2$ may be required in some instances due to, for example, regulation, carbon pricing, or other incentives.

18. See Melzer, supra note 13, at 6. An exception is natural gas separation associated with natural gas production operations, which is economic in many situations where CO$_2$-EOR is also available.

19. See A. S. Bhown & B. C. Freeman, Analysis and Status of Post-Combustion Carbon Dioxide Capture Technologies, 45 ENVTL. SCI. TECH. 8624, 8624-32 (2011); Anand B. Rao & Edward S. Rubin, A Technical, Economic, and Environmental Assessment of Amine-Based CO$_2$ Capture Technology for Power Plant Greenhouse Gas Control, 36 ENVTL. SCI. TECH. 4467, 4467-75 (2002); Melzer, supra note 13, at 6 (“The new age of anthropogenic supplies of CO$_2$ has just not advanced to meet the supply shortages. The CO$_2$ cost gap between industrial CO$_2$ and the pure, natural CO$_2$ remains a barrier.”).


23. CCUS has been included in Step 1 of a top-down BACT analysis for GHGs. See Utility Air Reg. Grp. v. EPA, 134 S. Ct. 2427, 2448 (2014). However, EPA guidance specifies that its inclusion “does not necessarily mean CCS should be selected as BACT for such sources.” See John-Mark Stensvaag, Preventing Significant Deterioration Under the Clean Air Act: The BACT Determination – Part 1, 41 ENVTL. L. REP. NEWS & ANALYSIS 11101, 11104 n.25 (2011) (citing U.S. EPA Office of Air and Radiation, PSD and Title V Permitting Guidance for Greenhouse Gases). EPA’s Proposed New Source Rule Proposal for New, Modified, and Reconstructed Plants under CAA 111(b) also relied on the use of CCUS in establishing emissions limitations. See Michael. J. Nasi & Jacob Arechiga, Greenhouse Gas Reduction Technologies for Power Generation, RMMLF SPECIAL INST., CLIMATE
governmental imperatives\textsuperscript{25} for geoengineering solutions to climate change.\textsuperscript{26} As a result, it is likely that the capture of CO\textsubscript{2} from anthropogenic sources and its transport for both CO\textsubscript{2}-EOR and CCUS will be of increasing importance in coming years.

The transport of CO\textsubscript{2} across long distances is critical to both improved oil recovery and climate mitigation through CCUS.\textsuperscript{27} Sources of CO\textsubscript{2}, whether natural or anthropogenic, are rarely co-located with established oil fields or appropriate subsurface storage complexes for geologic storage.\textsuperscript{28} In order to deliver CO\textsubscript{2} to these end users, a pipeline network is required,
often crossing several states and federal land. An integrated and nationwide network may address concerns about CO$_2$ availability and reliability for CO$_2$-EOR and favorably impact economics for CCUS and captured anthropogenic CO$_2$. However, unlike the massive growth of natural gas pipelines in the 20th century, CO$_2$ pipelines are unlikely to grow explosively or pervasively. Demand for CO$_2$ is highly localized and development is likely to progress through point-to-point, single use pipelines. An integrated backbone CO$_2$ pipeline infrastructure that is flexible enough to accommodate CO$_2$-EOR and CCUS uses is unlikely to develop organically. Accordingly, facilitating the expansion of CO$_2$ transportation networks in a manner that addresses economic needs, while promoting CCUS, presents unique legal challenges.

Exploration, Production, and Capture of CO$_2$

CO$_2$ can be produced from naturally occurring underground sources or can be captured from industrial facilities, such as mining processing facilities or coal fired generation. Natural CO$_2$ is produced from underground reservoirs that are typically called domes. Known reservoirs of natural CO$_2$ exist in Colorado, Utah, New Mexico, and Mississippi. These reservoirs contain high purity CO$_2$ that is suitable for use in CO$_2$-EOR with minimal processing. Natural CO$_2$ reserves in the United States are substantial: as of 2012, known reservoirs of natural CO$_2$ were estimated to contain approximately 41 trillion cubic feet of CO$_2$.

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31. See Duncan, supra note 21, at 3 (stating that “[n]aturally occurring CO$_2$ reservoirs exist in Colorado, New Mexico, and Mississippi”).
34. Id.
35. Id.
36. Id. at 69-70.
Ownership and Leasing of CO₂

Natural CO₂ is found on both private and federal lands, including both private and federal split estate configurations. A split estate exists where different parties own the surface and mineral interests. “Split Estate Federal Minerals,” arose principally from reservations in patents issued under the land disposition acts of the early 20th century, including the Coal Land Acts, Agricultural Entry Act, and the Stock Raising Homestead Act. By retaining the minerals Congress sought to preserve valuable public resources while simultaneously promoting efficient extraction of mineral resources and development of the arid west for both natural resource and agricultural purposes. In the past one hundred years, whether these reservations include specific substances, such as gravel or coal bed methane, has been hotly contested, leaving ambiguity as to what precisely has been conveyed or retained. Consistent with these cases, in the late 1970s and early 1980s, when production of natural CO₂ for CO₂-EOR purposes was gaining momentum, there was confusion as to whether CO₂


41. See Watt v. W. Nuclear, 462 U.S. 36, 47 (1983) (“While Congress expected that homesteaders would use the surface of SRHA lands for stock-raising and raising crops, it sought to ensure that valuable subsurface resources would remain subject to disposition by the United States, under the general mining laws or otherwise, to persons interested in exploiting them.”); United States v. Union Oil Co. of Cal., 549 F.2d 1271, 1276 (9th Cir. 1977) (“When Congress imposed a mineral reservation upon the Act’s land grants, it meant to . . . retain governmental control of subsurface fuel sources, appropriate for purposes other than stock raising or forage farming.”).

42. Id. (holding that the gravel found on lands patented under the SRHA is a mineral reserved to the United States despite the fact that it would not have been considered a mineral at the time of the SRHA).


44. See Watt, 462 U.S. at 62 (Powell, J., dissenting) (noting that by including gravel as a “mineral” within the reservation of the Stock Raising Homestead Act “only the dirt itself could not be claimed by the Government”); Union Oil, 549 F.2d at 1278 (noting that the patent under the SRHA “give[s] the owner much more than the surface, [it] give[s] him all except the body of the reserved mineral”) (citation omitted).
was a “gas” as defined within these mineral reservations of “oil and gas.”

The Department of Interior, citing the broad definition of gas in BLM regulations and the general intent of the Congress to retain valuable mineral resources, determined that the oil and gas reservations in land patents issued by the United States include CO₂. This position was later confirmed in *Aulston v. United States*. Thus, in addition to federal fee lands, CO₂ is federally owned on land with private surface and federal minerals retained pursuant to these reservations.

Federally owned CO₂ is considered a leasable mineral under the Mineral Leasing Act (MLA). Like combustible and hydrocarbon gas, CO₂ on federal lands is produced by drilling and completing wells pursuant to oil and gas leases. “Gas,” as used in the MLA, is not restricted to hydrocarbons. In fact, Bureau of Land Management definitions define “gas” as “any fluid, either combustible or noncombustible, which is produced in a natural state from the earth and which maintains a gaseous or rarefied state at ordinary temperatures and pressure conditions.”

Noting specifically that helium, a non-hydrocarbon gas, was within the meaning of “gas” in the statute, the Tenth Circuit in *Aulston* held that CO₂ was a “gas” within the meaning of the MLA and thus could be extracted under the terms of an oil and gas lease.

Where both surface and minerals are privately owned, a property-specific analysis is required to determine ownership of CO₂. If CO₂ is expressly granted or reserved, the language of the grant or reservation will control. However, where the conveyancing language is ambiguous, state

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45. *See Aulston v. United States*, 915 F.2d 584 (10th Cir. 1990).
47. *Aulston*, 915 F.2d at 598 (citing *Union Oil*, 549 F.2d at 1274-76).
49. 915 F.2d 584 (10th Cir. 1990).
50. *See generally Aulston v. United States*, 915 F.2d 584 (10th Cir. 1990).
53. 43 C.F.R. § 3000.0-5(a) (2017).
54. *See Aulston*, 915 F.2d 584, 591-99 (10th Cir. 1990) (citing Northern Nat. Gas Co. v. Grounds, 441 F.2d 704 (10th Cir. 1971)).
case law or statutory enactments may be determinative. These approaches may variously look to the value of the substance, its location and the degree of surface damage caused by the manner by which it can be reasonably extracted, the substance’s similarity to named minerals, and the commonly understood meaning of the term at the time of the grant. Some states like North Dakota have statutorily defined “minerals,” although doing so has not necessarily resolved uncertainty for interpretation. Despite abundant case law on the question, ambiguous mineral reservations or conveyances may still be unclear as applied to various substances—including CO₂.

**Exploration and Production**

State regulation of exploration activities and potential surface and environmental impacts of exploration are very similar to those for oil and gas. CO₂ is produced using methods similar to those used for hydrocarbon gas production. In fact, CO₂ domes may be discovered in the course of oil and gas exploration. Accordingly, state oil and gas conservation agencies may be authorized to create drill spacing units, permit new drilling, and unitize leases for purposes of CO₂ production. Drilling for CO₂ results in

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61. See Bailey v. Shell W. E&P, Inc., 609 F.3d 710 (5th Cir. 2010); see, e.g., Miss. Code. Ann. § 53-1-3(d) (West 1995) (defining “gas” to include Carbon Dioxide and therefore putting CO₂ within the permitting authority of the state Oil and Gas Board); N.M. Stat. Ann. § 70-2-34(A) (West 2003) (“The oil conservation division shall adopt and
surface disturbances and can generate impacts to species, noise and light pollution, and other environmental externalities associated with the exploration and production of other gaseous underground resources. Appropriately, surface requirements for bonding, setbacks, and reclamation may also be similar to those mandated for oil and gas exploration.

Producing CO₂ as a byproduct from industrial processes and natural gas separation plants is an alternative to natural CO₂. Early CO₂-EOR projects, prior to the discovery of natural sources, used CO₂ from industrial facilities and natural gas separation plants. Although the processes are distinct, and the CO₂ itself is indistinguishable from that produced by natural sources, for purposes of this paper CO₂ sourced from these types of facilities are collectively referred to as “anthropogenic CO₂.” Anthropogenic CO₂ can be captured from the flue gas stream from existing sources such as natural gas, coal, and combined cycle power plants, and from energy intensive industrial processing facilities such as gas processing, coal gasification, combined cycle generation, and fertilizer production facilities. Most currently available technologies capture from a flue through retrofits onto existing plants. The cost of capture and the purity of CO₂ captured depend on the quantity of CO₂ in the flue and the method of generation, and estimates vary greatly. While the potential volume of CO₂ that can be captured from these sources may exceed that available from underground reservoirs, methods of capture can be expensive and the CO₂ captured may require additional processing to reach pipeline quality specifications. These specifications require removal of water and other impurities that

administer rules on the conservation, the production and the prevention of waste of carbon dioxide, helium and other non-hydrocarbon gases in the same manner as it regulates, conserves and prevents waste of natural or hydrocarbon gas.”).

63. Duncan, supra note 21, at 3; Schnacke, supra note 13, at 287; Dipietro, supra note 33, at 1, tbl. 2-3.
64. Duncan, supra note 21, at 3; Rao & Rubin, supra note 19, at 4467.
contribute to corrosion during transportation or make the CO₂ unsuitable for EOR. Perhaps due to these constraints, the majority of CO₂-EOR projects use natural CO₂. Only eight oil and gas fields presently utilize anthropogenic CO₂ for enhanced recovery operations.

**CO₂ Transportation**

Once captured, CO₂ is processed, dehydrated, pressurized, and transported via pipeline to end-users for CO₂-EOR. According to data compiled by the Pipeline Hazardous Materials Safety Administration (PHMSA), as of 2016, there were over 5,100 miles of CO₂ pipelines in the U.S. The majority of CO₂ pipelines were built to deliver CO₂ from reservoirs in New Mexico and Colorado for EOR operations in the Permian oil field in West Texas. In addition to these states, demand for EOR has driven construction of significant CO₂ pipeline infrastructure in Wyoming, Mississippi, Louisiana, and Texas. These pipelines are highly localized and field specific, and carry “both naturally-occurring CO₂ and anthropogenic CO₂ extracted or captured from industrial sources.” CO₂-EOR accounts for approximately 90 percent of total CO₂ transported, although additional end uses include manufacturing, such as soda bottling.

Transportation of CO₂ by pipeline requires unique design and construction to address the pressure and temperature requirements for transport in a supercritical phase. CO₂ is transported in a supercritical dense-phase state at pressures ranging “from 1,200 to 2,700 psi”—pressures significantly higher than those used for the transport of natural gas. Dense-phase gas has attributes that are both like a gas and a liquid.

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68. MIT Report, *supra* note 16.


72. *Id.*; Dooley, *supra* note 9, at 1596.


74. *Id.* at 289 (citing Presentation, Lisa Bacanskas, *CO₂-EOR and EPA’s Greenhouse Gas Reporting Program*, EPA Workshop: Introduction to Carbon Dioxide Enhanced Oil Recovery (CO₂-EOR) (June 11, 2013)).

75. *Id.* at 278.

Because dense-phase CO$_2$ moves like a liquid, pumps, rather than compressors, are required to move it through the pipeline.\textsuperscript{77} Compression to these pressures is itself energy intensive.\textsuperscript{78} Since CO$_2$ cannot be burned to generate the energy necessary for compression, compression stations must be located near sources of electric power or natural gas.\textsuperscript{79} Due to high pressures, CO$_2$ pipelines typically use thicker walled pipe than is used for natural gas pipelines.\textsuperscript{80} Additional linings, claddings, and coatings may be necessary to manage corrosion risk.\textsuperscript{81} Although possible, these unique construction specifications make requalification of existing natural gas pipelines for CO$_2$ unusual.\textsuperscript{82}

\textit{End Uses of CO$_2$}

CO$_2$ is considered a commodity for use in manufacturing, the food and beverage industry, and energy production.\textsuperscript{83} The majority of CO$_2$ drilled, produced, and transported today is for use in oil fields for CO$_2$-EOR.\textsuperscript{84} Conventional oil production may only produce as much as 80\% or as little as 10\% of the initial oil in place.\textsuperscript{85} As pressure within the reservoir diminishes, oil remains trapped within the pore space.\textsuperscript{86} Some of this stranded oil can be produced by the injection of CO$_2$ to mobilize flow of oil within the pore spaces towards a production well.\textsuperscript{87} EOR operations also result in underground storage of CO$_2$. As long as tertiary recovery operations continue, CO$_2$ is recycled and reinjected with only minimal losses throughout the process.\textsuperscript{88} Approximately 90\% of the total CO$_2$ injected will remain within the hydrocarbon reservoir, a process
that is referred to as “associated storage.” This storage accounts for the majority of anthropogenic CO₂ that has been sequestered to date.

CO₂ can also be sequestered underground for CCUS to decarbonize fossil-fuel generation and mitigate climate change. In this process, CO₂ is viewed as a waste rather than a commodity. CO₂ is captured from anthropogenic sources, such as coal and natural gas fired power plants or natural gas separation facilities, and injected underground for long term or permanent storage. Sequestration requires rock formations with impervious layers and that are free of faulting to prevent the injected CO₂ from migrating or escaping into other formations, such as fresh water aquifers, or to the surface. The underground reservoirs where CO₂ can be sequestered may be depleted oil or gas fields—hydrocarbon reservoirs that have already demonstrated secure containment of substances under pressure over a geologic time scale—or newly discovered non-hydrocarbon storage sites such as deep saline aquifers or coal seams.


90. Marston & Moore, supra note 15, at 425 (“The amount of CO₂ that has been incidentally stored [as residual unrecoverable CO₂ injected for EOR] over the last several decades dwarfs the volumes injected by CCS pilot projects around the world.”).


92. Academic literature refers to both CCUS and CCS, often using the terms interchangeably. However, there are differences between projects where CO₂ is exclusively stored and projects where CO₂ is utilized for EOR, or the production of chemicals or other industrial products. See Rosa M. Cuellar-Franca & Adisa Azapagic, Carbon Capture, Storage, and Utilization Technologies: A Critical Analysis and Comparison of Their Life Cycle Environmental Impacts, 9 J. OF CO₂ UTILIZATION 82-102 (Mar. 2015).


94. Stefan Bachu, Identification of Oil Reservoirs Suitable for CO₂-EOR and CO₂ Storage (CCUS) Using Reserves Databases, with Application to Alberta, Canada, 44 INT’L
The U.S. Department of Energy (DOE) estimates that in the U.S. alone there is adequate sequestration capacity for geologic storage to contain more than 3,300 billion metric tons of CO$_2$. Implementation of CCUS at the nationwide, commercial scale necessary to materially impact climate change will require CO$_2$ pipeline infrastructure to expand dramatically. Development of even a small portion of these storage resources will require a significant expansion of CO$_2$ transportation infrastructure. An explosion of construction, however, is unlikely. Thus far, implementation of CCUS technology has been exclusively through pilot projects with extensive government funding. The DOE has provided billions of dollars for CCUS research, technology development, and pilot projects. It is unknown whether, and to what extent, these technologies will be commercially adopted.

Pipelines developed for EOR will likely form the basis for a larger system to accommodate CCUS deployment. In fact, many depleted EOR assets may have additional carbon storage potential. Transitioning end-of-life EOR assets to permanent storage facilities requires navigation of complex and inconsistent regulatory permitting requirements and


97. Kevin Bliss, et al., A Policy, Legal, and Regulatory Evaluation of the Feasibility of a National Pipeline Infrastructure for the Transport and Storage of Carbon Dioxide, Topical Report, Interstate Oil & Gas Compact Comm’n, at 32 (Sept. 10, 2010); Dooley, supra note 9, at 1957.


adjustments to real property entitlements.\textsuperscript{100} While these assets may permit utilization of existing pipeline infrastructure for at least some storage, in order to make maximum utility of available methods of capture and the reservoirs at each terminus, the unique needs and objectives of those technologies will need to be evaluated.\textsuperscript{101}

The exact “size and configuration of the pipeline system” that will be required for CCUS will depend on a number of factors, including the demand and economics of EOR, fuel switching, and the timing, rate, and stringency of commercial adoption of CCUS technologies.\textsuperscript{102} By all accounts, however, there will be significant expansion of CO\textsubscript{2} pipeline infrastructure between now and 2050.\textsuperscript{103} Much of this infrastructure may be pieced together from pipelines developed for CO\textsubscript{2}-EOR. Integration of these pipelines into a flexible, hybrid infrastructure that can accommodate CCUS requires consideration of the ways in which CO\textsubscript{2} pipelines are sited, constructed, and regulated today.

\textit{II. The Federal Regulatory Framework for CO\textsubscript{2} Transport}

Unlike pipelines for natural gas, there is no federal regulatory framework for siting CO\textsubscript{2} pipelines or providing pipeline developers with eminent domain authority. Only safety is subject to comprehensive federal regulation. Rather, the design, routing, construction, and operation of CO\textsubscript{2} pipelines are regulated at the state level. Nonetheless, numerous federal laws and regulations influence CO\textsubscript{2} pipeline siting, design, or operation, particularly where pipelines cross state lands. These regulations introduce

\textsuperscript{100} A full exploration of these issues is beyond the scope of this article. See Patrick Falwell, \textit{State Policy Actions to Overcome Barriers to Carbon Capture and Sequestration and Enhanced Oil Recovery}, CTR. FOR CLIMATE AND ENERGY SOLS., (Sept. 2013) (for the Industry Working Group of North America 2050); Elizabeth J. Wilson & David Gerard, \textit{Carbon Capture and Sequestration: Integrating Technology, Monitoring and Regulation} (Blackwell Publishing 2007); Marston & Moore, \textit{supra} note 15.

\textsuperscript{101} \textit{Id.} at 464 ("A CCS Pipeline for removing captured CO\textsubscript{2} from one or more power plants for permanent geologic storage is, in certain respects, the polar opposite of the EOR pipeline.").

\textsuperscript{102} Richard S. Middleton & Jeffrey M. Bielicki, \textit{A Comprehensive Carbon Capture and Storage Infrastructure Model}, 1 ENERGY PROCEDIA, at 1611-16 (Feb. 2009); Dooley, \textit{supra} note 9; \textit{Id.} at 436.

\textsuperscript{103} Howard J. Herzog, \textit{Scaling Up Carbon Dioxide Capture and Storage: From Megatons to Gigatons}, 33 ENERGY ECONOMICS 4, 597-604, 600 (2011); M.D. Jensen, et al., \textit{A Phased Approach to Building a Hypothetical Pipeline Network for CO\textsubscript{2} Transport During CCUS}, ENERGY PROCEDIA 37, 3097-3104 (2013).
mechanisms for federal agencies to influence the siting of CO₂ pipelines in coordination with state regulatory agencies.

Safety

Safety is the only aspect of CO₂ pipeline development that is subject to comprehensive federal regulation. PHMSA—part of the U.S. Department of Transportation—regulates the safety of interstate CO₂ pipelines pursuant to the Hazardous Liquid Pipeline Safety Act of 1979 (HLPSA). Through the Office of Pipeline Safety (OPS), PHMSA regulates the design, construction, pressure testing, operation, maintenance, corrosion control, and reporting requirements for hazardous liquid pipelines. Department of Transportation regulations categorize CO₂ as a non-flammable gas hazardous material and not as a hazardous liquid. However, in 1988 Congress amended the HLPSA to require regulation of CO₂ pipeline facilities. Accordingly, CO₂ pipelines are subject to the same safety regulations as hazardous liquid pipelines, rather than those applied to natural and other gas pipelines.

States are largely preempted from adopting and imposing additional safety standards for interstate pipelines. States can, however, accept responsibility for the safety regulation of intrastate CO₂ pipelines and can “participate in oversight of interstate pipelines” as “agents of the OPS” pursuant to delegation of HLPSA authority. HLPSA permits state regulatory authority and responsibility for enforcement of HLPSA requirements either through certification pursuant to Section 60105(a) or by

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104. CO₂ pipelines are defined as pipelines carrying at least 90% CO₂ molecules compressed to a supercritical state. 49 C.F.R. § 195.2 (2008).
109. 49 U.S.C. § 60104(c) (2006); Olympic Pipe Line Co. v. City of Seattle, 437 F.3d 872 (9th Cir. 2006).
entering into agreements with the OPS. A state must adopt the minimum federal regulations and must provide for injunctive and monetary sanctions similar to those authorized by federal pipeline safety laws to obtain certification. All of the states with significant CO₂ pipeline infrastructure have obtained OPS certification to regulate some safety aspects of intrastate CO₂ pipelines. Accordingly, state agencies may be responsible for functions such as inspection, accident investigation, and regulatory enforcement of intrastate hazardous liquid pipelines.

In addition to administration of federal requirements, HLPSA permits states to impose additional requirements on intrastate hazardous liquid and CO₂ pipelines, provided that the additional or more stringent regulations are not inconsistent with federal regulations. Pursuant to this authorization, several states have imposed specific requirements for CO₂ pipelines or for hazardous liquid pipelines in general. For example, Texas requires CO₂ operators to engage in additional public education and reporting, restricts siting near schools, and imposes additional corrosion control requirements. Wyoming mandates specific casing and siting requirements for hazardous liquid pipelines facilities within the state highway system right-of-way, and Oklahoma imposes additional notice


114. Nordhaus & Pitlick, supra note 110, at 96.

115. Id.


requirements for hazardous liquid pipeline developers.\textsuperscript{118} Recommended practices suggest siting pipelines based on the likelihood and consequence of failure considering pipeline contents and human activity along the pipeline route.\textsuperscript{119} Through these requirements states can semi-customize safety requirements to address local land use, political, geographic, and environmental considerations.

\textit{An Absence of Federal Siting Authority}

There is no federal siting authority for CO$_2$ pipelines. CO$_2$ concurrently falls outside the scope of “natural gas” within the Natural Gas Act (NGA) and within the “gas” exclusion in the Interstate Commerce Act (ICA).\textsuperscript{120} Accordingly, there is no authority for federal siting of CO$_2$ pipelines, other than issuance of rights-of-way for those on federal land.

Natural gas pipelines are sited according to the NGA. In 1938, Congress granted the Federal Power Commission (FPC), now the Federal Energy Regulatory Commission (FERC), authority for regulating transportation of natural gas in interstate commerce.\textsuperscript{121} The NGA requires a certificate of public convenience and necessity from FERC for every new pipeline or pipeline extension for “the transportation in interstate commerce of natural gas”\textsuperscript{122} and for the acquisition and operation of interests in natural gas pipelines.\textsuperscript{123} Each step of the FERC process for obtaining a certificate of public convenience and necessity is designed to provide transparency, opportunities for public comment, and coordination between stakeholders, thus streamlining the siting process through consolidated information gathering and approvals.\textsuperscript{124} This process facilitates consideration of local and national needs and impacts to either customers or the environment.\textsuperscript{125} If granted, the pipeline company receives the right to use eminent domain for the pipeline’s entire length.\textsuperscript{126} Accordingly, although other state

\begin{flushleft}
\textsuperscript{119} Design and Operation of CO$_2$ Pipelines, supra note 82, at 17.
\textsuperscript{121} Natural Gas Act, 15 U.S.C. §§ 717c, 717h (1938); Alex B. Klass & Danielle Meinhardt, Transporting Oil and Gas: U.S. Infrastructure Challenges, 100 Iowa L. Rev. 947 (2015).
\textsuperscript{123} Id. § 717(f)(c)(1)(a).
\textsuperscript{124} Klass & Meinhardt, supra note 121, at 1007.
\textsuperscript{125} Id.
\end{flushleft}
requirements may apply, natural gas pipelines are not required to navigate state siting and eminent domain requirements to obtain right-of-way.

The NGA does not define the term “natural gas.”127 CO₂ is gaseous at atmospheric pressures. However, it is transported via pipeline at high pressures that result in a phase change from gas to an “indeterminate” state that is neither solid, liquid, or gaseous—variously called “dense phase gas,” “supercritical fluid,” or a “dense vapor.”128 As a result, it was initially unclear whether the NGA applied to CO₂ pipelines. Accordingly, in anticipation of the development of several interstate CO₂ pipelines, Cortez Pipeline Company petitioned FERC for a jurisdictional determination of whether CO₂ was a natural gas under the statute.129 FERC declined to make a determination based on the chemical composition of the gas130 and determined that gas that was 98% CO₂ was not a “natural gas” as intended by Congress in the NGA.131 Instead, FERC based its determination on the fact that the NGA was enacted by Congress to regulate a “burgeoning” and “defined industry” in order to “protect the consumers of a salable commodity from exploitation at the hands of the natural gas companies.”132

Concluding that the CO₂ transported was solely for the purpose of increasing the production of oil and would not be sold as fuel to the public, the Commission found that the proposed pipeline was “not within the NGA jurisdiction provided by the Commission.”133 In 2006, in Southern Natural Gas Co., FERC reaffirmed its lack of jurisdiction, stating that CO₂ facilities were “exempt from jurisdiction under [ ] the NGA.”134

Oil pipelines are also subject to federal regulation, although not federal siting, pursuant to the Interstate Commerce Act (ICA).135 The ICA was passed in 1887 to address the growing problem of natural monopolies in railroads.136 It required that railroads charge “just and reasonable rates”

127. Cortez Pipeline Co., 7 FERC 61024 (Apr. 6, 1979) (stating that “[t]here appears to have been no attempt during the legislative debate over the NGA to address the problem of the ambiguity in the term natural gas”) (internal citations and quotations omitted).
128. Schnacke, supra note 13, at 3.
130. Id.
131. Id.
133. Id.
135. ExxonMobil Oil Corp. v. FERC, 487 F.3d 945, 956 (D.C. Cir. 2007).
without regard to locality or distance and without preference to any individual product or shipper—thus establishing the baseline requirements for what is now referred to as “common carriage.”

Oil pipelines were similarly “bedeviled” by monopolistic practices. By 1904 Standard Oil transported more than 90% of the total oil transported in the United States. In response to complaints of Standard Oil’s monopolistic behavior and the resulting lack of access to interstate markets and price disparities, Congress passed the Hepburn Act of 1906 and expanded the regulatory responsibilities of the Interstate Commerce Commission (ICC) under the ICA to include oil pipelines. Oil pipelines were thus subjected to common carrier requirements, including non-discriminatory access, regulation of rates and terms of service, and ICC approval of tariffs.

Oil pipeline regulation was transferred to FERC with the passage of the Department of Energy Organization Act in 1977. FERC authority over oil pipelines is notably different from its authority over natural gas pipelines. The authority it derives from the ICA is exclusively focused on assuring reasonable and nondiscriminatory access to oil pipelines; FERC does not regulate the siting, construction, expansion, or operation of oil pipelines and does not provide developers with nationwide powers of eminent domain along proposed pipeline routes. Accordingly, state law determines siting, permitting or certification, and a developer’s rights to acquire land by eminent domain.

CO\textsubscript{2} is also excluded from FERC regulation under the ICA. The ICA initially applied to all persons engaged in “the transportation of oil or other commodity, except water and gas, by means of pipelines.” Similar to the NGA, the ICA leaves the term “gas” undefined. In 1981, in response to a request from Cortez Pipeline Co. and after public comment, the ICC, the predecessor regulatory agency to FERC, issued a final declaratory order.

139. Klass & Meinhardt, supra note 121, at 959-60.
141. Klass & Meinhardt, supra note 121, at 961.
142. Id. at 980 (citing JAMES H. MCGREW, FERC: FEDERAL ENERGY REGULATORY COMMISSION 227 (2d ed. 2009); 42 U.S.C. § 7172(b)).
The ICC also elected not to base its decision on the physical properties of CO₂. Instead, the ICC based its analysis on the original language in the Hepburn Act and legislative history regarding the exclusion of “natural or artificial” gas. In a decision that it later affirmed, the ICC concluded the “all gas types classified by origin or source were excluded from [its] jurisdiction.”

Where a proposed CO₂ pipeline will cross federal land, the Bureau of Land Management (BLM) has authority to grant rights-of-way for CO₂ pipelines as a “natural gas” pursuant to the MLA. In Exxon Corp. v. Lujan, Exxon challenged the grant of a right-of-way for a CO₂ pipeline under the MLA, asserting instead that the proper authority for issuing the right-of-way was the Federal Land Policy and Management Act (FLPMA). BLM has authority under the MLA to grant right-of-way for “pipeline purposes for the transportation of oil, natural gas, synthetic liquid or gaseous fuels, or any refined product produced therefrom,” whereas pipeline rights-of-way for water and any substance other than those covered by the MLA are issued pursuant to FLPMA. The BLM determined that the term “natural gas” as used in the MLA was not limited to hydrocarbons and accordingly issued the right-of-way pursuant to the MLA. Exxon argued that because carbon dioxide was not a hydrocarbon and FERC had each previously determined that CO₂ was not a “natural gas” in Cortez Pipeline, the appropriate authority for issuing right-of-way was FLPMA. The court affirmed BLM’s decision, finding that FERC’s determination was under a different statute and accordingly had “no bearing” on BLM’s

145. Nordhaus & Pitlick, supra note 110, at 90.
147. Exxon Corp. v. Lujan, 970 F.2d 757, 761 (10th Cir. 1992).
148. Id. (The crux of this dispute concerned whether or not Exxon would be required to operate its pipeline as a common carrier.)
149. 30 U.S.C. § 28(a)185.
151. Lujan, 970 F.2d at 761.
152. Id. at 760. Hydrocarbon refers to a chemical composition including both hydrogen and carbon, whereas CO₂ is a combination of carbon and oxygen.
interpretation. Given the many definitions of “natural gas” within the federal regulations, including some within the Department of Interior, the court found that BLM’s interpretation that CO₂ was a “natural gas” was not unreasonable. Accordingly, CO₂ pipelines crossing federal land are sited by BLM pursuant to the MLA.

**Opportunities for Federal Input in State Siting Processes**

Despite the lack of federal siting and eminent domain authority, the National Environmental Policy Act (NEPA), the Clean Water Act (CWA), the National Historic Preservation Act (NHPA), and the Endangered Species Act (ESA), among others, may provide opportunities for federal agencies to influence on CO₂ pipeline siting. These opportunities are most abundant where the pipeline crosses federal lands or waterways—as is often true in the western United States. For example, Denbury’s proposed Riley Ridge to Natrona project in Wyoming required the grant of a 212-mile right-of-way, 76% of which crossed federal lands administered by five BLM field offices. Although not requiring a full assessment of the entire pipeline project, thus far the project has required section 106 review, ESA consultation, and preparation of an EIS. These processes may increase public awareness about CO₂ pipeline projects, enhance consideration of potential impacts, and influence siting decisions made pursuant to state law.

**NEPA**

NEPA may provide an opportunity for federal agencies to conduct additional environmental analyses, facilitate public participation, and contribute oversight to state siting processes. NEPA requires the preparation of an environmental assessment (EA) or an Environmental Impact Statement (EIS) for any major federal action that will significantly affect the quality of the human environment prior to the irreversible or irretrievable commitment of resources. Construction of a CO₂ pipeline, particularly one of adequate size for CCUS, across federal lands could have

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154. *Lujan*, 970 F.2d at 757.
significant environmental impacts. Unless the pipeline could be built within a pipeline corridor or otherwise qualify for a categorical exclusion, BLM would be required to conduct an EA or EIS prior to issuing a right-of-way. The analysis would prompt consideration of multiple alternatives—including a no action alternative—and could prompt the integration of mitigation measures. While not mandating a specific outcome, the NEPA process provides opportunity for stakeholder and agency input on proposed projects that require right-of-way or other major federal action.

NEPA’s application to pipelines crossing only private land is more limited. In order to trigger NEPA, there must be a “major federal action.” Private actions may become subject to NEPA where the project is subject to federal control or requires a federal authorization, funding, or permit. These analyses are limited to the proposed action, and would be unlikely to trigger a NEPA review of the entire pipeline project and route. Although it is possible for an otherwise private project to become “federalized” if the federal government has “actual power to control the project,” the cumulative effect of decisions, such as PHMSA approval of a safety plan or


162. 40 C.F.R. § 1508.18.


164. Sierra Club v. Bostick, 787 F.3d 1043 (10th Cir. 2015).
Fish and Wildlife Service issuance of a biological opinion, are unlikely to reach that threshold.\(^\text{165}\)

**Section 404 Permits**

Federal permits are frequently required for water and wetland crossings on otherwise private projects.\(^\text{166}\) The Army Corps of Engineers issues permits for discharge of dredge or fill materials under Section 404 of the Clean Water Act.\(^\text{167}\) Section 404 requires a permit for any “utility line”—defined as including “any pipe or pipeline for the transportation of any gaseous, liquid, liquefied, or slurry substance for any purpose”—crossing requiring discharge of dredge or fill material into waters of the United States.\(^\text{168}\) Due to the expansive geographic scope of the program, almost any pipeline project will require a 404 permit.\(^\text{169}\) The level of environmental analysis includes a range of possibilities based on the type of permit required.\(^\text{170}\) Permits issued under Section 404 are categorized as either general (nationwide) or individual.\(^\text{171}\) General permits evaluate a category of activities having minimal cumulative impacts.\(^\text{172}\) Although general permits “undergo a stringent pre-approval evaluation process that involves a comprehensive environmental assessment under NEPA and also public notice and comment,” the process does not involve substantive findings related to each discrete project.\(^\text{173}\) Individual water or wetland crossings with potentially significant impacts trigger a more extensive 404 permitting process.\(^\text{174}\) These projects are evaluated under public interest review based


\(^{167}\) Greater Yellowstone Coal. v. Flowers, 359 F.3d 1257, 1266 (10th Cir. 2004).


\(^{170}\) Id. at 171.

\(^{171}\) Sierra Club v. U.S. Army Corps of Eng’rs, 990 F. Supp. 2d 9, 19 (D.D.C. 2013) (citing 33 U.S.C. §§ 1344(a), (e) (for general permits) and 33 C.F.R. §§ 323 and 325 (2013) (for the application and review requirements of specific permits)).


\(^{173}\) Sierra Club, 990 F. Supp. 2d. at 19 (citing 33. U.S.C. § 1344(e)); Biber & Ruhl, supra note 169, at 167. For linear projects like utility lines, each crossing of a waterway is considered to be a “single and complete project” as long as these crossings are “separate and distant.” See Sierra Club v. Bostick, 787 F.3d 1043 (10th Cir. 2015).

\(^{174}\) 40 C.F.R. § 230.
on environmental criteria and require the consideration of alternatives and incorporation of compensatory mitigation.\textsuperscript{175} Neither of the 404 processes requires a consolidated environmental review of the entire project.\textsuperscript{176} The 404 permitting process may provide a vehicle for public and federal input on siting relative to specific projects and the attachment of specific conditions and mitigation requirements within state law siting.\textsuperscript{177} However, the efficacy of the permitting program to address cumulative consideration of environmental impacts from private land projects has been criticized.\textsuperscript{178}

\textit{NHPA Consultation}

National Historic Preservation Act (NHPA) procedures may also provide avenues for federal input on pipeline siting. The NHPA’s consultation and review process is designed to avoid or minimize, to the extent possible, harm to historic properties where “the area of potential effects” from a proposed project “may result in changes in the [property’s] character or use.”\textsuperscript{179} The NHPA requires federal agencies to consult with the Advisory Council on Historic Preservation and other consulting parties prior to taking an action\textsuperscript{180} that may affect a site “included in or eligible for inclusion” in the National Register.\textsuperscript{181} Sites may include “traditional cultural properties” that, due to their association with the cultural history, practice, or traditions of Native American groups, rural communities, or particular cultural groups within urban neighborhoods, “are important in maintaining the continuing cultural identity of the community.”\textsuperscript{182} Were a proposed pipeline project to

\textsuperscript{176} \textit{Sierra Club}, 990 F. Supp. 2d. at 34.
\textsuperscript{177} Dave Owen, \textit{Little Streams and Legal Transformations,} 2017 UTAH L. REV. 1, 24 (2017).
\textsuperscript{179} 36 C.F.R. § 800.2 (2000). Changes in character can result from direct, indirect, short-term, long-term, or cumulative effects.
\textsuperscript{180} Lee v. Thornburgh, 877 F.2d 1053, 1056 (D.C. Cir. 1989) (stating that “[t]he NHPA is aimed solely at discouraging federal agencies from ignoring preservation values in projects they initiate, approve funds for, or otherwise control”).
\textsuperscript{181} Historic places can be nominated by agencies, individuals, preservation groups and historic societies, and, if they are deemed to meet the eligibility criteria, may be listed in the National Register. 54 U.S.C.A. § 302104.
impact historic or cultural properties, an agency would have to engage in the NHPA consultation process. Like NEPA, an agency’s obligations under the NHPA are procedural and not outcome driven. The process does not guarantee the preservation of historically or culturally significant properties, provided that the consultation process is adequate. Accordingly, the utility of the NHPA to influence CO₂ pipeline siting will vary based on the location and scope of the project and level of public engagement.

**FWS Consultation**

Finally, pipeline siting may be influenced by species and habitat preservation concerns for threatened or listed species, including federal and state habitat protection and mitigation requirements. Federal laws such as the Endangered Species Act, the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act, among others, prohibit developers from activities that are likely to result in a “take” or disturbance of a protected species and impose both civil and criminal penalties for violations. Before undertaking activities likely to result in take, pipeline developers must consult with the Fish and Wildlife Service as part of NEPA or to obtain a Section 10 Incidental Take Permit and develop a habitat


183. NHPA compliance may be part of a NEPA record, but can apply to projects qualifying for a categorical exclusion. Nat’l Envtl. Policy Act Handbook H-1790-1, supra note 160, at 4.1.

184. Monumental Task Comm., Inc. v. Foxx, 157 F. Supp. 3d 573, 590 (E.D. La. 2016) (citing Coliseum Square Ass’n, Inc. v. Jackson, 465 F.3d 215, 224 (5th Cir. 2006) (quoting Bus. & Residents All. of E. Harlem v. Jackson, 430 F.3d 584, 591 (2d Cir. 2005) (“The NHPA is procedural in nature. . . . It does not itself require a particular outcome, but rather ensures that the relevant federal agency will, before approving funds or granting a license to the undertaking at issue, consider the potential impact of that undertaking on surrounding historic places.”) (internal citations and quotations omitted))).


188. Id. § 668 (1972).

conservation plan. Based on Fish and Wildlife Service conclusions, pipelines may be required to reroute or implement other “reasonable and prudent alternatives” to avoid effects to protected species or as conditions attached to an incidental take statement. Pipeline developers, in coordination with agencies, may also agree to voluntary conservation measures through public-private conservation agreements or letters of commitment. State conservation measures and species management plans, such as those put in place for protection of the greater sage-grouse in Wyoming and Nevada, may impose other siting limitations or habitat mitigation requirements. For example, Wyoming’s Greater Sage-Grouse Core Area Strategy limits surface disturbances in core habitat area through a disturbance cap of 5%, a density limit of not more than one per square mile, and a prohibition of surface disturbances within 0.6 miles of any active sage-grouse lek. These habitat and conservation requirements can significantly impact pipeline siting. For example, Denbury’s Greencore Pipeline route was modified in order to conform to a number of species protection mandates including those for the greater sage-grouse, raptors, and the mountain plover.

Procedural requirements contained in numerous environmental laws provide opportunities for federal influence in pipeline siting. In some cases, the reviews required may be significant. These mechanisms invite participation from a diverse group of stakeholders and prompt consideration of federal interests and environmental impacts. Environmental laws thus provide a framework within which pipeline developers and agencies can

192. Id. Although these voluntary public-private conservation plans may be necessary to obtain agency permission for construction, an agency may not rely on voluntary measures to approve a pipeline. Benjamin Hanna, The Ninth Circuit Constrains Non-Enforceable Public-Private Endangered Species Conservation Agreements, 41 B.C. ENVT'L. AFF. L. REV. E. SUPP. 42 (2014).
work together to address national and environmental concerns in a manner that complements state siting processes.

III. Siting Under State Law: The Condemnation of Pipeline Easements

The majority of CO₂ pipeline routing is dependent on state law. State laws may authorize siting authorities, establish set back, permitting, or industrial siting requirements, and create mechanisms for local government participation. Most significantly, state law establishes whether and for what purposes CO₂ pipeline developers may utilize eminent domain authority to acquire property along the pipeline route.

Eminent domain, the power to take private property for public use, is essential to the ability of a sovereign, including the federal and state governments, to fulfill government functions and promote the public welfare. The Fifth Amendment of the United States Constitution recognizes the right of a sovereign to take private property subject to two conditions: it must be for a “public use” and “just compensation” must be paid in return. States are similarly constrained in their ability to take property by the Fourteenths Amendment and by public use provisions within state constitutions.

The public use requirement arose from concerns that an unrestricted right in the government to take property would be subject to private influence resulting in a threat to private rights. Coerced transfers to private parties

196. Fish & Martin, supra note 28 at 4; Nordhaus & Pitlick, supra note 110, at 100.
202. U.S. Const. amend. V.
203. Id. A discussion of the various manners of calculating just compensation for pipeline rights-of-way is beyond the scope of this article.
for private use were viewed as inconsistent with due process of law.\textsuperscript{206} Accordingly, the public use limitation was drafted to restrict coerced property transfers “for the private use of another” to those that would be available for “use by the general public.”\textsuperscript{207} Consistent with this interpretation, early American applications of eminent domain were predominantly to general government functions—such as the construction of town halls, court houses, and other public buildings or buildings for the public welfare—and to “build roads and provide hydropower to grist mills widely used by local populations.”\textsuperscript{208} These takings were seen as consistent with the public use requirement because the resultant project would either be publicly owned or, if privately owned, would be available for use by the public.\textsuperscript{209} This view pervaded up until the end of the 19th century.\textsuperscript{210} However, as technological innovations and modes of production innovated, courts increasingly permitted the extension of eminent domain authority to private corporations for private purposes.\textsuperscript{211} New towns and homesteads were springing up in the American West, fueled by booms and busts in coal, oil, timber, and uranium.\textsuperscript{212} Cities were rapidly developing too; and, with development came new public health hazards associated with overcrowding and dilapidated tenement housing.\textsuperscript{213} Soon, it seemed, land was needed not only for roads to landlocked parcels or mills, but for mines


\textsuperscript{207} Kelly, supra note 205, at 10 (citing Mt. Vernon-Woodberry Cotton Duck Co. v. Ala. Interstate Power Co., 240 U.S. 30, 32 (1916) (Holmes, J)).

\textsuperscript{208} Meidinger, supra note 205, at 2.


\textsuperscript{210} Kelly, supra note 205, at 10 (citing Richard A. Epstein, Takings: Private Property and the Power of Eminent Domain 178 (1985) (stating that “[t]he nineteenth century view, abstractly considered, was that it was a perversion of the public use doctrine to acquire land by condemnation for these purposes”)).

\textsuperscript{211} Prichett, supra note 209, at 9.


and more urban needs such as the elimination of blight. Initial constructions that interpreted the public use limitation as requiring actual use by the public proved inadequate to advance legislative goals as applied to these new purposes. Thus, judicial interpretations of the public use limitation evolved in response. Takings where the use advanced “public values” or was for the “comfort, convenience, and prosperity of the people” soon withstood judicial review.

The division between these interpretations exists today. There are two judicial tests principally used to define “public use.” The first is a narrow interpretation—requiring that the end use of the property taken must be open to actual use by the public or some subset thereof. The construction of roads, the creation of parks and public spaces, and other public infrastructure projects such as pipelines and railroads have all been found to satisfy this narrow requirement of “use by the public.” The second approach encompasses a broad scope of uses and property interests where the taking yields some general public benefit—be it revenue generation, jobs, tax base, or development of industry. Projects benefiting from this approach include economic redevelopment, mineral or agricultural

218. Dayton Gold & Silver Mining Co. v. Seawell, 11 Nev. 394 (1876); Rindge Co. v. Los Angeles Cty., 262 U.S. 700, 707 (1923); Merrill, supra note 216, at 67-68.
220. Merrill, supra note 216, at 64.
development projects,\textsuperscript{222} and other purposes that promote “economic expansion.”\textsuperscript{223} Most courts, including the U.S. Supreme Court, have adopted the more expansive interpretation, thus deferring to legislative determinations of public use.\textsuperscript{224} While not establishing an “authoritative delimitation,” courts look instead to the various factors influencing historical development of the public use.\textsuperscript{225}

The majority of states have no legislation specifically addressing the siting of CO\textsubscript{2} pipelines. This owes to the private nature of CO\textsubscript{2} transportation. Unlike oil, electricity, or natural gas, there are not broad public markets for CO\textsubscript{2};—it is neither a generation nor transportation resource.\textsuperscript{226} Thus, development has progressed along narrow corridors in a handful of states with either CO\textsubscript{2} sources or EOR. Were development to expand beyond these areas for CCUS or other purposes, states siting new infrastructure would assess public use for CO\textsubscript{2} pipelines under existing state frameworks for eminent domain.

The few state statutes that grant eminent domain authority for CO\textsubscript{2} pipelines may provide insight to how public purpose questions will be resolved. These statutes typically require that public purpose is established in one of two ways: either the pipeline will produce a public benefit by advancing the development of natural resources within the state,\textsuperscript{227} or the pipeline will be available for “use by the public” through operation as a common carrier.\textsuperscript{228} An analysis of the two predominant approaches provides an opportunity for deeper exploration of the public purpose requirement as applied to CO\textsubscript{2} transportation.

\begin{footnotesize}
\textsuperscript{222} Mont. Talc Co. v. Cyprus Mines Corp., 748 P.2d 444 (Mont. 1987); Tanner v. Treasury Tunnel, Mining & Reduction Co., 35 Colo. 593 (1906).
\textsuperscript{223} Corey J. Wilk, The Struggle Over the Public Use Clause: Survey of Holdings and Trends, 1986-2003, 39 REAL PROP. PROB. & TR. J. 251 (2004); Merrill, supra note 216 (noting even acquisition of a football team’s intangible contract rights could be a public use).
\textsuperscript{224} Norwood v. Horney, 853 N.E.2d 115, 132-33 (Ohio 2006); Merrill, supra note 216, at 68 (citing United States ex rel. TVA v. Welch, 327 U.S. 546, 551-52 (1946)).
\textsuperscript{226} Cortez Pipeline Co., FERC 61024 (Apr. 6, 1979).
\textsuperscript{227} See infra notes 246-63 and accompanying text.
\end{footnotesize}
Citing Carbon Dioxide Pipelines

The concept of “natural resource development takings” refers to private oil, gas, and mining companies’ “power of eminent domain under state constitutions or state statutes to take private property to develop coal, oil, or other natural resources.” These public purpose justifications exist almost exclusively in the American West and are deeply rooted in the history of frontier expansion. Development of the west was fueled by private exploitation of natural resources: timber, water, mineral, wildlife, grass, and hydrocarbon. Eager to grow their populations and economies, western states’ territorial legislatures sought to advance these purposes by embedding authority to take private property as necessary for natural resource development purposes within state constitutions. Accordingly, many western state constitutions authorize eminent domain for “private takings” to promote the extractive industries through the development of roads, flues, ditches, canals, tramways, and other necessary infrastructure.

States sought to serve a public purpose through the creation and growth of a resource based state economy. Through the encouragement of industry states endeavored to assure their future prosperity—jobs and wealth—and encourage the expansion and development of communities that were attendant with those industries. It was commonly believed that natural resources would be the sole source of development. Considering the possibility of a coal severance tax in the Wyoming Constitution, one legislator expressed that once the coal was exhausted Wyoming would “have nothing left but a howling wilderness.” With these principles memorialized in states’ constitutions and statutes, western landowners, mineral developers, and courts’ concepts of property and public use

229. Klass, supra note 217, at 652.
230. Id. at 651.
231. Id.
233. Klass, supra note 217, at 667-68.
236. Klass, supra note 217, at 657-61, n.25.
developed in a way that was more permissive of the acquisitiveness inherent to private “natural resource takings” than in eastern states.\footnote{237} Traditionally, states have benefited from the “extreme judicial deference” afforded to the public use limitation.\footnote{238} The result, as Professor Klass has noted, is an “absence of meaningful judicial review of natural resource development companies’ contentions that the taking of private property to support development of natural resources is for a public use.”\footnote{239} Due to strong grants of constitutional and statutory authority, and the deference to state legislatures in establishing these purposes, the public purpose of almost any taking of private property to serve expansion and development of the extractive industries is presumed.\footnote{240} The wide latitude given to state legislatures has led many scholars, at least prior to\footnote{241} Kelo, to declare the public use clause “moribund.”\footnote{242}

A number of states grant developers of CO\textsubscript{2} pipelines eminent domain authority based on statutes grounded in the concept of natural resource development. These grants may be general, giving CO\textsubscript{2} pipelines condemnation authority without regard to the end use.\footnote{243} Others address CO\textsubscript{2} as necessary to enhanced oil recovery\footnote{244} or underground carbon storage,\footnote{245} or include CO\textsubscript{2} within general statutory or constitutional grants for pipelines or mineral development.\footnote{246} Consistent with historic values, these grants advance the “great public interest in an imminent need for

\footnote{237}{Id. at 657-59 (citing \textit{Gordon M Bakken, Rocky Mountain Constitution Making} 1850-1912, at 30-32 (1987) (noting that not all westerners ascribed to this philosophy)).}

\footnote{238}{Id. at 661 (stating that “[c]ourts in the Interior West responded to public use challenges with strong language upholding the right of private industry to exercise the power of eminent domain as a ‘public use’ without the need for any oversight by local, county, or state political bodies”); Merrill, supra note 216, at 65; Oswald, supra note 215, at 251-58.}

\footnote{239}{Klass, supra note 217, at 661.}

\footnote{240}{Id. at 661-69, (citing Mont. Talc Co. v. Cyprus Mines Corp., 748 P.2d 444, 447-48 (Mont. 1987) (“In present day Montana, as in Wyoming, once a private taking is found to be within a broadly-defined statutory or constitutional public use, there is little further role for a court in reviewing whether the exercise of the taking power is in fact in the interests of the public.”).}

\footnote{241}{Prichett, supra note 209, at 2.}


\footnote{245}{As discussed in notes 238-247, condemnation effectuated based on statutes authorizing mineral development may preclude utilization of those CO\textsubscript{2} pipelines for CCUS.}
energy" and promote economic growth through the extraction of mineral or other natural resources, including CO₂.

Natural Resource Development as Public Purpose

Idaho, Wyoming, and Colorado advance natural resource takings through constitutional provisions granting condemnation authority to private developers for mining purposes. The Idaho Constitution declares mining to be a public use in a particularly expansive provision that includes “the drainage of mines, or the working thereof, by means of roads, railroads, tramways, cuts, tunnels, shafts, hoisting works, dumps, or other necessary means to complete development, or any other use necessary to the complete development of the materials resources of the state.” The Colorado and Wyoming constitutions each provide that “[p]rivate property shall not be taken for private use . . . except for . . . reservoirs, drains, flumes, or ditches on or across the lands of others for agricultural, mining, milling, domestic or sanitary purposes.” Historically, these provisions have been used by mining companies for access and transportation facilities, as well as for land, lumber, and construction materials, and upheld based on the public interest in exploiting resources and making new markets.

Constitutional natural resource takings provisions have been interpreted to encompass a range of uses beyond those specifically enumerated within the provision. Instead courts have focused on states’ broader intent to promote natural resource development. For example, the Wyoming Supreme Court has included oil and gas exploration and production activities within the term “mining” as used in Article I, section 32 of the Wyoming Constitution and the Wyoming Eminent Domain Act. Rejecting a strict interpretation, the court found that oil and gas development was encompassed in the term “mining” based on its historical categorization as a mineral, early exploration techniques referring to oil and

250. Meidinger, supra note 205, at 30 (citing Dayton Gold & Silver Mining Co. v. Seawell, 11 Nev. 294, 411 (1876)).
251. Klass, supra note 217, at 661.
gas wells as mines, and consistency with the purpose of the provision to “facilitate the development of [the] state’s resources.”

253 The result was a significant extension of authority to private oil and gas companies. Uses that fall within those enumerated in section 32 are presumed “by constitutional edict” to have “the force and effect of a public use,” thus satisfying the public purpose requirement of the Wyoming Eminent Domain Act.

254 Based on this expansive reading of the term “mining,” CO₂ production and its associated transportation may also fall within the broad scope of Wyoming’s natural resource taking authority. Categorization of one substance, for example natural gas, is not dispositive as to the categorization of another. Whether a specific project falls within the legislative declarations of public use requires an analysis of the project and material within its geographic and historical context. There are no precise analogs for CO₂ pipelines or production. CO₂, like natural gas, is gaseous at atmospheric pressures and can be extracted via wells under the terms of oil and gas leases. However, technical definitions may be less persuasive than considerations of history and purpose. While CO₂ is like other extractive activities that benefit from Wyoming’s natural resource takings provision in that it brings economic benefits to the state through encouragement of energy and generation of revenue, it is unique in that its production is a fairly recent development and is not limited to drilling or other techniques.

255. Merrill, supra note 216, at 94 (citing Kaiser Steel Corp. v. W. S. Ranch Co., 467 P.2d 986, 988 (N.M. 1970)) (noting that coal mining may be governed by one rule, metal mining by another).

256. Cortez Pipeline Co., 7 FERC 61024 (Apr. 6, 1979); Exxon Corp. v. Lujan, 970 F.2d 757 (10th Cir. 1992).
like mining. Thus, CO₂ pipelines may not benefit from the rich history that served the condemnor in *Coronado*.  

State statutes detail the legal processes to condemn property and which entities have authority to condemn. These statutes may limit the scope of condemnation authority for natural resource development. Accordingly, determination of whether and, if so, how CO₂ pipeline developers are authorized to use eminent domain requires a state specific analysis. A survey of state statutes, regulations, and procedures goes beyond the scope of this Article. However, a look at Colorado’s grant of condemnation authority to pipelines provides insight to the types of interpretation issues that are likely to arise. Colorado’s eminent domain laws grants condemnation authority to “telegraph, telephone, electric light power, gas, or pipeline compan[ies]” and to “pipeline[s] for the transmission of power, water, air, or gas for hire to any mining or mining claim or for any manufacturing, milling, mining, or public purpose.” Despite Colorado’s broad constitutional natural resource takings provision, Colorado courts have precluded oil pipelines from using eminent domain on the basis that they are neither “pipeline companies” within the meaning 38-5-105, nor do they transport “water, air, or gas” as required by 38-4-102. CO₂ pipelines may fall within the scope of these statutory authorizations based on the classification of CO₂ as “gas.” However, as noted elsewhere, CO₂ is transported in a pseudo-liquid state, thus complicating that determination.

A pipeline company could also demonstrate that the CO₂ was transported to a “mining claim” or for “mining” or another public purpose. Unlike Wyoming, Colorado courts have not considered whether the term “mining” includes operations for oil and would thus encompass EOR operations. A developer could also advance arguments that CO₂ transportation by pipeline is for a public purpose—be it climate mitigation or natural resource

257. Failing to establish CO₂ production itself as mining, a potential condemnors could also argue that CO₂ transportation as part and parcel of enhanced oil recovery would fall within the courts prior expansive reading of the term “mining.”

258. A sampling of these statutes is listed in Klass, supra note 217, at n.25.


260. *Id.* § 38-4-102.


262. *See supra* note 127 and accompanying text.

263. Colorado courts have not considered whether the term “mining” includes oil production.
production. Whether those uses constitute a sufficient public use would ultimately be determined by the judiciary.\textsuperscript{264}

While advancing many of the same public benefits, CO\textsubscript{2} fits imperfectly within the historical context of constitutional natural resource development takings provisions. Statutory provisions regarding the authority and procedures granted to natural resource companies for eminent domain are likewise ambiguous when applied to CO\textsubscript{2} pipelines. Accordingly, while natural resource development takings provisions have been interpreted broadly and given extensive judicial deference, the extent to which CO\textsubscript{2} pipeline developers can avail themselves of these provisions is unclear.

\textit{To the Last Drop: EOR as a Public Purpose}

A number of states grant eminent domain authority specifically to CO\textsubscript{2} pipeline developers for the purpose of encouraging enhanced oil recovery.\textsuperscript{265} This approach is a refinement of the general natural resource development approach to establishing public purpose. In these states, CO\textsubscript{2} is not viewed as the primary resource itself but is rather an ancillary product necessary for production of another natural resource: oil.

State legislatures adopting this approach establish public purpose through increased petroleum production.\textsuperscript{266} For example, Louisiana’s

\textsuperscript{264} \textit{Colo. Const.} art. II, § 15 (“[W]henever an attempt is made to take private property for a use alleged to be public, the question whether the contemplated use be really public shall be a judicial question, and determined as such without regard to any legislative assertion that the use is public.”).


\textsuperscript{266} This article does not address the merits of putting in place policies that facilitate increasing oil recovery rather than transitioning to renewable energy. However, social cost associated with climate change may be a limiting factor in public use determination. In at least one case, \textit{Merrill v. City of Manchester}, the court stated that “if social costs exceed probable benefits, the project cannot be said to be built for a public purpose.” 499 A.2d 216, 237 (N.H. 1985). For analysis of the evolving metrics for calculating the social cost of carbon in regulatory and NEPA analyses, see Daniel A. Farber, \textit{Coping with Uncertainty: Cost-Benefit Analysis, the Precautionary Principle, and Climate Change}, \textit{90 Wash. L. Rev.} 1659 (2015); Michael Greenstone, et al., \textit{Developing a Social Cost of Carbon for US Regulatory Analysis: A Methodology and Interpretation}, \textit{7 Rev. Envtl. Eco & Pol’y} 23 (2013); Ted Hamilton, \textit{The Virtues of Uncertainty: Lessons From the Legal Battles Over the Keystone XL Pipeline}, \textit{18 U. J. Envtl. L.} 222, 249-53 (2016); Mark Squillace & Alexander Hood, \textit{NEPA, Climate Change, and Public Lands Decision Making}, \textit{42 Envtl. L.} 469 (2012).
statute provides that the state, corporations, or limited liability companies may expropriate private property for “the piping or marketing of carbon dioxide for use in connection with a secondary or tertiary recovery project for the enhanced recovery of liquid or gaseous hydrocarbons.” Similarly, Mississippi’s statute advances enhanced oil recovery within the state as the public purpose for the exercise of eminent domain by CO₂ pipeline developers. New Mexico, while not specifying that CO₂ within pipelines must be used for enhanced oil recovery, grants eminent domain authority to pipeline developers pursuant to its oil and gas chapter, indicating a relationship to those purposes.

CO₂-for-EOR provisions blur the already fuzzy distinctions between natural resource development takings and economic development takings. Economic development takings originated in the 1920s as part of the urban renewal movement’s efforts to eliminate the public health and safety hazards associated with slums and blight. Over time, the scope of economic development expanded to include the creation of jobs, increases in tax base or revenues, and community revitalization—all of which were found to constitute permissible public purposes. Recently, however, the


270. Klass, supra note 217, at 652.


Supreme Court revived the question of whether private takings to further economic development activities constitute public use.\textsuperscript{273} In \textit{Kelo v. City of New London}, the Court found that economic development was a “traditional and long accepted function of government,”\textsuperscript{274} and, deferring to legislative determinations that general increases in tax base and economic revitalization were public purposes, upheld a taking for those purposes.\textsuperscript{275} The public was less convinced, resulting in a tide of legislative action to limit the use of eminent domain for private economic development purposes.\textsuperscript{276}

CO\textsubscript{2}-EOR undeniably generates economic benefits to the state through the maximization of recoverable reserves. Nationwide, DOE estimates that CO\textsubscript{2}-EOR could increase domestic oil reserves by 87.1 billion barrels.\textsuperscript{277} This additional recovery has significant economic benefits. For example, EOR has the potential to revitalize state economies by generating significant state revenues from severance and income taxes and royalty and provide high-compensation employment opportunities.\textsuperscript{278} Although general economic benefits may inure to the state or its citizens, except where development occurs on state or federal land, the profits these operations yield are private.

EOR is similar in many ways to economic redevelopment. In response to the \textit{Kelo} decision, many states have enacted anti-\textit{Kelo} or post-\textit{Kelo} laws through statutes or constitutional amendments, disclaiming economic redevelopment as a public purpose.\textsuperscript{279} Public purpose arguments based

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\begin{itemize}
  \item \textsuperscript{273} Kelo v. City of New London, 545 U.S. 469 (2005).
  \item \textsuperscript{274} \textit{Id}. at 484.
  \item \textsuperscript{275} \textit{Id}.
  \item \textsuperscript{278} Melzer, \textit{supra} note 13, at 6.
  \item \textsuperscript{279} County of Wayne v. Hathcock, 684 N.W.2d 765 (Mich. 2004); Eagle & Perotti, \textit{supra} note 276.
\end{itemize}
exclusively on EOR may be vulnerable to these same criticisms.\footnote{280}{Klass, supra note 217, at 676-77, 681-700.} EOR is more similar to the “upgrading” of property of which Justice O’Connor was so skeptical in her \textit{Kelo} dissent.\footnote{281}{\textit{Id.} at 672 (citing \textit{Kelo}, 545 U.S. at 503 (O’Connor, J., dissenting) (“Nothing is to prevent the state from replacing any Motel 6 with a Ritz Carlton, any home with a shopping mall, or any farm with a factory.”)).} In the context of the tertiary recovery operations for which the majority of CO$_2$ is needed, the economic resource has already been at least partially developed. The developer will not be “shut in and deprived of the opportunity to exploit” his valuable resources.\footnote{282}{Coronado Oil Co. v. Grieves, 603 P.2d 406, 411 (Wyo. 1979).} Rather, condemnation of private property is desired in order to increase the profitability and yield of existing resources.

Despite these similarities, natural resources takings have been more-or-less insulated from the wave of post-\textit{Kelo} reforms aimed at limiting the ability of political subdivisions or private parties to take private property for economic redevelopment.\footnote{283}{Colorado, Wyoming, and Louisiana have all imposed harsh limitations on the ability of the state to take property for economic development purposes; however, these limitations may not extend to natural resource takings. See \textit{L. A. Const. Art. VI} § 21 (creating the industrial use exception, “Assistance to Local Industry”); \textit{La. Stat. Ann.} § 19:2 (permitting expropriation by certain corporations and limited liability companies); \textit{Utah Code Ann.} § 78-34-1 (West 2002 & Supp. 2007), as amended by S.B. 117, 2006 Leg., Gen. Sess. (2006)) (noting exceptions specifically for natural resource development purposes; Eagle and Perotti, supra note 276 (citing \textit{Alaska Stat.} § 09.55.240(a) (2006), as amended by H.B. 318, 24th Leg., Reg. Sess. (2006)); Klass, supra note 217, at 675-76. North Dakota’s constitutional amendment, which limits all takings except for those by common carriers or public utilities, is a notable exception. See \textit{N.D. Const.} art. I, § 16 (as amended by Measure 2) (2006).} That owes in part to the differing historical contexts behind these public purpose justifications. Economic redevelopment takings originated in the 1920s with the movement to eliminate the public health hazards associated with blight,\footnote{284}{Norwood v. Horney, 853 N.E. 2d 1115, 1132-33 (Ohio 2006) (citing \textit{The Public Use Limitation on Eminent Domain: An Advance Requiem}, 58 \textit{Yale L.J.} 599, 600 (1949); Philip} and accordingly the extension of that authority to take property for the purpose of increasing tax revenue was perceived by the public as an overreach. On the contrary, the history of natural resource takings indicates that the high grading of property in order to encourage industrial and agricultural development was precisely the purpose of these constitutional provisions. Natural resource takings were intended to establish new industries, promote exploitation of land and natural resources, and encourage the growth of emerging economies.\footnote{285}{Lefcoe, supra note 271; Luce, supra note 213; Somin, supra note 271.} Though perhaps less existential to western states’
economies today, the continued expropriation of property for those purposes still falls within the scope of the original constitutional and statutory provisions.

Public Use: CO₂ Pipelines as Common Carriers

A second category of statutes adheres to a more traditional “public use” justification for eminent domain. Some states that have enacted these statutes, such as North Dakota, Montana, and Colorado, may also have natural resource takings provisions within their state constitutions but have limited the scope of that authority through the imposition of common carrier requirements. These requirements authorize private companies to take private property for utilitarian use, provided that they consent to “provide necessary services without discrimination and at reasonable rates.”

Courts have confirmed that the “public use” requirement is satisfied where privately owned pipelines are required to operate as common carriers. In Vardeman v. Mustang Pipeline Company, a landowner challenged that the purpose of the pipeline was not a public use. The court found that the public use requirement was satisfied both because the pipeline would be used “in a manner determined by the legislature to be a public use”—the movement of “a petroleum product . . . from the producing areas to areas where it can be used”—and because the designation as a common carrier also established use for a public purpose.

Several states and the federal government adopt the common carrier approach with respect to CO₂ pipelines. These statutes authorize condemnation for CO₂ pipelines provided that the pipelines are operated as common carriers. Common carriers provide non-discriminatory access to

Nichols Jr., The Meaning of Public Use in the Law of Eminent Domain, 20 B.U. L. REV. 615, 617 (1940) (“In America’s nascent period, there was an abundance of unclaimed land, limited government activity, and little controversy over the use of eminent domain to develop land and natural resources.”).

286. Meidinger, supra note 205, at 22.
287. Megan James, Checking the Box is Not Enough: The Impact of Texas Rice Land Partners v. Denbury Green Pipeline-Texas, LLC and Texas’s Eminent Domain Reforms on the Common Carrier Application Process, 45 TEX. TECH L. REV. 959, 987 n.283-84 (citing Vardeman v. Mustang Pipeline Co., 51 S.W.3d 308, 310 (Tex. App.—Tyler 2001, pet. denied)).
288. Id.
289. Pipelines receiving right of way pursuant to the MLA are required to act as common carriers. 30 U.S.C. § 185(r) (2006).
pipelines at established tariffs, thereby opening their pipelines to public use.\textsuperscript{290} While these carriers can establish specifications that require all CO\textsubscript{2} transported through them to be of pipeline quality,\textsuperscript{291} they must willing to carry product for anyone meeting those specifications. As such, by conferring eminent domain authority under this condition, states assure that the infrastructure itself is available for use by the public thus encouraging the growth of industry. Common carrier requirements may also foster efficiencies. As infrastructure expands, these nondiscriminatory access and regulated rate pipelines may help avoid duplicative routes or facilities by promoting development of a core backbone infrastructure by providing access to existing point-to-point pipelines. Further, by lowering barriers to entry, common carrier requirements may facilitate more widespread implementation of CCUS or transitions from CO\textsubscript{2}-EOR to incremental storage operations.

\textit{Common Carriers and Pipelines}

Common carrier requirements evolved from the assumption that in order to counteract adverse behavior, companies enjoying a natural monopoly should be required to “serve all comers at fair rates.”\textsuperscript{292} The hallmark requirements of common carriage are that the carrier must offer nondiscriminatory access to unrelated parties at fair and reasonable rates.\textsuperscript{293} Common carrier requirements are found across a broad spectrum of industries providing “public goods,” including public utilities, telecommunications companies, airlines, taxicabs, cruise ships, canal operating companies, and oil pipelines.

The Hepburn Act, passed in 1906, requires oil pipelines to operate as common carriers, regardless of whether eminent domain was utilized in obtaining right of way.\textsuperscript{294} Prior to its passage, monopolistic behavior by the Standard Oil Trust, which controlled nearly all the oil pipelines in the country, limited the ability of Kansas refineries to ship crude out of state.\textsuperscript{295}

\textsuperscript{290} Reed, \textit{supra} note 146, at 104.
\textsuperscript{291} Bliss, \textit{supra} note 97; Marston & Moore, \textit{supra} note 15, at 442, 448.
\textsuperscript{293} Belle Fourche Pipeline Co., 28 FERC 61,150, 61,281 (1984); Posner, \textit{supra} note 292; Klass & Meinhardt, \textit{supra} note 121, at 960.
\textsuperscript{295} Id.
In order to obtain access to its pipelines, Standard Oil required that producers first sell oil to it at its set price. The Hepburn Act assured equitable treatment of producers and shippers by amending the ICA and extending ICC authority to oil pipelines. Regulatory provisions of the ICA required nearly all pipelines to “charge just and reasonable rates for their service; provide and furnish transportation upon reasonable request; establish reasonable through routes with other carriers; and establish just and reasonable rates for through transportation.” The only exception was for “a pipeline engaged solely in transporting oil from its wells across a state line to its own refinery for its own use.”

With the exception of pipelines receiving a right of way across federal lands pursuant to the MLA, CO₂ pipelines are not subject to federal common carrier requirements. However, a number of states statutorily require CO₂ pipelines, or pipelines generally, to operate as common carriers. These statutes establish processes and requirements for developments that are intended for use by the public. For example, North Dakota imposes universal common carrier requirements. Were Colorado’s constitutional or statutory provisions for condemnation found to extend to CO₂ pipelines, those pipelines would be required to act as common carriers by carrying CO₂ “for hire.” Similarly, Montana and Texas impose common carrier requirements only on those CO₂ pipeline companies utilizing the power of eminent domain. The following three

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297. Coburn, supra note 294, at 229 (citing Staff of Subcomm. on Antitrust and Monopoly of the Senate Comm. on the Judiciary, Oil Company Ownership of Pipelines, 95th Cong., 2d Sess., 99 (Comm. Print 1978)).
299. Id. at 562 (citing Pipe Line Cases, 234 U.S. 548 (1914)).
300. Natural gas pipelines crossing federal land were originally obligated to act as common carriers but were exempted in 1953. See William A. Mogel & John P. Gregg, Appropriateness of Imposing Common Carrier Status on Interstate Natural Gas Pipelines, 25 ENERGY L.J. 21, 42 (2004).
303. See supra notes 259-264 and accompanying text.
304. COLO. REV. STAT. ANN §§ 38-4-102, 38-4-105 (West 2017).
examples demonstrate differing approaches to common carrier requirements as applied to CO₂ pipelines.

North Dakota imposes strict common carrier requirements on CO₂ pipelines via both constitutional and statutory provisions. A citizen-initiated constitutional amendment passed in response to the *Kelo* decision provides that “[p]rivate property shall not be taken for the use of, or ownership by, any private individual or entity, unless that property is necessary for conducting a common carrier or utility business.” North Dakota also statutorily defines any party transporting natural gas via pipeline “for hire or for sale” within the state, “the right of way for which is granted or secured . . . through the exercise of the right of eminent domain” as a common carrier. North Dakota goes further by defining any entity “engaged in the business of transporting crude petroleum, gas, coal, or carbon dioxide by pipelines” as a pipeline common carrier. As such, pipeline operators must submit to the jurisdiction of the North Dakota Public Service Commission, which, among other things, establishes and enforces rates and regulates tariffs. Accordingly, all CO₂ pipelines in North Dakota must operate as common carriers, whether or not eminent domain is used to acquire right of way.

Montana grants eminent domain authority only to common carrier pipelines but does not require all pipelines to operate as common carriers. Montana law defines a common carrier pipeline as one that transports by pipeline “carbon dioxide from a plant or facility that produces or captures carbon dioxide” but excludes “pipelines that are limited in their use to the wells, stations, plants, and refineries of the owner.” This provision would require some CO₂ pipelines transporting anthropogenic CO₂ to operate as a common carrier but would exclude pipelines transporting only natural CO₂. In a provision that mimics the Hepburn Act “Uncle Sam”

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305. N.D. CONST. art. I, § 16.
306. N.D. CENT. CODE § 49-19-01(3).
307. Id. § 49-19-01(1).
308. Id. § 49-19-17.
311. Plant or facility is defined as “a facility that produces a flow of carbon dioxide that can be sequestered or used in a closed-loop enhanced oil recovery operation. This does not include wells from which the primary product is carbon dioxide.” Id. § 15-6-158(2)(g).
exception, Montana also excepts point-to-point pipelines where both the CO₂ source and the end use are owned by the same party.

Texas takes a similar approach but does not distinguish based on either the source or end use of the pipeline. Private pipelines are permitted for any source or use of CO₂, however, the use of eminent domain obligates a CO₂ pipeline to operate as a common carrier. Although no permit is required prior to construction, the Texas Railroad Commission must designate the pipeline as a common carrier. To do so, the pipeline must notify the Commission of its proposed route and establish whether or not the pipeline will be available for use by the public through the filing of a T-4 permit application and a P-5 Organization Report. The developer must declare itself to be a common carrier, provide the Texas Railroad Commission with a letter agreeing to be subjected to Chapter 111 of the Natural Resource Code, and publish a tariff prior to exercising eminent domain. However, mere willingness to serve other customers is not enough to exercise eminent domain; the court in Denbury Green Pipeline-Texas, LLC v. Texas Rice Land Partners, Ltd. clarified that there must also be a reasonable probability that the pipeline will actually be used by the public. Consistent with the proposition that landowners should not be deprived of their property for purely private use, the developer must demonstrate that

312. Coburn, supra note 294, at 231.
314. TEX. NAT. RES. CODE ANN. § 111.019(b) (West 2011); Amanda Buffington Niles, Comment, Eminent Domain and Pipelines in Texas: It’s as Easy as 1, 2, 3 – Common Carriers, Gas Utilities, and Gas Corporations, 16 TEX. WESLEYAN L. REV. 271 (2010).
315. TEX. NAT. RES. CODE ANN. §§ 111.002(6), 111.020(d) (West 2011).
317. TEX. NAT. RES. CODE ANN. §§ 111.002(6), 111.014 (West 2011); Cavarrio Carter, System Check: Balancing Texas’s Need for Natural Resources Exploration with Texas Landowner Rights in Light of Texas Rice Land Partners v. Denbury Green Pipeline Texas, 2 LSU J. ENERGY L. & RES. 309, 318 (2014); James, supra note 287, at 971.
318. Denbury Green Pipeline-Texas, LLC v. Tex. Rice Land Partners, Ltd, 510 S.W.3d 909 (Tex. 2017) (stating that there must also be a reasonable probability “that the pipeline will at some point after construction serve the public by transporting gas for one or more customers who will either retain ownership of their gas or sell it to parties other than the carrier”).
the pipeline will not be “limited in [its] use to the wells, stations, plants, and refineries of the owner.”

Texas’ approach equates common carriage with public use. Once a pipeline has demonstrated that it will serve as a common carrier, it does not have to make any additional showing regarding the public purpose of the pipeline. Accordingly, whether the pipeline will mitigate climate change, provide CO₂ for the beverage industry, or be used for EOR is irrelevant. The operation of the pipeline as a public good is itself indicative of public purpose. In a subsequent decision, the Texas Supreme Court clarified that the state’s requirement does not mandate that a pipeline serve a substantial public purpose but rather that it establishes a reasonable probability of public use.

Pipelines for CCUS: Public Purpose v. Use by the Public

The growing demand for EOR and investment and research towards CCUS indicate that there will be increased development of CO₂ pipelines in coming decades. As new CO₂ pipelines expand across the country, private landowners nationwide will be expected to yield their property towards those ends. CO₂ pipelines intended for CCUS may not be able to rely on traditional natural resource development justifications of public purpose to obtain condemnation authority. This challenge illustrates the limitations of public purpose arguments based solely on extraction and contributes to the dialogue on whether property taken by private companies should be made available to some “possession, occupation, and direct enjoyment by the public.” Resolution of these issues will influence where pipelines are located, how they are operated, and the extent to which they can be integrated into a broader network to serve both EOR and climate-change mitigation uses.

Many of the traditional public purpose justifications for natural resource development are ill fitting as applied to CO₂ pipelines for CCUS, absent

322. Denbury, 510 S.W.3d at 917.
323. Dooley, supra note 9.
324. Klass, supra note 217, at 662.
associated EOR operations. Although non-EOR-CCUS may offset the environmental externalities of natural resource development, it does not, in itself, result in either the expansion of tax revenue or the development or production of natural resources. Accordingly, many of the statutes and constitutional provisions that have enabled use of condemnation for CO\textsubscript{2} pipelines related to the production of CO\textsubscript{2} or for EOR would be insufficient with respect to pipelines for carbon storage alone.

If natural resource takings provisions are narrowly interpreted as serving a public purpose solely by advancing resource extraction through the elimination of holdouts,\textsuperscript{325} CO\textsubscript{2} pipelines for CCUS hardly fit within those confines. However, these constitutional provisions can also be interpreted as an intentional effort to broaden the eminent domain authority granted to private industry as a means for facilitating natural resource development towards the general end of economic prosperity.\textsuperscript{326} Viewed in this light, it is feasible to argue that CCUS serves these same public purposes by decarbonizing fossil energy generation, thus resulting in an avoided cost from climate-related harms and potentially costly new emissions regulations.

The challenge of applying natural resource development takings provisions to CO\textsubscript{2} pipelines for CCUS illustrates the limitations inherent in public purpose justifications based entirely on the end use of the substance produced or transported. Whereas condemnation for CO\textsubscript{2} transportation as a resource or as necessary to “mining” would be nearly presumed to serve a public purpose, condemnation for CO\textsubscript{2} pipelines intended for CCUS may be constrained by the public purpose limitation. While little would prevent a pipeline developer from making a pipeline available for transport for purposes of CCUS after construction,\textsuperscript{327} the law is opaque as to whether pipelines could be constructed with CCUS as the principal end. Due to the fact that the permanent storage reservoir might not be co-located with the

\textsuperscript{325}. Coronado Oil Co. v. Grieves, 603 P.2d 406 (Wyo. 1979); Dayton Gold & Silver Mining v. Seawell, 11 Nev. 394 (1876) (“[T]he entire people of the state are directly interested in having the future developments unobstructed by the obstinate action of any individual or individuals.”).

\textsuperscript{326}. See Potlatch Lumber Co. v. Peterson, 88 P. 426, 431 (Idaho 1906) (holding that “a complete development of the material resources of our young state could not be made unless the power of eminent domain was made broader than it was in many of the Constitutions of the several states of the Union” because to hold otherwise would be “to defeat the development of the great natural advantages, resources and industrial opportunities.”).

EOR use, these limitations could be problematic, particularly for development of spur lines for the last mile. Accordingly, natural-resource development justifications of public purpose unnecessarily constrain development of an integrated CO$_2$ transportation network precisely at a time where maximum flexibility and expansion are needed.

As others have suggested, the natural resource development justification for public purpose is ripe for reconsideration in light of changing public needs.\(^\text{328}\) A historical narrative characterizes the relationship of American attitudes and the physical environment as moving through three distinct phases: 1) fear; 2) conquest and mastery through maximum economic utilization; and, 3) appreciation and preservation.\(^\text{329}\) Although reality was more nuanced than this linear model suggests,\(^\text{330}\) historical approaches to interpreting public use clauses throughout the 19th and early 20th centuries largely align with this model, with courts considering public purpose in light of changing norms and historical use.\(^\text{331}\) Yet, modern analyses of public purpose as it relates to natural resource purposes are firmly rooted in the rhetoric of conquest and utilization,\(^\text{332}\) even whereas public attitudes towards nature have reoriented towards conservation, integration, and restraint.\(^\text{333}\) Accordingly, as Professor Klass has suggested, the forced reallocation of property rights to promote natural resource development seems increasingly inconsistent with the evolving economies of western states towards emphasis on conservation and tourism, the protection of surface rights, and concerns about climate change and the social costs of carbon.\(^\text{334}\)

**Climate-Change Mitigation as Public Purpose**

Climate-change mitigation may soon qualify as a public purpose independent of natural resource development.\(^\text{335}\) There is a “general consensus that climate change poses a threat to human health and the

\(^{328}\) Klass & Meinhardt, *supra* note 121, at 689.

\(^{329}\) Limerick, *supra* note 212, at 172-73.

\(^{330}\) Id.

\(^{331}\) Norwood, 853 N.E.2d at 1129-30.

\(^{332}\) Coronado, 603 P.2d at 411.

\(^{333}\) Klass, *supra* note 217, at 679.

\(^{334}\) Id. at 679, 680, 689.

environment,” as well as significant threats to private property.\textsuperscript{336} Addressing these threats is one of the country’s critical needs, and despite public perceptions to the contrary, likely provides specific benefits within the individual states.\textsuperscript{337} As states and the federal government move to address the impacts of climate change or to reduce emissions, whether climate-change mitigation constitutes a public purpose is likely to be of critical importance.

This question is already being considered in the context of CCUS. CCUS will require not only land for pipelines but significant subsurface property rights necessary for sequestration.\textsuperscript{338} It is generally acknowledged that existing statutes permitting eminent domain for gas storage are likely insufficient to acquire subsurface rights necessary for CCUS.\textsuperscript{339} Accordingly, regulatory initiatives for CCUS and legislative declarations of pore space ownership have been shaped by the background landscape of eminent domain. In fact, the Interstate Oil and Gas Compact Commission (IOGCC) model statute proposes eminent domain as a tool to acquire subsurface property for CCUS.\textsuperscript{340} In addition to other natural-resource based approaches to establishing public purpose, both Louisiana and Kentucky have passed legislation designating carbon storage as a public

\textsuperscript{336} Climate, supra note 91, at 424-25; Holly Doremus, Climate Change and the Evolution of Property Rights, 1 UC IRVINE L. REV. 1091 (2011).


\textsuperscript{338} Delissa Hayano, Guarding the Viability of Coal and Coal-fired Power Plants: A Road Map for Wyoming’s Cradle to Grave Regulation of CO\textsubscript{2} Sequestration, 9 WYO. L. REV. 139, 141 (2009) (citing Steven L. Bryant, Geologic CO\textsubscript{2} Storage – Can the Oil and Gas Industry Help Save the Planet?, 54 ROCKY MNT. MIN. L. INST. 2-1, 2-8 (2008)); Tara Righetti, Correlative Rights and Limited Common Property in the Pore Space: A Response to the Challenge of Subsurface Trespass in Carbon Capture and Sequestration, 47 ENVTL. L. REP., NEWS & ANALYSIS 10420 (May 2017).

\textsuperscript{339} Mark A. de Figueiredo, Property Interests and Liability of Geologic Carbon Dioxide Storage, A Special Report to the MIT Carbon Sequestration Initiative, LAB. FOR ENERGY AND ENV’T. 12-14 (Sept. 2005).

purpose.\textsuperscript{341} Although courts have traditionally afforded extensive deference to legislative declarations of public purpose, these designations may not be dispositive as to judicial interpretations of states’ constitutional provisions.

In some states, however, there may be insufficient political initiative to declare CCUS or climate mitigation as a public purpose. In fact, at least two states, Wyoming and Oklahoma, have expressly provided that nothing within their carbon capture and sequestration statutes creates a right to use eminent domain for CCUS.\textsuperscript{342} These provisions do not necessarily preclude developers of CO\textsubscript{2} pipelines from obtaining condemnation authority under other provisions of law.\textsuperscript{343} However, an express statement of the legislature against utilization of eminent domain for CCUS—at least in the context of unitization of subsurface rights—may challenge arguments that pipelines for CCUS is within broader declarations of public purpose.

At least one case has analyzed issues that tangentially relate to use of eminent domain for climate change. In Borough of Harvey Cedars v. Karan, a New Jersey borough successfully condemned a landowner’s beachfront strip for the construction of protective sand dunes.\textsuperscript{344} Sand dune protection is pertinent to coastal climate adaptation projects.\textsuperscript{345} In fact, the National Oceanic and Atmospheric Administration’s U.S. Climate Resilience Toolkit describes sand dunes as “natural infrastructure” that towns can protect or enhance to reduce damage from “rising sea levels.”\textsuperscript{346}

\begin{itemize}
\item 341. KY. REV. STAT. ANN. § 154.27-100 (2014); LA. STAT. ANN. § 30:1108 (2009).
\item 342. OKLA. STAT. tit. 3 § 5-106(d); WYO. STAT. ANN. § 35-11-316 (West 2009).
\item 343. Oklahoma grants eminent domain authority to oil pipelines for transport of “petroleum, liquid or liquefiable hydrocarbons and chemicals” and to natural gas pipelines. OKLA. STAT. ANN. tit. 52 §§ 51-67, 21-35. It is unknown whether CO\textsubscript{2} pipelines would fall within either of these provisions. Oklahoma requires both oil and natural gas pipelines to be common carriers.
\end{itemize}
The dispute in *Borough of Harvey Cedars* concerned the determination of just compensation for an easement necessary to construction of protective sand dunes.\textsuperscript{347} The municipality’s right to acquire easements through its statutory powers of eminent domain for the construction of the sand dunes does not appear to have been questioned. In fact, the public benefits of the storm-protection project are discussed only as to whether it conferred a special benefit upon the property owners.\textsuperscript{348} The benefits of protective sand dunes are much more localized and causally related to the property taken, and accordingly fall more closely within traditional public purposes than atmospheric GHG reduction strategies. Accordingly, although *Borough of Harvey Cedars* does not establish acceptance of climate change as a public purpose, it indicates that condemnation is already being used to acquire property necessary for climate-change mitigation projects. Further, the partial takings issues addressed in *Borough of Harvey Cedars* are likely to be a critical issue should eminent domain be used for condemnation of subsurface pore space.\textsuperscript{349}

The transportation of CO\textsubscript{2} is a critical component of the vast infrastructure necessary to CCUS, and thus CO\textsubscript{2} pipelines have the potential to serve an important public purpose. Even were CCUS or climate-change mitigation accepted as a public purpose in its own right, success of CCUS on a national scale will require access to a greater interstate pipeline network. The incremental construction of trunk and spur lines for EOR pipelines could develop into the foundation for an national CO\textsubscript{2} pipeline network, but only if others can make use of that infrastructure. Absent common carrier requirements, infrastructure constructed using eminent domain to serve EOR purposes will not be available to “use by the public” through access by other producers or shippers in the same area. Thus, CCUS project proponents wishing to connect existing networks with new sources of captured CO\textsubscript{2} may suffer the same limits on access to market as early oil producers, hindering development of an integrated national pipeline network available for public use. Where used as an alternative to natural resource development justifications of public purpose, public use requirements thus serve a dual purpose in assuring future access to infrastructure built using eminent domain and eliminating limitations based on the natural resource end uses of CO\textsubscript{2} transported. Presently, those


\textsuperscript{348} *Borough of Harvey Cedars*, 70 A.3d 524.

\textsuperscript{349} Climate, *supra* note 91, at 420.
limitations may preclude development of pipelines intended for CCUS, whereas stand-alone public use requirements would permit their development provided that they too operated as common carriers. Accordingly, where states elect to grant condemnation authority to CO₂ pipeline developers, approaches that require availability for use by the public may be preferable to those that focus solely on the end use of the product transported.

IV. Adequacy of the Current Regulatory Framework

The cost of pipeline construction⁵ and unavailability of an integrated, open-access CO₂ pipeline network have been identified as among the major obstacles to widespread implementation of CCUS or greater deployment of EOR technologies. Concerns about inconsistent regulation between states and monopolization are cited as major impediments to its development. In response, many have suggested that a federal siting process is needed. This part evaluates the adequacy of the current regulatory framework to facilitate development of a nationwide integrated CO₂ pipeline network and suggests that many of the monopolization concerns identified could be overcome through state integration of common carrier requirements.

Proposals for a Federal Siting Framework

CO₂ pipelines are planned, constructed, and financed based on the specific characteristics of both the source and the end use—in almost all cases for EOR.⁵¹ Accordingly, construction of CO₂ pipelines is likely to unfold in a slow and geographically limited manner as new industrial facilities, EOR operations, and CCS-enabled power plants are brought online. Early development of natural gas and oil pipelines, and of electric transmission lines, progressed in much the same way. In each case, an initial, localized build-out of infrastructure was accomplished through state

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⁵ Cost estimates for CO₂ pipeline construction range from $70,000 to $126,000 per inch-diameter/mile. Joseph Essandoh-Yeddu & Gürcan Gülen, Economic Modeling of Carbon Dioxide Integrated Pipeline Network for Enhanced Oil Recovery and Geologic Sequestration in the Texas Gulf Coast Region, I ENERGY PROCEEDIA 1, 1602-10 (2009); Tim Grant, et al., Carbon Dioxide Transportation and Storage Costs in NETL Studies, U.S. DEP’T OF ENERGY, NAT’L ENERGY TECH. LAB. (May 2014); Sean T. McCoy & Edward S. Rubin, An Engineering-Economic Model of Pipeline Transport of CO₂ with Application to Carbon Capture and Storage, GREENHOUSE GAS CONTROL, 219-29 (2008). An inch-diameter/mile is a cost estimate tool based on the cost per inch of diameter of pipe over a mile.

⁵¹ Schnacke, supra note 13, at 286.
regulation and private enterprise.\textsuperscript{352} As the industry grew and expanded, federal regulation or backstop authority eventually became necessary to overcome geographic barriers or market failures.\textsuperscript{353}

CO\textsubscript{2} pipelines may follow this well-worn path. Concerns about monopolization, among other problems, have led a number of scholars to conclude that federal regulation of CO\textsubscript{2} pipeline siting is needed.\textsuperscript{354} Suggested frameworks include a model based upon the Natural Gas Act, federal common carrier requirements similar to those imposed on oil pipelines, FERC backstop authority, or the creation of an opt-in option for federal siting.\textsuperscript{355} Each of these proposals seeks to address the inefficiencies of inconsistent state regulations and the risk of monopoly control.

Although federal regulation may eventually be required, it may not be needed yet. In the natural gas context, federal siting contributed to faster permitting, ease in obtaining right of way, and price stability.\textsuperscript{356} However, these efficiencies came with new costs, such as “high rates, barriers to entry, stymied productivity, technological change, and management quality.”\textsuperscript{357} Thus, where state approaches appear to be sufficient, premature imposition of federal siting authority may impose unnecessary costs.\textsuperscript{358}

States are better equipped to establish public participation and consider significant local concerns about safety, land use, and impacts to property and environment.\textsuperscript{359} Further, under state siting rules, pipeline infrastructure has grown steadily, including a number of interstate pipelines and market participants. Those very pipelines are likely to form the backbone of the CO\textsubscript{2} transportation infrastructure that will ultimately be required. A

\textsuperscript{353} Climate, \textit{supra} note 91.
\textsuperscript{354} Policy Brief: Regulating Carbon Dioxide Pipelines for the Purpose of Transporting Carbon Dioxide to Geologic Sequestration Sites, CCS REG. PROJECT 3, 5 (2009).
\textsuperscript{356} Bliss, \textit{supra} note 97.
\textsuperscript{357} Id.
\textsuperscript{359} Klass & Rossi, \textit{supra} note 352, at n.148.
preemptive disruption in siting processes could drive away the only capital currently being invested in CO₂ transportation.

Proposals for federal siting have arisen in response to concerns that the incremental piecing together of CO₂ pipelines for EOR may later preclude or deter use and access to infrastructure for CCUS. Common carrier requirements in state eminent domain and siting processes may address many of these concerns. Common carrier requirements are consistent with historical understandings of public use, and will assure that the EOR-driven development of CO₂ pipelines today will later be available to serve CCUS or other carbon-mitigation industries. By doing so, states can concurrently promote development of an accessible and integrated pipeline infrastructure and avoid upsetting what has thus far seemed to be a workable paradigm.

The Monopoly Concern

All pipelines are considered natural monopolies. The investment and time required to permit and build long distance pipelines, particularly interstate pipelines, is significant. Once built, pipelines present an opportunity to exert market power and extract secondary rents. While nothing de facto prevents others from entering the market, “the costs of entering the market are so high [due to the fixed cost of building a pipeline] that it is most efficient for only one firm to serve a given geographical region.”

Prior to the Hepburn Act and NGA, both the oil and natural gas industries were characterized by control and consolidation of infrastructure in the hands of a few companies. Consumers and producers alike complained of monopolization. In response, Congress enacted federal regulation. In the case of the NGA, the purpose was to protect consumers from market dominance, prevent discrimination against unaffiliated entities, and provide rate stability. While not imposing common carrier requirements, the NGA granted FERC’s predecessor, the Federal Power Commission, jurisdiction to assure that rates were “just and reasonable” and

361. Merrill, supra note 216, at 85.
363. Klass & Meinhard, supra note 121, at 994.
364. Mack & Endemann, supra note 355, at 738; see also Assoc. Gas Distrib. v. FERC, 824 F.2d 981 (D.C. Cir. 1987).
that pipelines did not discriminate through “undue preferences.”\textsuperscript{365} The Hepburn Act addressed similar concerns through the imposition of federal common carrier requirements and rate regulation by the ICC.\textsuperscript{366}

CO\textsubscript{2} pipelines are vulnerable to the same market manipulations. In fact, almost all of the large scale CO\textsubscript{2} trunk lines in the United States today are controlled by subsidiaries of three companies: Denbury Resources, Kinder Morgan, and Occidental Petroleum.\textsuperscript{367} Further, unlike oil, CO\textsubscript{2} is not transportable by other means. Although conditions that might tend to create a natural monopoly are present, it is unclear to what extent closely held control of the transportation infrastructure impacts shipper access to pipelines or pricing of CO\textsubscript{2} to downstream EOR consumers. Affordable access to CO\textsubscript{2} has been identified as the “single largest challenge to the development of a thriving CO\textsubscript{2}-based EOR industry in Wyoming.”\textsuperscript{368} However, it is unclear whether, or to what extent, high CO\textsubscript{2} prices result from lack of supply, insufficient capacity, or rent seeking by pipeline companies.

Similarly, it is unknown if pipeline control by a small number of market participants results in discriminatory access. At least one producer in Mississippi has asserted that access to CO\textsubscript{2} pipelines in the state is restricted through submarket pricing, limiting production and trapping reserves.\textsuperscript{369} In Louisiana and Mississippi,\textsuperscript{370} neither of which imposes common carrier requirements on CO\textsubscript{2} pipelines, one company controls all of the CO\textsubscript{2}

\textsuperscript{366} Granitz & Klein, supra note 140; Klass & Meinhardt, supra note 121, at 961.  
\textsuperscript{367} Matthew Wallace, et al., A Review of the CO\textsubscript{2} Pipeline Infrastructure in the U.S., U.S. DEP’T OF ENERGY (Apr. 21, 2015).  
\textsuperscript{370} LA. STAT. ANN § 30:1107 (2009) (providing that issuance of a certificate of public convenience and necessity shall not “[c]ause any . . . transporter of carbon dioxide for storage to become, or be classified as, a common carrier or . . . [subject] such carbon dioxide to storage transporter to any duties, obligations, or liabilities as a common carrier”).
transportation infrastructure.\textsuperscript{371} In contrast, in Texas, where common carriage is required to exercise eminent domain, at least two companies operate major trunk lines, and an even greater number of companies operate smaller scale distribution systems.\textsuperscript{372} On its face this would indicate the existence of a natural monopoly in states without common carrier requirements. The experience in the Rocky Mountain Region, however, tells a different story; in Wyoming, where common carriage is not required, a number of companies operate both trunk and spur lines.\textsuperscript{373} Accordingly, the efficacy of common carrier requirements in assuring more market participation or access is likewise unclear.

\textit{A Return to Public Use}

States can facilitate development of infrastructure that may later prove compatible with CCUS through the imposition of common carrier requirements on pipeline developers utilizing eminent domain. This approach, similar to what has been adopted in Texas, establishes public use through the creation of infrastructure available for use by the public. As the litigants in \textit{Texas Rice Partners} asserted, there is something about CO\textsubscript{2} transportation that \textit{feels} private—particularly where, as many CO\textsubscript{2} pipelines are, such pipelines are constructed and operated principally, if not exclusively, for the transportation of CO\textsubscript{2} owned and used by the same party. A public use approach establishes a public benefit through the availability of the infrastructure to the public—thus encouraging new development, exploration, and uses of CO\textsubscript{2} where such infrastructure is located. Public use, as distinguished from public purpose, limits opportunities for monopoly and “secondary rent seeking” through the creation of public goods.\textsuperscript{374} By reducing barriers to entry, common carrier requirements may reduce concerns about unfair pricing to both unaffiliated CO\textsubscript{2} producers and consumers for EOR.

The use of eminent domain for projects that are available to public use may be more defensible under both state and federal constitutional protections of private property. As discussed in Part III, the public purpose justifications for siting CO\textsubscript{2} pipelines—for natural resource development or

\textsuperscript{371} DiPietro, \textit{supra} note 33.
\textsuperscript{372} \textit{Id}.
\textsuperscript{373} Matthew Wallace, et al., \textit{A Review of the CO\textsubscript{2} Pipeline Infrastructure in the U.S.}, U.S. DEP’T OF ENERGY (Apr. 21, 2015).
\textsuperscript{374} Merrill, \textit{supra} note 216, at 73 (citing \textit{R. Epstein, Private Property and the Power of Eminent Domain} (1985)) (“Public goods are those that possess both jointness in supply and impossibility of exclusion.”).
EOR—are based exclusively on the end use of the product transferred. Many of these statutes are ambiguous as applied to CO₂, which may or may not constitute a “gas” or “natural resource” within the terms of those statutes. Further, changing views on climate, growing interests in recreation and tourism, and increasing land values leave natural resource extraction justification of public use vulnerable to criticism. Even were states to adopt legislation declaring transportation for CCUS a public purpose, those pipelines would similarly be limited—granting access to a closed set of market participants to transport a product for a defined purpose. Transitions to renewable energy and other market shifts may make CCUS uncompetitive as a decarbonization strategy for the power sector, thus rendering the public purposes advanced by laws authorizing condemnation for CO₂ pipelines on that basis obsolete. The result is a rigid infrastructure that promotes monopolization and discourages innovation, rather than one that promotes creation of public goods in the form of pipelines to offer nondiscriminatory access to all potential future users.

A public access approach to siting addresses these limitations, although an imposition of common carrier requirements on pipelines developed without the use of eminent domain does not seem necessary. Like North Dakota, the Hepburn Act imposed federal common carrier requirements on all pipelines—regardless of how right of way was obtained. Doing so was necessary to upend an entrenched monopoly characterized by uncompetitive practices resulting in stranded assets and limited access to market. This sort of retroactive reallocation of property does not seem necessary. In at least two of the three geographic areas where CO₂ pipeline infrastructure exists, there are already a number of competitive market participants owning and operating CO₂ pipelines. If common carrier requirements were linked only to the use of eminent domain—as they are in Montana and Texas—pipelines developed entirely on private land with private capital through voluntary agreement with landowners could be privately operated for the exclusive use of the owner(s).

376. Klass & Meinhardt, supra note 121, at 961; see supra notes 305-308 and accompanying text.
378. See supra notes 372-373 and accompanying text.
Challenges of CO₂ Common Carriage

Common carrier requirements are criticized as resulting in a paucity of public goods. Precisely because they are open to public use and do not convey a monopoly or unique advantage on the holder, common carrier requirements may deter investments resulting in scarcity.379 Historically, both oil and natural gas companies opposed common carrier requirements.380 These companies argued that common carrier requirements impermissibly subject private investment to public use, or would deter investments in infrastructure.381 Yet, neither state nor federal regulatory siting or rate regulation requirements have resulted in an underdevelopment of pipeline infrastructure for oil or natural gas.382 Similarly, although implementation challenges certainly exist,383 development of CO₂ pipelines has not been forestalled by common carrier requirements in Texas, Colorado, Montana, and on federal lands.384

Curtailment and Single-Customer Pipelines

In order for common carrier requirements to work within the current industrial organizational structure, they must be consistent with the made-to-measure manner of pipeline development for EOR.385 This raises two primary issues: curtailment and single-customer pipelines. CO₂ pipelines are designed with both a specific quantity of supply and a specific quantity of need/capacity at each terminus. Accordingly, common carrier requirements that result in curtailment—in order to make available capacity downstream—may create uncertainty as to whether there will be sufficient capacity to justify either capture costs or to adequately support the downstream EOR purposes.386 For example, disparate common carrier requirements could result in bottlenecks driven by downstream oversubscriptions, thus making the pipeline unsuitable to an upstream

379. Miceli, Thomas J., Free Riders, Holdouts, and Public Use: A Tale of Two Externalities, 148 PUBLIC CHOICE 105-117 (2011); Klass & Meinhardt, supra note 121, at 992; Merrill, supra note 216, at 73.
380. Klass & Meinhardt, supra note 121, at 992.
381. Id.
382. Id. at 1016.
384. It is unclear how BLM has implemented its MLA common carrier obligations in existing pipelines. See Sam Kalen, Thirst for Oil and the Keystone XL Pipeline, 46 CREIGHTON L. REV. 1, 21 (2012).
385. Schnacke, supra note 13, at 313.
386. Zarraby, supra note 355, at 969.
facility’s capture needs. Further, if a private developer of a CO₂ pipeline cannot be assured that it will have sufficient CO₂ for its EOR operations or offloading capacity for captured CO₂, the pipeline may be difficult to finance. In response to these issues, both a 2010 interagency task force established by President Obama and the IOGCC/SSEG CO₂ Pipeline Transport Task Force concluded that the apportionment practices under the oil pipeline framework were unworkable with the dedicated business models for CO₂ transport. Accordingly, an effective CO₂ pipeline network—and any common carrier requirements attached thereto—will likely need to provide a mechanism for sources to reserve capacity.

The made-to-measure nature of most CO₂ pipelines also creates the likelihood that many pipelines may be single-customer in the early stages of development. As Mack and Endemann note, this may make common carrier requirements more difficult to satisfy. However, although criticized by landowners, the reasonable likelihood of a future public use standard articulated by the court in Texas Rice Partners may be sufficient. Pipeline companies would not necessarily need contracts from multiple generators or storage/EOR companies, provided that such use could be reasonably contemplated at some point in the future. While this may be sufficient, the standards for establishing common carriage may differ from state to state, creating uncertainty as to whether pipelines can rely on access to eminent domain. A requirement that a pipeline affirmatively establish the existence of multiple suppliers prior to construction could create an insurmountable obstacle to early-stage infrastructure development.

**Pipeline Gas Specifications**

Pipeline gas specifications may limit existing pipelines’ utility to other shippers. Pipeline specifications for gas composition are critical to the safety and operation of the pipeline—the presence of other chemical

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387. Id. at 968.
388. Exxon Corp. v. Lujan, 730 F. Supp. 1535, 1537 (D. Wyo. 1990) (“In order for tertiary recovery operations to be successful, a steady, constant, and uninterrupted supply of carbon dioxide is needed.”).
389. Mack & Endemann, supra note 355, at 739. Challenges of common carrier requirements as applied to oil pipelines may provide insight to these issues. See Jeff. D. Makholm, et. al., The Politics of U.S. Oil Pipelines: The First Born Struggles to Learn from the Clever Younger Sibling, 37 ENERGY L.J. 409, 422 (2016).
391. Id. at 311-12 (citing Bliss, supra note 97, at 15).
392. Mack & Endemann, supra note 355, at 741.
components within the CO\textsubscript{2} stream can lead to corrosion or impact miscibility pressures.\textsuperscript{393} For example, material concentrations of either nitrogen or methane can preclude dense phase operations and oxygen can lead to corrosion.\textsuperscript{394} Accordingly, pipeline specifications recommend dewatering and removing impurities at the inlet to the pipeline.\textsuperscript{395}

Not only is dehydration and removal of certain impurities important for preventing corrosion, different downstream uses also require different qualities of gas. For example, the food and beverage industry has higher requirements than EOR.\textsuperscript{396} Components like nitrogen in CO\textsubscript{2} may adversely impact suitability of CO\textsubscript{2} streams for EOR, whereas other chemicals within CO\textsubscript{2} may result in damage to industrial equipment.\textsuperscript{397} Storage operators and EOR operators alike would need to consider the specific chemical and geologic characteristics of the target formation to avoid undesired interactions.\textsuperscript{398} Due to these diverse considerations, gas specifications are tailored to fit the commercial requirements of the downstream project for which it is built.\textsuperscript{399} CO\textsubscript{2} sources entering the pipeline would need to meet those specifications.\textsuperscript{400} These specifications could result in limited utility of certain pipelines to other shippers or downstream users. Accordingly, uniform specifications, while promoting an integrated network, may be prohibitively costly and inefficient relative to certain sources or uses.\textsuperscript{401}

The source and chemical components of CO\textsubscript{2} entering the pipeline may also subject pipeline and downstream users to additional regulatory requirements. For example, storage and injection pipeline operators would also be careful to avoid including any CO\textsubscript{2} stream containing components that might fall outside EPA’s Conditional Exclusion from the Resource...
Conservation and Recovery Act (RCRA). Similarly, pipelines may also prohibit introduction of CO$_2$ into the pipeline in order to avoid perceived project delays resulting from greenhouse gas reporting requirements under the EPA’s Subpart RR rules. Occidental has successfully complied with Subpart RR in order to obtain the 45Q tax credit in two CO$_2$-EOR projects—suggesting that such requirements are not an insurmountable obstacle. However, critics have suggested that downstream users may be concerned that comingle CO$_2$ would become subject to additional plan approval and reporting requirements, thus requiring assurance from pipeline companies. Accordingly, CO$_2$ pipeline specifications may exclude certain upstream sources to avoid the potential of subjecting the entire stream to GHG Reporting Requirements or RCRA.

**Inconsistent Rates**

A final concern regarding state imposition of common carrier requirements on interstate CO$_2$ pipelines is the likelihood of inconsistent rates along various pipeline segments. The establishment and publication of non-discriminatory rates is a hallmark of common carriage and is subject to state economic regulation. In a state directed common carrier model, each state would establish its procedures and requirements for rate regulation. For example, Texas authorizes the Railroad Commission to establish rules for CO$_2$ tariffs, whereas in Montana the Public Service Commission regulates rates. Due to varying procedures and policies, there is a strong possibility for differential rates along segments of an interstate pipeline. Resulting implementation challenges may limit the efficacy of requirements in providing actual pipeline access and result in uncertainties for pipeline users.

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407. MONT. CODE ANN. § 69-13-102 (West 2013); Nordhaus & Pitlick, *supra* note 110, at 96 (citing TEX. NAT. RES. CODE ANN. § 111.014 (West 1977)).
developers and customers.\textsuperscript{409} This concern may be mitigated to a limited extent by rate dispute resolution by the Surface Transportation Board, an agency within Department of Transportation.\textsuperscript{410} The STB has jurisdiction over interstate common carrier transportation, including some pipelines for commodities “other than water, gas, or oil.”\textsuperscript{411} Although its authority has not been tested with respect to CO\textsubscript{2} pipelines and STB could disclaim jurisdiction, a government accounting office report found that the STB had jurisdiction to resolve rate discrimination disputes.\textsuperscript{412} This authority would not assure uniform rates across state lines, but rather that rates were reasonable and non-discriminatory.\textsuperscript{413} Accordingly, if a shipper brought a case to the board and the STB agreed to take up the issue, it is unclear how disputes would be resolved.

	extit{Implementation}

The integration of reserve capacity and specific made-to-measure pipeline gas specifications into tariff agreements and terms of service could undermine the actual utility of CO\textsubscript{2} pipelines as common carriers, adding costs to both upstream shippers and downstream users.\textsuperscript{414} Determinations of pipeline quality gas, rate consistency, and reserve capacity present challenges that will need to be considered in tariff agreements and assessed to assure that the result is not so specific as to preclude actual access by other shippers. Accordingly, common carrier requirements should be developed in consultation with industry to assure compatibility with existing pipeline business models and to avoid disruption to CO\textsubscript{2}-EOR operations.\textsuperscript{415}

State agencies play an important role in balancing these considerations. State regulatory agencies, such as infrastructure authorities or oil and gas conservation or public service commissions, have experience siting oil pipelines and would have regulatory authority over the permitting and

\textsuperscript{409} Id.
\textsuperscript{410} Nordhaus & Pitlick, supra note 110, at 90-91, 99.
\textsuperscript{411} Id. at 90 (citing 49 U.S.C. §15301(a) (2006)).
\textsuperscript{413} Nordhaus & Pitlick, supra note 110, at 99.
\textsuperscript{414} Marston & Moore, supra note 15, at 455.
unitization of CCUS facilities and EOR operations. These agencies may be better equipped than federal regulators to balance the additional cost of uniform standards or curtailment with the state interest in making infrastructure truly accessible for use by the public.

The majority of states do not have laws specifically addressing siting or eminent domain for CO₂ pipelines. In the absence of EOR activities within the state, there has been no urgency to adopt specific legislation. Accordingly, whether a CO₂ pipeline can obtain eminent domain authority and under which conditions requires an analysis of whether such pipelines fall within existing authority for intrastate natural gas and oil pipelines or natural resource development. However, as EOR operations extend into new areas—for example, Ohio and Pennsylvania—and as CCUS plays an increasingly larger role in the national climate change dialogue, state legislatures will have to consider statutes for siting CO₂ pipelines. Eminent domain is likely essential to development of both intrastate and interstate pipelines and will thus be a core component of any such siting legislation. Accordingly, legislatures will have a new opportunity to make a determination between public purpose and public use. By imposing common carrier requirements on CO₂ pipelines utilizing eminent domain, states can play an important role in assuring that the CO₂ pipelines built today can later be integrated into a CO₂ pipeline network that will serve both EOR and CCUS needs.

Common carrier requirements could also be integrated into the eminent domain laws for states with existing siting rules and operating CO₂ pipelines. For example, New Mexico, Wyoming, Mississippi, and Louisiana all permit use of eminent domain for CO₂ pipelines but do not require common carriage. These statutes could be modified going forward. However, doing so may prove difficult. Failed efforts to enact common carrier legislation in Mississippi in 2014 and 2016 indicate that there may be a lack of political will for those changes or that efforts may face opposition from entrenched interests. Additionally, retroactive imposition of common carrier requirements on pipelines not currently carrying product

416. Klass & Meinhardt, supra note 121, at 1027.
418. Id.
for other shippers—nor indicating a willingness to do so—could raise constitutional concerns.\textsuperscript{420}

\textit{Limitations of the State Siting Approach}

The current state siting approach is subject to a number of limitations that may need to be resolved as the industrial organization and pipeline configuration grows to accommodate CCUS.\textsuperscript{421} A long distance CO\textsubscript{2} pipeline would require a multiplicity of state and local approvals, each with potentially different requirements for eminent domain, common carriage, rate regulation, and stipulations.\textsuperscript{422} The resulting patchwork may introduce uncertainty and inefficiency, thus diminishing economies of scale and limiting access to capital.\textsuperscript{423} Further, as pipelines expand into new regions, states may block pipelines that would go through their sovereign territory but are unpopular either because they serve politically unsupported purposes or would not materially serve customers or industries within the state.\textsuperscript{424} A majority of states have neither CCUS nor EOR operations and thus would have little incentive to subject private landowners in the state to eminent domain for an activity perceived as having little local relevance.\textsuperscript{425} While the existence of several interstate CO\textsubscript{2} pipelines indicates that these challenges have not precluded development thus far,\textsuperscript{426} the lessons of the Keystone XL pipeline, the Constitution natural gas pipeline, and the Plains & Eastern Clean Line caution not to discount that possibility.\textsuperscript{427} Although CO\textsubscript{2} pipelines are unlikely to be characterized by rapid expansion relating from new sources of supply or exponentially increasing demand, additional regulation at the state and federal level may be necessary to address these obstacles as the need for interstate pipelines grows. Even then,

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\textsuperscript{420} United States v. Ohio Oil Co., 234 U.S. 548, 561 (1914).
\textsuperscript{421} Industrial organizational structures for CCUS are unlikely to mimic those for EOR, thus, as those new configurations come on line, the administrative regulation of access to pipelines may again require consideration. See M. A. de Figueiredo, et al., \textit{Regulating Carbon Dioxide Capture and Storage}, MIT CTR. FOR ENRGY & ENVTL. POL`Y RES. (2007).
\textsuperscript{422} Mack & Endemann, supra note 355, at 739.
\textsuperscript{423} \textit{Id.} at 739; Nordhaus & Pitlick, supra note 110, at 98; Zarraby, supra note 355, at 968.
\textsuperscript{424} \textit{Id.}; Klass & Rossi, supra note 352.
\textsuperscript{425} For examples of these challenges in the transmission context, see Alexandra B. Klass & Elizabeth J. Wilson, \textit{Interstate Transmission Challenges for Renewable Energy: A Federalism Mismatch}, 65 VAND. L. REV. 1801, 1084, 1858-75 (2012).
\textsuperscript{426} For example, the northern Rockies CO\textsubscript{2} pipeline network crosses Colorado, Utah, Wyoming, and Montana, see Nemmedal, supra note 368; Wallace, supra note 367, at 15.
\textsuperscript{427} Klass & Rossi, supra note 352; Player, supra note 320.
\end{quote}
comprehensive federal siting may not be the optimal approach. For example, as scholars have suggested in the transmission and oil pipeline contexts, these challenges may open pathways for non-binary state and federal cooperation or for limited federal intervention in state pipeline siting: for example, through interstate compacts,\textsuperscript{428} backstop siting authority,\textsuperscript{429} or the establishment of interstate pipeline corridors.\textsuperscript{430}

Despite these limitations, for the time being the current state siting approach is preferable to a federal siting framework. While there is a strong and growing national interest in CCUS as a component of broader federal climate policy, presently, almost all CO\textsubscript{2} pipeline construction is occurring in the context of CO\textsubscript{2}-EOR. These oil and gas production activities have traditionally been regulated by state conservation agencies, which permit operations and create unities for EOR and which are well equipped to make the types of balancing determinations related to tariffs and common carrier requirements that will be required. Further, CO\textsubscript{2} pipelines’ design, construction, and operation, and impacts to the environment and to landowners are predominately local. Thus, it is appropriate for state legislature to make these important determinations regarding land use, private property, and public purpose.

\textit{V. Conclusion}

There is no federal siting framework for CO\textsubscript{2} pipelines. Accordingly, state law determines whether and under which conditions private entities developing CO\textsubscript{2} pipelines may utilize eminent domain. States thus far have provided this authority under two public purpose justifications: natural

\textsuperscript{428} Klass & Rossi, supra note 352, at 486; Alexandra B. Klass & Jim Rossi, \textit{Revitalizing Dormant Commerce Clause Review for Interstate Coordination}, 100 MINN. L. REV. 129, 145 (2015); Bliss, supra note 97, at 50.

\textsuperscript{429} Nordhaus & Pitlick, supra note 110, at 101 (citing 16 U.S.C. § 824p (2005)); Klass & Rossi, supra note 352, at 455-56. Congress provided federal backstop authority for transmission lines based on concerns related to grid reliability and energy security, concerns not present for CO\textsubscript{2} pipelines.

resource development and the creation of physical infrastructure available for use by the public.

The anticipated expansion of CO₂ pipelines provides a fresh opportunity for consideration of the public purpose requirement in light of changing social norms, public needs, and new technologies. The historically adequate public purposes of natural resource and economic development may hinder development of an integrated and accessible CO₂ pipeline network that can accommodate growing demand for both EOR and CCUS. Given anticipated needs for CO₂ pipelines for CCUS, a public use approach is preferable. This approach may assure that new pipelines developed for CO₂-EOR will be available for use by other shippers. Further, a public use approach clarifies condemnation authority of CCUS pipeline developers by resolving interpretation problems related to provisions that link eminent domain to extractive natural resource development.

The imposition of common carrier requirements within a state siting framework provides opportunities to promote growth and flexibility within the commercially driven CO₂ pipeline industry. This approach, however, leaves important structural and implementation issues to be resolved regarding the application of common carrier requirements to existing infrastructure, coordination between agencies across many levels of government, and disparate pipeline gas specifications and state regulations. These challenges provide a valuable opportunity for industry and state legislatures to collaboratively and proactively advance solutions that appropriately balance commercial concerns, the property rights of landowners, and the public interest.