Sources to Sinks: Expanding a National CO2 Pipeline Network

Article · January 2020

Jada Garofalo

SOURCES TO SINKS: EXPANDING A NATIONAL CO_2 PIPELINE NETWORK

by Jada F. Garofalo and Madeleine Lewis

Jada Garofalo is a clerk in the Superior Court of the Third Judicial District of Alaska.
Madeleine Lewis is a clerk in the U.S. District Court for the District of Wyoming.

SUMMARY

Enhanced oil recovery has generated an immense and growing market for carbon dioxide (CO_2), which has uses in manufacturing, medical, and industrial settings. In the next 30 years, these combined end-uses will necessitate a three- to fivefold expansion of existing CO_2 transportation infrastructure in the United States. A more flexible, extensive, and integrated CO_2 pipeline network is necessary to accommodate this growing demand. Like oil pipelines and electric transmission lines, CO_2 pipelines are sited according to state law, which determines where and how they are routed and the conditions under which they will be operated. This Article provides an overview of CO_2 pipeline regulation, a state-by-state comparison of siting, routing, and operation laws, and a case study of the federal and state permitting required for a recent CO_2 pipeline. It closes with suggestions for state legislatures looking to encourage the development of CO_2 transportation infrastructure.

Despite its depiction as a waste product and greenhouse gas (GHG) whose emitters are increasingly answerable for the effects of climate change, carbon dioxide (CO_2) is widely commodified as a tool of both manufacturing and oil production. Its diverse manufacturing applications span a wide spectrum, including soda bottling and the production of biofuel, mattresses, car seats, and fire retardants.[1] More prominently, CO_2 is critical for improved oil recovery (enhanced oil recovery, or EOR), a process through which CO_2 and other substances are injected underground to mobilize otherwise unreachable reserves of oil and gas.[2] At the end of its useful life, the gas can also be injected underground for permanent storage as a climate change mitigation technique, a process commonly referred to as carbon capture and sequestration (CCS).[3] When industry players refer to a combination of these techniques (EOR and CCS), the term carbon capture *use* and sequestration is employed (CCUS).[4]

Whether its final characterization is as commodity or waste product, the transportation of CO_2 serves important public purposes. The commodity uses of CO_2 are expected to necessitate an expansion of existing CO_2 transportation infrastructure within the United States in the next 30 years.[5] The demand for geologic storage of CO_2 will also increase as a result of state and federal tax and regulatory incentives aiming to curtail atmospheric CO_2.[6]

Authors' Note: All opinions expressed in this Article belong solely to the authors and do not reflect the views of their judiciary employers. The authors would like to thank Prof. Tara K. Righetti of the University of Wyoming College of Law and School of Energy Resources for her profound mentorship and invaluable input on drafts. They would also like to thank ClearPath Foundation for its support in the development of this Article.

1. Paul Parfomak & Peter Folger, Cong. Research Serv., RL34316, Pipelines for Carbon Dioxide (CO_2) Control: Network Needs and Cost Uncertainties (2008). Other common uses of CO_2 include medical procedures in which CO_2 is used as an insufflation gas to promote visibility in surgical sites, and cryotherapy. BOC Healthcare UK, *Medical Carbon Dioxide*, https://www.bochealthcare.co.uk/en/products-and-services/products-and-services-by-category/medical-gases/carbon-dioxide/medical-carbon-dioxide.html (last visited Nov. 19, 2019).
2. U.S. Department of Energy (DOE), Office of Fossil Energy, *Enhanced Oil Recovery*, https://www.energy.gov/fe/science-innovation/oil-gas-research/enhanced-oil-recovery (last visited Nov. 19, 2019).
3. DOE, Office of Fossil Energy, *Moving Forward on CCS*, https://www.energy.gov/fe/articles/moving-forward-ccs (last updated Mar. 14, 2014).
4. Judith Greenwald, *Putting the "U" in CCUS*, Center for Climate & Energy Solutions, May 3, 2012, https://www.c2es.org/2012/05/putting-the-u-in-ccus/.
5. *See* James J. Dooley et al., *Comparing Existing Pipeline Networks With the Potential Scale of Future U.S. CO_2 Pipeline Networks*, 1 Energy Procedia 1595, 1598 (2009) ("Between 11,000 and 23,000 additional miles of dedicated CO_2 pipeline might be needed in the United States before 2050."), *available at* https://www.researchgate.net/publication/222530686_Comparing_Existing_Pipeline_Networks_with_the_Potential_Scale_of_Future_US_CO2_Pipeline_Networks.
6. *See, e.g.*, 26 U.S.C.A. §45Q (West 2019).

CO_2 sources are either natural (developed from underground deposits) or anthropogenic (emitted as byproducts of industry, such as from coal-fired power plants), and sources are rarely co-located with oil fields, geologic formations, or with industries that seek CO_2 for EOR, sequestration, or manufacturing.[7] Because the current CO_2 pipeline network has developed on an as-needed basis and primarily for EOR, it is fairly localized to the southern and western regions of the United States and is principally used to connect reliable sources of CO_2 to oil fields for CO_2-EOR.[8] Given the burgeoning market for CO_2, a more flexible, extensive, and integrated CO_2 pipeline network is necessary to accommodate growing demand for CO_2.

The expansion of a CO_2 pipeline network across the United States faces significant challenges. To accommodate the forecasted growth of the CO_2 market, the rate of the pipeline build-out is expected to require approximately 1,000 miles of new pipeline per year until 2030.[9] Public funding for this expansion of pipeline is unprecedented, as the majority of existing CO_2 pipelines have been funded as part of, and in connection with, privately developed EOR projects. While the current commodity-driven market for CO_2 used for EOR is likely to change as CCUS technologies are increasingly employed,[10] it remains unclear whether CO_2 pipelines for sequestration or manufacture will be financed in a similar commodity-driven way.[11] If not privately developed, it is unclear how, and whether, project financing might be secured and pipelines made accessible to diverse carriers of CO_2.[12]

Yet another challenge implicit in the expansion of CO_2 pipeline infrastructure is the possibility of a "mixed" CO_2 supply portfolio including regulated and unregulated CO_2. States that do regulate CO_2 typically regulate anthropogenically sourced CO_2 (such as CO_2 produced from point sources of emission such as coal-fired power plants) rather than naturally sourced CO_2 (such as CO_2 that is released from ancient geologic formations). "Commingled" supply streams of CO_2 are theoretically subject to different layers of regulation, and the imposition of multiplied tax and regulatory burdens for each source-stream. The complications of commingled supply streams may disincentivize the siting, construction, and operation of commingled pipelines, particularly where a project proponent desires to claim a credit for injected CO_2.[13] Variations in the regulation of the different source-streams have the potential to encourage separate pipeline networks, ultimately resulting in redundant pipelines and less incentive to transport anthropogenic CO_2, specifically.

Finally, transporting CO_2 via pipeline is not risk-free; there are safety risks inherent in the task. Generally, the risks associated with transportation of CO_2 by pipeline are those that can be solved by creating specification requirements for quality and inspection of pipelines. Safety regulation is carried out by the Pipeline and Hazardous Materials Safety Administration (PHMSA)—part of the U.S. Department of Transportation (DOT)—though states may regulate the safety of strictly intrastate pipelines.[14]

Similarly to oil pipelines and electric transmission lines, CO_2 pipelines are sited subject to state law.[15] Many states do not specifically regulate CO_2 pipelines due to the historically privatized expansion and development of the CO_2 market.[16] States that do regulate CO_2 pipelines commonly create siting authorities, establish permitting and industrial siting requirements, standardize mechanisms for local government participation, and dictate methods through which CO_2 pipelines may acquire property along a proposed pipeline route.[17]

Typically, states facilitate the acquisition of property through rights-of-way (ROWs) for pipelines that traverse private property by invoking the state's authority of eminent domain power of the state, or by complying with common carrier requirements.[18] Eminent domain, when applicable, is used for projects with a "public purpose," while common carrier standards are characterized by projects that provide nondiscriminatory access to pipelines.[19] Sometimes, state statutes simply dictate that a "public purpose" sufficient for the exercise of eminent domain exists when the pipeline is a common carrier.[20] For pipelines that cross federal land,

7. *See* Ian J. Duncan, *CO_2-EOR 101: An Overview of CO_2 Enhanced Oil Recovery*, *in* Enhanced Oil Recovery: Legal Framework for Sustainable Management of Mature Oil Fields 7-3 (Rocky Mountain Mineral Law Foundation 2015); Phil DiPietro et al., *A Note on Sources of CO_2 Supply for Enhanced-Oil-Recovery Operations*, Soc'y Petroleum Engineers Econ. & Mgmt., Apr. 2012, at 69, 69-74.
8. U.S. Department of Transportation (DOT), Pipeline and Hazardous Materials Safety Administration (PHMSA), *Annual Report Mileage for Hazardous Liquid or Carbon Dioxide Systems*, https://www.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-hazardous-liquid-or-carbon-dioxide-systems (last updated Nov. 5, 2019).
9. Kiera Zitelman et al., National Association of Regulatory Utility Commissioners, Carbon Capture, Utilization, and Sequestration: Technology and Policy Status and Opportunities 78 (2018).
10. Kevin Bliss et al., Interstate Oil and Gas Compact Commission, A Policy, Legal, and Regulatory Evaluation of the Feasibility of a National Pipeline Infrastructure for the Transport and Storage of Carbon Dioxide 60 (2010), http://www.sseb.org/downloads/pipeline.pdf.
11. *Id.*
12. *Id.*
13. International Energy Agency, Tracking Clean Energy Progress 2013: IEA Input to the Clean Energy Ministerial (2013).
14. Tara Righetti, *Siting Carbon Dioxide Pipelines*, 3 Oil & Gas Nat. Resources & Energy J. 907, 925 (2017); 49 U.S.C. §60101.
15. Adam Vann & Paul W. Parfomak, Cong. Research Serv., RL343070, Regulation of Carbon Dioxide Sequestration Pipelines: Jurisdictional Issues 2 (2008).
16. *See infra* Section III.B.3.
17. *See infra* Section III.B.4.
18. *Id.*
19. *See id.* and Table 1. State Pipeline Policy Landscape. For a discussion of the "public purpose" or "public use" requirement in eminent domain proceedings, see *Kelo v. City of New London,* 545 U.S. 469, 35 ELR 20134 (2005).
20. A pipeline must operate as a common carrier to exercise eminent domain. *See* Tex. Nat. Res. Code Ann. §§111.002(6), 111.014 (West 2011). However, the operation of a pipeline in Texas is itself indicative of a public purpose, satisfying the common carrier requirement if there is a reasonable probability of use by the public, even if there are no third-party shippers at the time of construction. *See* Texas Rice Land Partners, Ltd. v. Denbury Green Pipeline-Tex., 363 S.W.3d 192 (Tex. 2012).

whether pipeline developers need to coordinate with federal land resource management agencies depends largely upon the types of lands traversed by the pipeline and what resources, if any, the pipeline may affect.[21]

This Article provides an overview of CO_2 pipeline regulation in the United States. After a brief introduction, Part I provides a description of the sources and end-uses for CO_2 in the United States. Part II examines the general challenges likely to encumber the expansion of a national pipeline system. Part III examines the current regulatory framework for CO_2 pipelines and explains the patchwork system of state and federal law currently applicable to CO_2 pipelines. Part IV examines the Riley Ridge Natrona Pipeline as a case study to demonstrate how coordination between state siting laws and federal resource management laws plays out in practice. Part V evaluates the policies and regulatory frameworks that may be most conducive to expanding a national CO_2 pipeline. This last part also contains recommendations, best practices, and incentives for states with limited oil, gas, or coal resources, as well as suggested regulatory frameworks and financing for pipeline expansion projects. Part VI concludes.

Given the projected growth of the market for CO_2 in the decades to come, there is great utility in exploring favorable regulatory frameworks to facilitate the national expansion of a CO_2 pipeline. Characteristics of an advantageous regulatory framework for a national CO_2 pipeline include the following state and federal actions: fostering federal-state cooperation, establishing state pipeline authorities to work within the U.S. Department of Energy's (DOE's) regional carbon sequestration partnerships (RCSPs), developing open and efficient agency coordination, and creating common carrier requirements for CO_2 pipelines and/or clear authority to use eminent domain.[22]

I. Where Does CO_2 Come From and Where Is It Going?

A. CO_2 Sources in the United States

More than 5,000 miles of CO_2 pipelines span portions of the southern and western United States.[23] The first CO_2 pipelines in the United States were developed in the 1970s to deliver CO_2 to depleted oil fields for improved recovery.[24] Today, about 64 million metric tons of CO_2 are permanently injected underground for EOR in relation to these operations each year.[25]

Sources of CO_2 may be either natural or anthropogenic. Naturally occurring CO_2 is that which has naturally accumulated in underground reservoirs (domes), such as the Jackson Dome in Mississippi or the McElmo Dome in Colorado.[26] Anthropogenic CO_2 is human-produced from sources such as processing plants or electric generation facilities that emit the gas as a byproduct of combustion, which can be chemically separated from the plant's flue gas and compressed for subsequent transport and geologic storage.[27] Neither anthropogenic point sources of CO_2—such as power plants—nor naturally occurring underground reserves of CO_2 tend to be co-located with oil fields that have demand for enhanced recovery.[28] In the roughly 40 years since CO_2 pipelines began to emerge across the United States, the network has remained localized and expanded generally only as necessary to connect natural sources of CO_2 to oil fields for CO_2-EOR.[29]

B. Demand for CO_2 in the United States

The CO_2 market is dominated by the EOR industries.[30] EOR is the overwhelming end-use of all transported CO_2,[31] which at its destination is injected underground to mobilize stranded deposits of oil and gas in the development of oilfields. Once injected, a significant portion of the injected CO_2 remains trapped underground in a "closed loop."[32]

Anthropogenic CO_2 can also be injected underground for permanent storage as a GHG reduction technology.[33] Demand for geologic storage of CO_2 is anticipated to increase as a result of state and federal support in tax and regulatory programs.[34] Accordingly, anthropogenic sources

21. *See infra* Section III.C.
22. *See infra* Sections V.A.-E.
23. DOT, *supra* note 8; Righetti, *supra* note 14, at 909.
24. Righetti, *supra* note 14, at 918; National Energy Technology Laboratory, DOE, A Review of the CO_2 Pipeline Infrastructure in the U.S. 2 (2015) (DOE/NETL-2014/1681), *available at* https://www.energy.gov/sites/prod/files/2015/04/f22/QER%20Analysis%20-%20A%20Review%20of%20the%20CO2%20Pipeline%20Infrastructure%20in%20the%20U.S_0.pdf.
25. U.S. Environmental Protection Agency (EPA) Greenhouse Gas Reporting Program, *Capture, Supply, and Underground Injection of Carbon Dioxide*, https://www.epa.gov/ghgreporting/capture-supply-and-underground-injection-carbon-dioxide (last updated Oct. 3, 2019).
26. DiPietro et al., *supra* note 7, at 69, 74.
27. International Organization for Standardization, ISO 27916:2019(E): Carbon Dioxide Capture, Transportation, and Geological Storage—Carbon Dioxide Storage Using Enhanced Oil Recovery (CO_2-EOR) 2 (2019).
28. Righetti, *supra* note 14, at 914 (citing Jerry R. Fish & Eric L. Martin, California Carbon Capture and Storage Review Panel, Technical Advisory Committee Report: Approaches to Pore Space Rights (2010), https://www.climatechange.ca.gov/carbon_capture_review_panel/meetings/2010-08-18/white_papers/Pore_Space_Rights.pdf).
29. Righetti, *supra* note 14, at 909.
30. Bliss et al., *supra* note 10, at 1.
31. J. Greg Schnacke et al., *Carbon Dioxide Infrastructure: Pipeline Transport Issues and Regulatory Concerns—Past, Present, and Future*, *in* Enhanced Oil Recovery: Legal Framework for Sustainable Management of Mature Oil Fields 10 (Rocky Mountain Mineral Law Foundation 2015).
32. *Id.* at 10-2.
33. Robert R. Nordhaus & Emily Pitlick, *Carbon Dioxide Pipeline Regulation*, 30 Energy L.J. 85, 86 (2009) (citing *Energy Department Awards $66.7 Million for Large-Scale Carbon Sequestration Project*, DOE, Dec. 18, 2007, https://www.energy.gov/articles/energy-department-awards-667-million-large-scale-carbon-sequestration-project).
34. *See, e.g.*, 26 U.S.C.A. §45Q (West 2019); Righetti, *supra* note 14, at 914.

of CO_2 must be connected to naturally occurring subsurface storage complexes suitable for CO_2 storage, such as depleted oil and gas fields, coalbeds, unmineable coal seams, and deep saline formations.[35]

The goal of an expanded CO_2 pipeline network is twofold. A network expansion should connect natural and anthropogenic sources of CO_2 to end-users, lending special attention to regions of heavy oil production that use large amounts of CO_2 for EOR.[36] Development of a network toward the regions with the most demand for CO_2 would also advance the climate change mitigation purpose of CO_2 transportation, as EOR sites have increasing potential to become sites of underground storage of anthropogenic CO_2, and their operators may become prospective, yet unwitting, allies for climate change mitigation by CCS.

An expanded network should anticipate the growth of CCS operations in response to state and federal tax incentives, and connect point sources of CO_2 emissions to suitable geologic formations.[37] This expansion may necessitate policy changes relative to pipeline siting, ROWs, and financing to create a more favorable landscape for the build-out of CO_2 transportation infrastructure. However, this Article identifies a number of policy, legal, and regulatory options for states seeking to expand their capacity for CO_2 transportation, use, and storage.[38]

II. General Challenges to Developing an Interconnected National CO_2 Pipeline Network

A. *Scale-Up Challenges*

Although states bear the responsibility for pipeline siting and policy, the challenges of a pipeline build-out are national. To develop a fuller CO_2 transportation pipeline network, it will be necessary to link "major emission areas, such as the Ohio Valley and its coal-fired power plants, with safe, reliable, large-scale CO_2 storage (or utilization) settings [that] will require large-scale CO_2 pipelines to cross state lines (often times several state lines)."[39] Regions of heavy development and emissions, like the Ohio Valley, have not serendipitously developed atop of geologic formations suitable for the use and storage of those emissions. Thus, expanding the United States' CO_2 pipeline infrastructure to a scale sufficient to capture CO_2 emissions from a variety of industrial activities that may facilitate CCS, and to connect those activities to suitable geologic destinations, will necessarily involve scale-up challenges. However, there is a growing demand for CO_2 and an available abundance of it from multiple industries, which may facilitate the proportionate growth of a pipeline network.[40]

As previously noted, the demand for CO_2 in the United States is significant and growing, although comprehensive data is not current or available to demonstrate the exact parameters of this projection.[41] In the past 10 years, CO_2 sales in the United States alone have averaged 65 million metric tons per year.[42] Demands for CO_2 transportation infrastructure are expected to necessitate a build-out of the existing CO_2 pipeline at a rate of approximately 1,000 miles of new pipeline per year until 2030.[43] By 2030, an estimated 15,000 to 66,000 miles of CO_2 pipeline will be necessary to meet demands for transportation, depending upon the amount of CO_2 that can reasonably be sequestered in or utilized for EOR and other industries at that time.[44] An estimated 18 billion metric tons of CO_2 are necessary to extract known recoverable oil and gas reserves, while the total projected storage potential for CO_2 through EOR is near 45 billion metric tons of CO_2.[45]

The available CO_2 supply will also continue to grow rapidly, reaching an estimated 57.9 million metric tons per year by the end of the decade.[46] This growth will exceed the amount of CO_2 captured and transported in 2014 more than four times over.[47] For instance, while fossil fuel electrical generation sources have been identified as a primary animus for the growth of CO_2 supply, the Carbon Capture and Sequestration Technologies Program at Massachusetts Institute of Technology found power plant sources made up less than one-quarter of carbon capture projects nationwide in 2016. In addition to under-captured gases from power generation, sugar refineries, cement plants, ammonia plants, and natural gas processing plants also produce a steady stream of CO_2. In 2017, the cement industry alone produced 40.3 million metric tons of CO_2 emissions, while the production of substances like ammonia, natural gas, lime, iron, steel, and metallurgical coke collectively emitted

35. Rickard Svensson et al., *Transportation Systems for CO_2—Application to Carbon Capture and Storage*, 45 Energy Conversion & Mgmt. 2343, 2353 (2004); Dooley et al., *supra* note 5, at 1596; Parfomak & Folger, *supra* note 1; John Gale & John Davison, *Transmission of CO_2—Safety and Economic Considerations*, 29 Energy 1319, 1319-28 (2004).
36. National Energy Technology Laboratory, *supra* note 24.
37. *Id.*
38. *See infra* Sections V.A.-E.
39. National Energy Technology Laboratory, *supra* note 24, at 34.
40. Dooley et al., *supra* note 5, at 1598.
41. Righetti, *supra* note 14, at 909; Vello Kuuskraa & Matt Wallace, *CO_2-EOR Set for Growth as New CO_2 Supplies Emerge*, Oil & Gas J., Apr. 7, 2014, https://www.ogj.com/drilling-production/production-operations/ior-eor/article/17210639/co2eor-set-for-growth-as-new-co2-supplies-emerge.
42. Marie B. Durrant, *Preparing for the Flood: CO_2 Enhanced Oil Recovery*, *in* Proceedings of the 59th Annual Rocky Mountain Mineral Law Institute 11-1, 11-3 (Rocky Mountain Mineral Law Foundation 2013).
43. Zitelman et al., *supra* note 9, at 78.
44. ICF International, Developing a Pipeline Infrastructure for CO_2 Capture and Storage: Issues and Challenges 1 (2009), https://www.ingaa.org/File.aspx?id=8228&v=4903b99e.
45. *Id.*
46. National Energy Technology Laboratory, *supra* note 24, at 16 ("the volume of CO_2 supplies from industrial facilities could reach 3,060 million cubic feet per day by the end of the decade").
47. *Id.*

an additional 94.4 million metric tons of CO_2.[48] Assuming technology and policies continue to support the capture of CO_2 from manufacturing and power generation, the network for CO_2 transportation must grow proportionately to connect supply and demand.

B. EOR and Financial Challenges to CO_2 Pipeline Expansion

The majority of existing CO2 pipelines have been funded as part of, and in connection with, EOR projects. However, the current commodity-driven market used for EOR may change as more CCUS technologies are deployed.[49] Thus, financing mechanisms and access to markets will also need to move beyond the commodity-driven market. It remains uncertain whether financing CO_2 pipelines not connected with EOR is even possible using a commodity-driven approach.[50] Further, without the involvement of private actors, the financial feasibility of pipeline financing and expansion is ambiguous.[51] Similarly, without a commodity-driven market for CO_2 sequestration, siting and operation decisions may be subject to varying procedures and the question whether the sales of CO_2 destined for a public project, such as underground storage, will cover the cost of the pipeline remains unanswered.[52]

C. Commingled Sources of CO_2

The possibility of a commingled CO_2 supply portfolio, including regulated and unregulated CO_2, also presents a regulatory hurdle for pipeline development. Naturally sourced CO_2 is CO_2 that is removed from ancient geologic formations. As a result of its natural genesis, naturally occurring CO_2 is typically unregulated or subject to fewer regulations than CO_2 that is anthropogenically derived.

To meet the continued needs for EOR, to facilitate growing demands for CO_2 in the coming decades, and to harmonize the reality of emissions with existing demands from industry, more anthropogenically sourced CO_2 is expected to enter the CO_2 supply portfolio.[53] This anthropogenically produced CO_2 is usually regulated, and is likely to enter the same pipelines as naturally sourced CO_2.[54] The result is a "commingled" supply stream of regulated and unregulated CO_2 on its way to market for EOR and other uses. In practice, a commingled stream of CO_2 may create regulatory difficulty in states that lack naturally sourced CO_2 regulations because whether the CO_2 originates from anthropogenic sources or is naturally sourced may impact whether and how the CO_2 may be used for CCUS projects.

A commingled supply of regulated and unregulated CO_2 may present difficulties to end-users. For instance, different source-streams of CO_2 may carry different kinds and levels of impurities.[55] Impurities or contaminants—such as nitrogen, methane, nitrous oxide, sulfur, water, and/or oxygen—can cause damage to pipeline infrastructure and biologic exposure concerns for humans or wildlife.[56] Commingling may also multiply the tax and regulatory obligations of a pipeline as each source-stream may be regulated differently for quality, purity, and reporting, especially where the project involves claims for tax credits.[57]

Naturally sourced CO_2 is not typically regulated for climate purposes nor is it subject to geologic storage or related requirements, whereas strict permitting requirements may apply to the development of a geologic storage facility or for EOR using anthropogenic CO_2. Take Texas, for instance, which defines "anthropogenic CO_2" in its statutory configuration and lacks a definition for naturally sourced CO_2.[58] Texas also includes exclusively "anthropogenic CO_2" in its conservation and pollution laws regarding geologic storage and associated injection of anthropogenic CO_2.[59]

This exclusively anthropogenic CO_2 framework necessarily limits claims for credits on geologic carbon storage or carbon injection projects to anthropogenically sourced CO_2, but also disincentivizes commingled streams as pipeline operators seek to avoid the requirements of reporting on an otherwise natural CO_2 supply stream for which credits are not sought. In the context of pipeline siting, regulations pertaining to exclusively anthropogenic CO_2 might entirely preclude the possibility of a commingled pipeline, resulting in parallel pipelines for different supply streams of CO_2, and, ultimately, network redundancies and inefficiencies.

D. Risks of CO_2 Transport by Pipeline

Transporting CO_2 via pipeline is not inherently risk-free, though when compared to natural gas and liquid pipelines (which do not include CO_2 pipelines[60]), CO_2 pipelines

48. U.S. EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017, at ES-6 (2019).
49. Bliss et al., *supra* note 10, at 60.
50. *Id.*
51. *Id.*
52. *Id.*
53. Philip M. Marston, *Regulation of Carbon Dioxide Pipelines: The US Experience and a View to the Future*, *in* Carbon Capture and Storage: Emerging Legal and Regulatory Issues 267, 276 (Ian Havercroft et al. eds., Bloomsbury 2d ed. 2018).
54. *See, e.g.*, Tex. Water Code §27.002(19) (West 2019) (anthropogenic CO_2 is defined as "not includ[ing] naturally occurring CO_2 that is produced, acquired, recaptured, recycled, and reinjected as part of enhanced recovery operations").
55. *See* George V. Last & Mary T. Schmick, *A Review of Major Non-Power-Related Carbon Dioxide Stream Compositions*, 74 Envtl. Earth Sci. 1189 (2015).
56. Bliss et al., *supra* note 10, at 23.
57. International Energy Agency, *supra* note 13.
58. Tex. Water Code §27.002(19) (West 2019).
59. *Id.* §27.0511; 12A Tex. Jur. 3d *Conservation and Pollution Laws* §320 (2019).
60. *See* Notice of Proposed Rulemaking, Transportation of Carbon Dioxide by Pipeline, 54 Fed. Reg. 41912 (Oct. 12, 1989). The rulemaking was initiated because regulations governing "hazardous liquids" do not apply to CO_2 pipelines. "Hazardous liquid" is defined at 49 C.F.R. §195.2, and does not

have many fewer incidents. From 1986 to 2008, there were only 12 reported accidents in the 3,500 miles of CO_2 pipeline, with no human injuries or fatalities associated with the accidents.[61] During the same time period, natural gas and liquid pipelines had 5,610 accidents, which caused 107 fatalities and 520 injuries.[62]

Generally, the risks associated with transportation of CO_2 by pipeline are those that could be solved by specification requirements for quality and inspection of pipelines and CO_2: pipeline damage, corrosion, leaks, and blowouts. Monitoring and safety tools employed may depend on the location, size, and pressure of the pipeline. However, CO_2 pipelines typically locate fracture arrestors at approximately every 1,000 feet, use block valves to isolate pipe sections that are leaking, use high durometer elastomer seals, and employ automatic control systems that monitor volumetric flow rates and pressure fluctuations.[63] Additionally, some pipelines use satellites or aircraft to monitor ROWs, periodically assess corrosion, and clean or inspect the internal pipelines.

III. The Current Regulation of CO_2 Pipelines

A. *Federal Regulation*

Safety is the only aspect of CO_2 pipeline development that is subject to comprehensive federal regulation. CO_2 pipeline safety is regulated pursuant to the Hazardous Liquid Pipeline Safety Act of 1979 (HLPSA).[64] Although DOT regulations categorize CO_2 as a nonflammable gas hazardous material, CO_2 pipelines are subject to the same safety regulations as hazardous liquid pipelines rather than those applied to natural and other gas pipelines.[65] PHMSA—part of DOT—regulates the safety of interstate CO_2 pipelines.[66] 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.[67]

B. *State Regulation*

1. Intrastate Safety Regulation

Federal authority over pipeline regulation largely preempts states from adopting and imposing additional safety standards for interstate pipelines.[68] States can, however, accept responsibility for the safety regulation of *intrastate* CO_2 pipelines, and can "participate in oversight of interstate pipelines" as "agents of the OPS" pursuant to delegation of HLPSA authority.[69] HLPSA permits state regulatory authority and responsibility for enforcement of HLPSA requirements either through certification pursuant to §60105(a) or by entering into agreements with the OPS.[70]

Certification permits state agencies to take responsibility for functions including inspection, accident investigation, and regulatory enforcement of intrastate hazardous liquid pipelines. To obtain certification, a state must adopt the minimum federal regulations and provide for injunctive and monetary sanctions similar to those authorized by federal pipeline safety laws.[71] Every state with significant CO_2 pipeline infrastructure has obtained OPS certification to regulate at least some aspects of safety of intrastate CO_2 pipelines.[72]

2. Siting CO_2 Pipelines

CO_2 facilities are exempt from Federal Energy Regulatory Commission (FERC) jurisdiction under the Natural Gas Act (NGA), and from regulation under the Interstate Commerce Act (ICA).[73] Accordingly, the majority of CO_2 pipeline routing is dependent on state law. State laws may include creation of siting authorities, permitting and industrial siting requirements, mechanisms for local government

include CO_2. At 49 C.F.R §195.0, the distinction between CO_2 and "hazardous liquids" is clarified by the language used to describe the applicability of the regulation to "pipeline facilities used in the transportation of hazardous liquids *or carbon dioxide*."

61. Parfomak & Folger, *supra* note 1.
62. *Id.*
63. Gale & Davison, *supra* note 35.
64. 49 U.S.C. §60101.
65. 49 C.F.R. §§195.00-.591 (2019).
66. *Id.* §§190, 195-199 (2008).
67. *Id.*
68. 49 U.S.C. §60104(c); Olympic Pipe Line Co. v. City of Seattle, 437 F.3d 872, 36 ELR 20033 (9th Cir. 2006).
69. Pipeline Safety Reauthorization Act of 1988, Pub. L. No. 100-561, 102 Stat. 2805.
70. Colorado Department of Regulatory Agencies, *Natural Gas Pipeline Safety*, https://www.colorado.gov/pacific/dora/aboutgaspipelines (last visited Nov. 20, 2019); Louisiana Department of Natural Resources, *Office of Conservation*, http://www.dnr.louisiana.gov/index.cfm/iframe/337 (last visited Nov. 20, 2019); Mississippi Public Service Commission, *Pipeline Safety*, https://www.psc.ms.gov/pipeline/safety (last visited Nov. 20, 2019); Oklahoma Corporation Commission, Transportation Division, *Pipeline Safety*, http://www.occeweb.com/tr/PLSHome.htm (last visited Nov. 20, 2019); Railroad Commission of Texas, *Pipeline Safety*, http://www.rrc.state.tx.us/pipeline-safety/ (last visited Nov. 19, 2019); Wyoming Public Service Commission, *Pipeline Industry*, https://psc.wyo.gov/pipeline (last visited Nov. 20, 2019).
71. 49 U.S.C. §60105.
72. PHMSA, CY2019: States Participating in the Federal/State Cooperative Gas and Hazardous Liquid Pipeline Safety Programs (2018), https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/about-phmsa/working-phmsa/state-programs/70561/2019-appendix-f-state-pipeline-program-certification-agreement-status_1.pdf.
73. Maritimes & Northeast Pipeline, L.L.C., 115 FERC 61176 (2006); Cortez Pipeline Co.—Petition for Declaratory Order—Commission Jurisdiction Over Transportation of Carbon Dioxide by Pipeline, 46 Fed. Reg. 18805 (Mar. 26, 1981); Vann & Parfomak, *supra* note 15, at 2.

participation, and dictating whether CO_2 pipelines may utilize eminent domain authority to acquire property along the pipeline route.

3. Variation of State CO_2 Pipeline Policies

Most states do not have legislation specifically addressing the siting of CO_2 pipelines. This owes to the private nature of CO_2 transportation. Unlike oil, electricity, or natural gas, there has not been a broad public market for CO_2—it is neither a generation nor a transportation resource and is not sold or distributed to the public.[74] Thus, development has progressed along narrow corridors in a handful of states with either CO_2 sources or EOR. States with existing CO_2 pipelines for use in EOR have the most comprehensive regulatory framework. If development were to expand beyond these areas, for CCUS or other purposes, states siting new infrastructure would assess public use for CO_2 pipelines under existing state frameworks for eminent domain and industrial siting, while coordinating compliance with federal safety requirements.

In states without significant natural CO_2 sources or EOR, the regulation of CO_2 pipelines falls within the scope of broader statutes or rules that govern all or many additional types of pipelines, including oil pipelines or intrastate pipelines for natural gas.[75] As a result, builders of interstate pipelines may encounter widely varying procedural obstacles or locational limitations depending on the laws of each state through which the pipeline passes, affecting the regulatory burdens upon the pipeline and the obligations of its operators. Because a pipeline may be subject to a new layer of siting and operational regulations in each state through which it passes, state requirements may ultimately be more burdensome than federal siting requirements.

4. Eminent Domain and Common Carrier Requirements

Private versus public ownership of a pipeline route also affects the development and operation of a pipeline. When a proposed CO_2 pipeline is expected to pass through private land, a developer must get permission for access and use of the private land. Where a pipeline company is unable to acquire a ROW for a pipeline through agreement with private landowners, the availability of eminent domain is critical for the siting of the pipeline. The Fifth Amendment to the U.S. Constitution prohibits the taking of private property for the purpose of transferring it to another private party.[76] States may, however, choose to authorize eminent domain if the planned use is necessary for a public purpose.[77]

The public purpose requirement does not require that the condemned property be open to public use, but it has been held to encompass state interests in economic development.[78] In *Kelo v. City of New London*, the U.S. Supreme Court determined that economic development constituted a "traditional and long accepted function of government."[79] Post-*Kelo*, waves of state legislation have imposed limitations on the exercise of state eminent domain authority for private economic development purposes.[80]

States can also pass legislation to expressly prohibit or permit the exercise of eminent domain for other purposes according to state policy interests. For instance, Wyoming has statutorily prohibited the condemnation of private pore space for the purpose of CO_2 sequestration, where Louisiana has expressly permitted eminent domain for that purpose.[81] As shown in Table 1, condemnation authority for CO_2 pipelines varies between the states, with some states broadly authorizing eminent domain and others limiting it to pipelines associated with an EOR project.[82]

In some states, utilization of eminent domain authority to acquire property along the pipeline route results in imposition of common carrier requirements to satisfy the public purpose requirement.[83] Common carriers are carriers that provide nondiscriminatory access to the carrier's services at uniform rates—classic examples of common carriers in other settings include telecommunications companies, railroads, airlines, and public utilities. Pipelines operating as common carriers must open their pipelines to any operator for the transport of its CO_2, on the condition that CO_2 transported through the pipeline meets standards for quality.[84] Currently, CO_2 pipelines exercising eminent domain in a number of states, including Montana, North Dakota, and Texas, and those obtaining a ROW pursuant to the Mineral Leasing Act (MLA), are required to operate as common carriers. However, in some of these states, the pipelines are operated as common carriers in name only and do not carry CO_2 for unaffiliated shippers.[85]

74. Cortez Pipeline Co., 7 FERC 61024 (1979).
75. *See infra* Table 1.
76. U.S. Const. amend. V.
77. *See* Kelo v. City of New London, 545 U.S. 469, 35 ELR 20134 (2005).
78. *Id.*
79. *Id.* at 484.
80. Righetti, *supra* note 14, at 948 (citing County of Wayne v. Hathcock, 684 N.W.2d 765 (Mich. 2004); Steven J. Eagle & Lauren A. Perotti, *Coping With* Kelo: *A Potpourri of Legislation and Judicial Responses*, 42 Real Prop. Prob. & Tr. J. 799 (2008)).
81. La. Rev. Stat. Ann. §30:1108(10) (West 2019); Wyo. Stat. Ann. §35-11-316 (West 2019).
82. *See infra* Table 1.
83. *Id.*
84. Righetti, *supra* note 14, at 951.
85. In Texas, common carriers operate as such in name only, evading the classic requirements of common carrier status. Common carriers generally must charge equal rates for service and publish their tariffs to be publicly accessible. While Texas imposes this obligation on its oil pipelines, it does not require CO_2 pipelines to publish their tariffs. 16 Tex. Admin. Code §3.71 (2019). CO_2 pipelines in Texas must meet only the following requirements:

> owns, operates, or manages, wholly or partially, pipelines for the transportation of carbon dioxide or hydrogen in whatever form to

In theory, common carrier requirements would result in a more efficient pipeline network, as nondiscriminatory access precludes the need for duplicative pipeline routes or facilities. However, differences in state common carrier policies and implementation complicate the development of an integrated pipeline.[86] For example, a pipeline crossing through Montana and Wyoming would, in Wyoming, be presumed to operate in the public interest if for development of oil and gas, and thus be permitted to exercise eminent domain for acquisition of the pipeline corridor in Wyoming.[87] To exercise eminent domain to secure the ROW in Montana, however, the pipeline would be required to operate as a common carrier.[88]

As a practical matter, one state's imposition of common carrier requirements may affect the operation of a pipeline in all states through which it runs. In the example of a pipeline running between Wyoming and Montana, it is unclear whether the entire pipeline would be required to act as a common carrier, or whether common carrier requirements would apply only in Montana. For instance, a shipper may gain "walk-up" entry to the pipeline in Montana for intrastate transportation, but the pipeline operator would not be required to carry the CO_2 into Wyoming.

A number of existing CO_2 pipelines must formally operate as common carriers, creating a network that is more widely accessible to CO_2 shippers.[89] However, due to the point-to-point nature of the majority of CO_2 pipelines developed thus far, many of the implementation questions regarding the regulation of an integrated and interstate CO_2 pipeline network remain unresolved.[90] There are a variety of regulatory frameworks available as models for a national CO_2 pipeline system; however, the most practical option for a national CO_2 pipeline regulatory framework is likely to incorporate qualities from existing cooperative federalism models.[91]

Table 1 below summarizes the prevalent policy elements that facilitate CO_2 pipeline siting within a selection of states.

C. Coordinating State Siting With Federal Resource Management

Although CO_2 pipeline siting is largely regulated by states, pipeline developers must also coordinate with federal resource management agencies. Determining which federal regulations apply to CO_2 pipelines depends largely upon the types of lands traversed by the pipeline and what resources, if any, the pipeline may affect. When a proposed CO_2 pipeline crosses only nonfederal private lands or lands controlled by a state agency, only federal *safety* requirements apply (as discussed above); the remaining regulations (such as regulation of siting, rates, access, specification, etc.) exist at the state level.[92] However, even these projects likely require federal permits and/or coordination with federal agencies. As a result, there is a need for federal-state coordination for CO_2 siting and regulation to ensure that all federal and state laws implicated by a proposed pipeline are addressed in an efficient and streamlined process.

Pipelines that cross federal land must obtain ROWs from the Bureau of Land Management (BLM).[93] ROW authorizations across federal lands are issued under the MLA.[94] The MLA permits BLM to issue "[r]ights-of-way through any Federal lands . . . for the transportation of oil, natural gas, synthetic liquid or gaseous fuels, or any refined product produced therefrom."[95] Further, the MLA requires that all pipelines and related facilities operating pursuant to a ROW across federal lands be "constructed, operated, and maintained as common carriers."[96] The MLA also requires that owners or operators "accept, convey, transport, or purchase without discrimination" the gas "without regard" to whether it was produced on federal or non-federal lands.[97]

Even if a proposed CO_2 pipeline traverses only private land, other federal statutes may be implicated, and therefore may influence the siting and regulation of CO_2 pipelines. The most notable of these include, but are not limited to, the National Environmental Policy Act (NEPA),[98] the Endangered Species Act (ESA),[99] the Clean Water Act

or for the public for hire, but only if such person files with the commission a written acceptance of the provisions of this chapter expressly agreeing that, in consideration of the rights acquired, it becomes a common carrier subject to the duties and obligations conferred or imposed by this chapter.

Tex. Nat. Res. Code Ann. §111.002 (West 2019).

86. *See infra* Table 1.
87. Wyo. Stat. Ann. §1-26-504(a) (2013); *id.* §1-26-814 (1981); *id.* §1-26-815 (2013); Coronado Oil Co. v. Grieves, 603 P.2d 406, 441 (Wyo. 1979) (interpreting the Wyoming Eminent Domain Act to allow takings for natural resource development on the basis that oil and gas development "facilitate[s] the development of state resources" (citing Grover Irrigation & Land Co. v. Lovella Ditch, Reservoir & Irrigation Co., 131 P. 43 (Wyo. 1913)); Righetti, *supra* note 14, at 943-44.
88. *See* Mont. Code Ann. §§69-13-101, 69-13-103, 69-13-104 (West 2019).
89. *See* Righetti, *supra* note 14, at 951.
90. For example, it is unclear how rate disputes regarding CO_2 pipelines would be resolved. It is generally believed that the Surface Transportation Board, an agency within DOT, would have jurisdiction to resolve rate describing disputes. However, it is possible that the Surface Transportation Board could disclaim jurisdiction. *See* 49 U.S.C. §15301(a); *Surface Transportation: Issues Associated With Pipeline Regulation by the Surface Transportation Board: Testimony Before the Senate Subcommittee on Surface Transportation and Merchant Marine*, 105th Cong. (1998) (statement of Phyllis F. Scheinberg, Associate Director, Transportation Issues, Resources, Community, and Economic Development).
91. See Section V.D. discussing regulatory frameworks, of which possibilities range from one modeled after frameworks with the most federal involvement, such as the natural gas pipeline framework, to the least, such as the current state-dominated siting method with minimal federal oversight.
92. Bliss et al., *supra* note 10, at 48.
93. BLM, Obtaining a Right of Way on Public Lands (2018).
94. 30 U.S.C. §185.
95. 30 U.S.C. §§185(a), (r)(1), (r)(2)(A).
96. *Id.*
97. *Id.*
98. 42 U.S.C. §§4321-4370h, ELR Stat. NEPA §§2-209.
99. 16 U.S.C. §§1531-1544, ELR Stat. ESA §§2-18.

Table 1: State Pipeline Policy Landscape

State	CO_2-Specific Pipeline Siting Rules	Pipeline Siting Authority	Common Carrier Requirement	Permitting and Certificate Requirements	Eminent Domain Authority	Local Government Participation
Colorado	No	Colorado Public Utilities Commission	Undetermined*	Operators must file map of proposed route with county clerk. Colorado corporations created for purpose of pipeline construction must state proposed pipeline route in articles of incorporation. This provision does not bind non-Colorado corporations.**	Possibly—courts have precluded oil pipelines from using eminent domain on the basis that they are neither "pipeline companies" within the meaning of Colorado Revised Statutes §38-5-105, nor do they transport "water, air, or gas" as required by §38-4-102. However, the judiciary may determine that CO_2 does fall within the meaning of these provisions.	Yes***
Illinois	Yes****	Illinois Commerce Commission	No	Applicant must demonstrate evidence of qualifications to construct and operate a pipeline and propose specific route, among other requirements.[+]	Yes—Illinois expressly grants this authority for CO_2 pipelines for EOR or CCUS.[++]	Yes—Pipeline operator must publish notice to the affected local governments of the proposed pipeline route.[+++]
Kentucky	Yes[++++]	Kentucky State Board on Electric Generation and Siting	No	Yes—Applicant must propose specific route, among other requirements.^	Yes—Kentucky expressly declares CO_2 pipelines to be within the public interest for purposes of eminent domain exercise.^^	Yes—Board must convene local public information meeting.^^^
Louisiana	Yes^^^^	Conservation Commission	No	Yes— Applicant for CO_2 pipeline ROW must obtain certificate of public convenience and necessity and commissioner approval.°	Yes— Louisiana explicitly provides eminent domain authority for CO_2 pipelines used for EOR. Louisiana also provides expropriation rights for operations related to storage of CO_2 underground.°°	No
Mississippi	No	Mississippi State Oil and Gas Board;°°° Mississippi Public Service Commission	No	Yes—Applicant for CO_2 pipeline must submit for approval a plan of pipeline installation.°°°°	Yes—Eminent domain authority is limited to CO_2 pipelines in connection with enhanced recovery of hydrocarbons (e.g., EOR).[x]	No
Montana	No	Montana Department of Environmental Quality	Yes[xx]	Yes—Pipeline construction is subject to the Montana Major Facility Siting Act, which requires the operator to file an application with the Department of Environmental Quality that explains the necessity and location of a pipeline.[xxx]	Yes—Common carrier pipelines may exercise eminent domain.[xxxx]	Requirement for public review and comment of pipeline certification decision.ˇ
New Mexico	Yes	New Mexico Public Safety Commission, Pipeline Service Bureauˇˇ	No	Yes—Pipeline operator must file yearly license and fee.ˇˇˇ	Yes—New Mexico grants eminent domain authority to pipeline developers pursuant to its oil and gas chapter, indicating a relationship to EOR purposes.ˇˇˇˇ	No
North Dakota	No	North Dakota Public Service Commission	Yes[▪]	Operators must file with Commission an application including map and facility analysis.[▪▪]	Yes—North Dakota grants eminent authority to pipeline developers, which all operate as common carriers.[▪▪▪]	No

Oklahoma	No	Oklahoma State Corporation Commission	Undetermined[▪▪▪▪]	Corporation Commission requires notice of plan and map of proposed route prior to construction.[□]	Possibly—Oklahoma grants eminent domain authority to oil pipelines for transport of "petroleum, liquid or liquefiable hydrocarbons and chemicals" and to natural gas pipelines.[□□]	No
Texas	Yes[□□□]	Texas Railroad Commission	Yes[□□□□]	No permit is required for pipeline construction, but Railroad Commission must designate operator as common carrier.[♥]	Yes—Pipeline available for common carriage, satisfying public purpose.[♥♥]	No
Wyoming	No	Wyoming Public Service Commission; Wyoming Department of Environmental Quality Industrial Siting Council	No	Developers must submit application to Industrial Siting Council describing the project, required funding.[♥♥♥]	Possibly—Oil and gas pipelines further public benefit of natural resource development, but application to CO_2 unclear.[♥♥♥♥]	No

* Colorado grants condemnation authority 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." *See* Colo. Rev. Stat. Ann. §38-4-102 (West 2019). As a gas, CO_2 may fall under the scope of this provision; however, its status is unclear given that CO_2 is transported in a pseudo-liquid state. In *Larson v. Sinclair Transportation Co.*, 284 P.3d 42, 43 (Colo. 2012), the Colorado Supreme Court expressly declared that Colorado eminent domain law "does not grant condemnation authority, either expressly or by clear implication, to companies for the construction of a petroleum pipeline." *Id.*

** *See* Colo. Rev. Stat. Ann. §7-43-102 (West 2019); *id.* §38-4-102; Sinclair Transp. Co. v. Sandberg, 228 P.3d 198, 202 (Colo. App. 2009).

*** *See* Colo. Rev. Stat. Ann. §§24-65.5-103.3, -105 (2017).

**** *See* 220 Ill. Comp. Stat. Ann. 75/1-99 (West 2019).

+ *See id.* 75/20.

++ *See id.* 75/5.

+++ *See* id. 75/20(c).

++++ *See* Ky. Rev. Stat. §154.27-100 (West 2019).

^ *See id.* §278.714 (2014).

^^ *See id.* §154.27-100 (West 2019).

^^^ *See id.* §278.714 (2014).

^^^^ *See* La. Rev. Stat. §§30:1101 to :1104 (West 2019).

° *See id.* §30:4.

°° *See id.* §19:2(10).

°°° *See* Miss. Code Ann. §53-1-3(d) (West 1995) (defining "gas" to include CO_2 and therefore putting CO_2 within the permitting authority of the state Oil and Gas Board). But *see id.* §77-11-311 (West 2019).

°°°° See 26 3 Miss. Code R. §1.10 (West 2019).

x *See* Miss. Code Ann. §11-27-47 (West 2019).

xx Montana does not require all pipelines to operate as common carriers, but only common carriers may exercise eminent domain authority. *See* Mont. Code Ann. §§69-13-101, 69-13-103, 69-13-104 (West 2019).

xxx *See id.* §75-20-211.

xxxx *See id.* §§69-13-101, 69-13-103, 69-13-104.

ˇ *See id.* §75-20-211.

ˇˇ *But see* N.M. Stat. Ann. §70-2-34(A) (West 2003) ("The oil conservation division shall adopt and 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.").

ˇˇˇ *See id.* §70-3-2 (West 2019); N.M. Admin. Code tit. 18, §18.60.3 (West 2019).

ˇˇˇˇ *See* N.M. Stat. Ann. §70-3-5(a) (2009).

▪ All CO_2 pipelines must operate as common carriers in North Dakota. *See* N.D. Const. art. I, §16; N.D. Cent. Code §49-19-01 (West 2019).

▪▪ *See* N.D. Cent. Code Ann. §49-19-09 (West 2019); N.D. Admin. Code §69-06-05-01 (West 2019).

▪▪▪ *See* N.D. Cent. Code §49-19-01(1), 12 (2007).

▪▪▪▪ *See* Okla. Stat. Ann. tit. 52, §§24, 56 (West 2019). Oil and natural gas pipelines must operate as common carriers, but it is unclear whether CO_2 pipelines are within the scope of those requirements.

□ *See* Okla. Admin. Code §§165:20-5-32, 165:20-1-4 (West 2019).

□□ *See* Okla. Stat. Ann. tit. 52, §§51-67, 21-35 (West 2019). However, the Oklahoma Legislature has expressly disallowed the use of eminent domain for CCUS. Okla. Stat. tit. 3, §5-106(d) (West 2019).

□□□ *See* Tex. Nat. Res. Code Ann. §§117.001-.102 (West 2019).

□□□□ A pipeline must operate as a common carrier to exercise eminent domain. *See* Tex. Nat. Res. Code Ann. §§111.002(6), 111.014 (West 2011). However, the operation of a pipeline in Texas is itself indicative of a public purpose, satisfying the common carrier requirement if there is a reasonable probability of use by the public, even if there are no third-party shippers at the time of construction. *See* Texas Rice Land Partners, Ltd. v. Denbury Green Pipeline-Tex., 363 S.W.3d 192 (Tex. 2012).

♥ *See* Tex. Nat. Res. Code Ann. §§111.002(6), 111.020(d) (West 2011).

♥♥ *See id.* §§111.002(6) (2007), 111.019(a) (1993).

♥♥♥ 020.0004.1 Wyo. Code R. §8 (West 2019).

♥♥♥♥ Eminent domain has been used at least once in Wyoming for purposes of obtaining a ROW for a CO_2 pipeline. *See* Barlow Ranch Ltd. P'ship v. Greencore Pipeline Co., 301 P.3d 75 (Wyo. 2013).The issue in that case, however, was calculation of compensation under the Wyoming Eminent Domain Act, rather than determination of a public purpose. *Id.* The Wyoming Legislature has expressly disallowed the use of eminent domain for CCUS injection sites. Wyo. Stat. Ann. §35-11-316 (West 2019).

(CWA),[100] and the National Historic Preservation Act (NHPA).[101] For example, if a pipeline traverses only private land, yet crosses a navigable water or wetland, the pipeline operator is required to obtain a §404 permit pursuant to the CWA.[102]

IV. Case Study: The Riley Ridge Natrona Pipeline

The Riley Ridge to Natrona Project (RRNP) segment of Denbury's CO_2 pipeline in Wyoming provides a helpful case study to illuminate the permitting process for a CO_2 pipeline that crosses both federal and state lands. In 2012, Denbury completed the Greencore Pipeline.[103] This segment of pipeline commenced Denbury's CO_2 pipeline project that will eventually connect various sources of anthropogenic CO_2 in the Rocky Mountains to the Cedar Creek Anticline in eastern Montana and western North Dakota, an area where Denbury has oil fields and plans to use CO_2 for EOR.[104] The Greencore Pipeline runs 232 miles, from the ConocoPhillips-operated Lost Cabin gas plant in Wyoming up to the Bell Creek Field in southeastern Montana.[105] In 2014, the Greencore Pipeline was connected with a third-party CO_2 pipeline in Wyoming, enabling transportation of CO_2 from Denbury's LaBarge Field to its Bell Creek Field.[106]

Denbury's most recent project is the permitting and construction of its own CO_2 pipeline to connect the proposed Riley Ridge Sweetening Plant to its Greencore Pipeline, the RRNP. The new pipeline will travel east from the sweetening plant through Sublette County and northern Sweetwater County; continue southeast through Brush Rim and into the Red Desert; turn northeast toward the Bairoil Interconnect (about 50 miles northwest of Rawlins); continue northeast through Fremont County along BLM's designated pipeline corridor; move east into Natrona County; and finally turn north to connect to the Greencore CO_2 Pipeline (30 miles west of Casper).[107]

As indicated in BLM's 2019 record of decision, the permitting for RRNP includes nearly 31 miles of nongaseous hydrogen sulfide (H_2S)/CO_2 pipeline and 213 miles of CO_2 pipeline, ancillary facilities (including roads, valves, flowlines, etc.), and a sweetening plant that cross private, state, and BLM-administered lands in the Pinedale, Rock Springs, Lander, Rawlins, and Casper BLM field offices.[108] BLM granted a ROW for the pipelines and ancillary facilities pursuant to the MLA, which authorizes BLM to issue ROWs for pipelines through federal lands for the transport of oil, natural gas, synthetic liquid, or gaseous fuels.[109] BLM is processing the ROW application for the transmission line under the Federal Land Policy and Management Act (FLPMA), which provides BLM with discretionary authority to grant ROWs on land it administers after consideration of the impacts of natural, historical, and cultural resources.[110] Notably, BLM's authorization pertains only to the project-area lands administered by BLM.[111]

The record of decision specifies that BLM mandates the same "requirements of the other major authorizing agencies for this Project concerning any necessary federal and state permits, licenses, and/or approval and consultation requirements on federal lands."[112] This text explains that despite acquiring a ROW, pipeline projects must also comply with any and all federal and state regulations before construction may proceed. Specifically, Denbury must obtain permits from the following federal agencies: BLM must ensure NEPA compliance, authorize notice to proceed subject to applicable state and federal cultural resources laws, and grant ROWs and temporary use permits; the U.S. Army Corps of Engineers must grant permits for dredged or fill material (§404 permit); the U.S. Fish and Wildlife Service must approve informal or formal consultation for endangered or threatened species under the ESA; and the U.S. Environmental Protection Agency (EPA) must approve spill prevention, control, and countermeasure plans.[113]

A parallel process exists within states. After acquiring a ROW, pipeline operators must also comply with state requirements before construction. Denbury must obtain permits and authorization from the following state agencies or authorizing authorities:

- The Wyoming Department of Environmental Quality must issue Wyoming air quality permits; a general permit to discharge stormwater associated with large construction activity; an industrial siting permit; a general permit to discharge stormwater associated with industrial activity; a temporary turbidity waiver; a general permit for temporary discharges; and a CWA §401 certification.

100. 33 U.S.C. §§1251-1387, ELR Stat. FWPCA §§101-607.
101. 16 U.S.C. §§470 et seq.
102. 33 U.S.C. §§1251-1387, ELR Stat. FWPCA §§101-607.
103. Denbury, *Greencore Pipeline Project*, https://www.denbury.com/default.aspx?SectionId=0fd5e3fd-08bc-480b-ac91-ece9dd20240b&LanguageId=1 (last visited Nov. 19, 2019).
104. *Id*.
105. *Id*.
106. *Id*.
107. BLM, U.S. Department of the Interior (DOI), Draft Environmental Impact Statement for the Riley Ridge to Natrona Project vol. I, at 42 (2018), https://eplanning.blm.gov/epl-front-office/projects/nepa/64342/138479/170483/01_Volume_I_of_II.pdf.
108. BLM, DOI, Riley Ridge to Natrona Project Record of Decision 9 (2019), https://eplanning.blm.gov/epl-front-office/projects/nepa/64342/168024/204586/FINAL_RRNP_BLM_ROD_508.pdf.
109. *Id*.
110. 43 U.S.C. §§1701-1785, ELR Stat. FLPMA §§102-603. Notably, BLM could not grant a ROW for the transmission line (under FLPMA) that would power the proposed sweetening plant because there were deficiencies in the ROW application that prevented BLM from meeting its compliance responsibilities under the NHPA and NEPA. Therefore, the transmission line ROW will be authorized in a separate BLM decision. *Id*. at 10.
111. *Id*.
112. *Id*. at 11.
113. BLM, supra note 107, at 69-70.

- The Wyoming Department of Transportation (WDOT) must issue transportation permits for oversized, overlength, and overweight loads; an M-54 license to place a utility within a WDOT ROW under state and federal highways.
- The Wyoming Oil and Gas Conservation Commission must issue an underground injection control (UIC) permit and approval for a Class II injection/disposal well for facilities on state lands.
- The Wyoming state engineer must issue a water agreement for temporary use of water for hydrostatic testing and dust abatement during construction of the pipeline and ancillary facilities, and an application for permit to appropriate groundwater to get approval for use of groundwater in construction, operation, and maintenance activities.
- The Wyoming State Historic Preservation Office must issue a letter of concurrence with BLM as to the eligibility and effects of the entire project.
- Local permits must be obtained from Sublette, Sweetwater, Fremont, and Natrona Counties. These include road use authorizations for overweight and overlength loads on county roads; conditional use and special use permits and zoning for new structures and ancillary facilities; county road access for construction of new roads that connect to county roads; and any other permits pertaining to control of fire, weeds, hazardous material storage, and boring under local roads.[114]

BLM's federal review of the RRNP took roughly five years; BLM published its notice of intent for the RRNP on June 9, 2014, and issued its record of decision in February 2019.[115] It is estimated that construction of the RRNP will occur in three separate periods over a 27-month period, beginning in the fall of 2019 with the construction of the Riley Ridge Sweetening Plant and segment one of the project (from the Riley Ridge Treatment Plant to the Proposed Riley Ridge Sweetening Plant), followed by segments two (from the Proposed Riley Ridge Sweetening Plant to the Bairoil Interconnect) and three (from the Bairoil Interconnect to the Lost Cabin Interconnect/Natrona Hub) in the fall of 2020 and fall of 2021, respectively.[116]

The time required to develop a CO_2 pipeline project is often determined by an operator's familiarity with the federal and state pipeline regulations that may affect the pipeline's development.[117] Estimates based on surveys of large-scale integrated CO_2 capture, transport, and utilization facilities by the Global Carbon Capture and Sequestration Institute found that it takes between one and two years for a CO_2 pipeline project to navigate the necessary permits for construction to begin developing a CO_2 pipeline.[118] The terrain, location of the pipeline, and types of land use associated with the route may strongly impact this time requirement for permitting. For instance, farmland and industrial areas require the least amount of permitting, while pipelines sited in populated areas, on federal lands, or through rough terrain may require a more rigorous permitting process.[119]

While there are commonalities among the permitting requirements for CO_2 pipelines that traverse federal lands, it is important to note that each pipeline project will trigger a different assortment of federal and state permitting requirements specific to the type of lands crossed and the nature of the particular project. For instance, since the permitting application for Denbury's most recent leg of its RRNP included the pipeline, *along with* ancillary facilities and a sweetening plant, some of the permitting regulations were specific to the ancillary facilities and the sweetening plant and not the pipeline alone.[120]

V. Policies and Regulatory Frameworks Conducive to Developing an Interconnected, National CO_2 Pipeline Network

A. Recommendations of the Interstate Oil and Gas Compact Commission

An expansion and harmonization of state CO_2 pipeline policies may result in more economically and environmentally efficient usage of CO_2 across the United States. As noted, PHMSA largely preempts states from regulating for pipeline safety. However, states have a wide scope of authority to regulate intrastate pipeline siting, eminent domain and/or common carrier requirements, and to maximize the benefit of CO_2 usage within their borders.

The Interstate Oil and Gas Compact Commission (IOGCC) offers states several recommendations toward capitalizing on their full CO_2 pipeline infrastructure capacities. The most pressing task for these states is to establish an agency responsible for the siting, construction, and operation of CO_2 pipelines.[121] In particular, such an

114. *Id.*
115. DOI, BLM, *Riley Ridge to Natrona Project (RRNP)*, https://eplanning.blm.gov/epl-frontoffice/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=90618 (last updated Mar. 6, 2019).
116. BLM, *supra* note 107, at 12.
117. National Energy Technology Laboratory, *supra* note 24, at 33.
118. *Id.*
119. *Id.* at 31.
120. BLM, *supra* note 108, at 9.
121. Bliss et al., *supra* note 10, at 69.

agency must be equipped to obtain ROWs from BLM or other federal agencies, as well as exercise the power of eminent domain for the purpose of siting pipelines. States with existing pipeline infrastructure have generally delegated this authority to public service or utilities commissions, departments of environmental quality, or to specifically delegated agencies therein.[122] For instance, although the Wyoming Public Service Commission exercises jurisdiction over pipeline certification, the Wyoming Industrial Siting Commission (a subsidiary agency of the Wyoming Department of Environmental Quality) exercises authority over pipeline routing and siting.[123]

B. Best Practices and Suggestions for State Improvements to CO_2 Pipeline Development and Siting Laws

States with the most developed CO_2 transportation infrastructure—Louisiana, Mississippi, Texas, and Wyoming—facilitate effective CO_2 pipeline operation in very different ways, both structurally and in policy. Yet, the siting and other regulatory regimes in these states appear to be bolstered by (1) efficient agency coordination at all geographic scales of development; (2) the enactment of clear eminent domain provisions for CO_2 pipelines; and (3) the avoidance of policies that differentiate incentives or burdens for CO_2 pipelines based upon source-streams.[124] These qualities represent non-exhaustive best practices for states seeking to expand their CO_2 pipeline infrastructure.

1. Streamline State Agency Coordination

A "best" practice of successful state CO_2 pipeline programs is to streamline interagency coordination. States meet the task of pipeline development coordination with differing approaches. Mississippi and Wyoming disperse the various aspects of CO_2 pipeline siting and permitting among a number of agencies within the state. For instance, Wyoming has delegated to its Public Service Commission jurisdiction over pipeline safety and ratemaking and to its Department of Environmental Quality authority over pipeline siting, which the Department in turn delegates to a subsidiary Industrial Siting Commission.[125] Louisiana and Texas, conversely, centralize siting and permitting authority within a single agency.[126]

Whether diffuse or centralized, it is imperative to promote open channels of communication among all relevant intrastate agencies. As one example of agency cooperation, the Texas Railroad Commission and the Texas Commission on Environmental Quality have set in place a memorandum of understanding (MOU) to delineate their respective jurisdictions for issues relating to CO_2 storage.[127] The MOU requires the agencies to coordinate review by any appropriate means to review proposed locations, geologic settings, and reservoir data.[128] Given that CO_2 pipeline and infrastructure siting may pass through the interest and jurisdiction of numerous discrete agencies, agreements such as the MOU serve conflict-avoidance functions to create more efficient and predictable procedures for CO_2 infrastructure permitting and development.

2. Implement Regional Planning and Coordination

Early regional planning may more seamlessly facilitate the expansion of a CO_2 pipeline network across the United States. Establishing regional partnerships between states that are regionally similarly situated, as to land ownership patterns and goals, may facilitate the development of common models for CO_2 pipeline expansion that fit within the states' shared goals for permitting and oversight of CO_2 pipelines. These models can expedite and align regulations that ease the permitting burden for companies seeking to build a pipeline throughout a region.

Some states have even established state pipeline authorities to assist with pipeline development. For instance, Wyoming has the Wyoming Pipeline Authority, which serves to "plan, finance, construct, develop, acquire, maintain and operate a pipeline system or systems within or without the state . . . to facilitate the production, transportation, and distribution and delivery of natural gas and associated natural resources produced."[129] Similarly, North Dakota's Pipeline Authority is authorized to participate in a pipeline project in numerous ways, including participating in financing, by making grants, borrowing money, or issuing bonds, or owning, constructing, planning, or operating pipeline systems or transportation corridors.[130] While the Wyoming Pipeline Authority provides ample assistance for pipeline coordination and development in the state, it is not responsible for granting ROWs or siting.

Ideally, regional state pipeline authorities could convene amongst themselves to develop models for the expansion and common guidelines for permitting and regulation of CO_2 pipelines throughout their region. In the past, DOE created RCSPs, which provided technical assistance to states and served as an intermediary between pipeline operators and federal, state, and local governments in an effort to develop regional infrastructure for CCS.[131] Com-

122. *See supra* Table 1.
123. Wyoming Public Service Commission, *Pipeline Utilities*, https://psc.wyo.gov/pipeline (last visited Nov. 20, 2019).
124. *See infra* Sections V.B.1. - 5.
125. Wyoming Department of Environmental Quality, *Industrial Siting*, http://deq.wyoming.gov/isd/ (last visited Nov. 19, 2019).
126. La. Rev. Stat. §30:4 (West 2019); Tex. Nat. Res. Code Ann. §§111.002(6), 111.020(d) (West 2011).
127. 16 Tex. Admin. Code §3.30 (West 2019).
128. *Id*.
129. Wyo. Stat. Ann. §37-5-102(a) (West 2019).
130. N.D. Cent. Code §54-17.7-04 (West 2019).
131. National Energy Technology Laboratory, *supra* note 24, at 34.

monly, state energy boards, commissions, or universities led these partnerships. While many of the original seven RCSPs have either been phased out or now have different names and/or participants, creating similar partnerships to work in tandem with state CO_2 pipeline authorities may facilitate regional planning and coordination. Establishing state CO_2 pipeline authorities to work with DOE RCSPs may assist companies seeking to expand the CO_2 pipeline network in the United States.[132]

3. Pursue Opportunities for State and Federal Agency Coordination

The necessity for agency coordination is not limited to intrastate contexts. Federal agencies own or manage nearly half of the land in the western United States.[133] States do not have authority to condemn federal lands for any purpose, including pipeline ROWs that would otherwise create obstacles for large pipeline projects. Thus, western states have collaborated with federal agencies for the purpose of promoting more cohesive pipeline networks inclusive of federal lands.

The Wyoming Pipeline Corridor Initiative (WPCI) provides one example of state efforts to secure ROWs across federal lands for CO_2 pipeline projects. WPCI offers an example of best practice implementation for states seeking to develop their CO_2 pipeline infrastructure. Through WPCI, Wyoming seeks to authorize more than 1,100 miles of pipeline corridor across federally managed (primarily BLM) land in Wyoming and nearly 1,000 miles of private or state lands.[134] If authorized, private operators would construct and operate pipelines to connect anthropogenic CO_2 supply to oil fields suitable for EOR.[135] The plan is expected to add thousands of jobs in Wyoming over the next decades, while expediting CO_2-dependent operations within and outside of the state.[136] Streamlined state-federal coordination through initiatives such as WPCI may promote a more integrated pipeline network across both state and federal lands.

Moreover, states may opt to abridge some types of federal agency involvement in intrastate pipeline development by assuming safety authority for pipelines under 49 U.S.C. §§60105-60106 subject to OPS certification.[137] PHMSA may authorize up to 80% reimbursement in state expenditures on compliance.[138]

4. Create Eminent Domain Authority and Common Carrier Requirements to Foster Efficiency

The availability of eminent domain authority to obtain pipeline ROWs is critical to the development of a comprehensive pipeline network. Encouraging state laws that allow use of eminent domain to obtain ROWs from landowners may facilitate the construction of CO_2 pipelines across states. Eminent domain is available where the taking of private land is necessary for the furtherance of an important public purpose.[139] In some states, the public interest in natural resource development is a sufficient basis to satisfy the public purpose test for eminent domain by a pipeline. Other states require that the pipeline be a common carrier.[140]

Some states, and most western states, already have laws that allow a CO_2 pipeline to use eminent domain to obtain this ROW from landowners.[141] Many of these states condition eminent domain powers upon a pipeline's common carrier status. A pipeline becomes a common carrier when required to transport product for any entity meeting its product quality requirements. 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 can 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_2-EOR to incremental storage operations.

5. Develop Uniform Pipeline Quality Specifications for Multiple Source-Streams

Anthropogenic and natural CO_2 source-streams are becoming increasingly integrated through transportation and end-use application. This integration of regulated and unregulated CO_2 supply sources creates efficiencies for the transportation and utilization of CO_2. States can further foster these efficiencies by *avoiding* the implementation of policies favorable to one source-stream over another,

132. DOE, National Energy Technology Laboratory, *Regional Carbon Sequestration Partnerships (RCSP) Initiative*, https://www.netl.doe.gov/coal/carbon-storage/storage-infrastructure/regional-carbon-sequestration-partnerships-initiative (last visited Nov. 19, 2019).
133. Carol Hardy Vincent et al., Cong. Research Serv., R42346, Federal Land Ownership: Overview and Data (2017), https://fas.org/sgp/crs/misc/R42346.pdf.
134. Wyoming Pipeline Authority, Wyoming Pipeline Corridor Initiative Plan of Development 9-10 (2014), https://www.wyopipeline.com/wp-content/uploads/2014/06/WPCI_POD_may_2014.pdf.
135. *Id.*
136. *Id.*
137. DOT, PHMSA, *State Programs Overview*, https://www.phmsa.dot.gov/working-phmsa/state-programs/state-programs-overview (last updated Mar. 12, 2019).
138. DOT, PHMSA, *State Oversight*, https://www.phmsa.dot.gov/working-phmsa/state-programs/state-oversight (last updated Mar. 11, 2019).
139. *See* Kelo v. City of New London, 545 U.S. 469, 35 ELR 20134 (2005).
140. *See* N.D. Const. art. I, §16; N.D. Cent. Code §49-19-01 (West 2019); Tex. Nat. Res. Code Ann. §§111.002(6), 111.014 (West 2011).
141. Bliss et al., *supra* note 10, at 65. Wyoming has expressly denied eminent domain authority for pipelines for CCUS. Wyo. Stat. Ann. §35-11-316 (West 2019). Wyoming Pipeline Authority, *supra* note 134, at 9-10.

which work to encourage bifurcation of the network and development of redundant pipelines.

This scenario has been resolved to some extent at the federal level, which offers an income-based model for states. Under §7704 of the Internal Revenue Code (IRC), EOR pipelines are structured as master limited partnerships (MLPs) and receive a tax exemption if deriving at least 90% of their income from mineral depletion.[142] This exemption created uncertainty as to whether the transportation of anthropogenic CO_2 (with no bearing on mineral depletion) would generate qualifying income.[143] In 2008, the U.S. Congress answered this question in the affirmative, passing the Energy Improvement and Extension Act, which expressly included income derived from the transportation of anthropogenic CO_2 within the purview of "qualifying income."[144]

States can also promote a more efficient pipeline network by regulating the quality specifications, rather than the source-streams (whether natural and typically unregulated, or anthropogenic, and typically regulated) of CO_2 that enters the pipeline. CO_2 for EOR and other uses must meet certain standards to be marketable, including limitations on the types or levels of source-stream impurities (such as carbon monoxide, nitrogen dioxide, sulfur dioxide, chlorine, and H_2S).[145] The presence of these contaminants can increase environmental or health risks in relation to the use activity or corrode the pipeline.[146]

For use in EOR, the minimum acceptable purity for CO_2 is approximately 90% per volume.[147] CO_2 sources entering a pipeline would need to meet the specifications of its downstream use, but 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.

C. *Incentives for States With No Oil, Gas, or Coal Development*

States without oil, gas, or coal natural resources may also benefit greatly from a more flexible, extensive, and integrated national CO_2 pipeline network. While carbon capture technologies have gained the most attention regarding CO_2-EOR, CO_2 capture, use, transport, and storage is also applicable to other large, energy-intensive CO_2-emitting industries, including cement manufacture, oil and natural gas refining, ammonia production, ethanol production, and iron and steel manufacture.[148] Therefore, even states without oil, gas, or coal resources could benefit from facilitating and contributing to the growth of a national CO_2 pipeline.

Additionally, states without common sources of CO_2 may be regionally significant locations for geologic storage of CO_2.[149] A number of states—in addition to Louisiana, Montana, North Dakota, Texas, and Wyoming—have passed, or are in the process of developing, statutes and regulations for the geologic storage of CO_2 using the model statute and rules created by the IOGCC in 2007.[150] Other states already have state climate mitigation programs.

For instance, in early 2019, the California Air Resources Board formally approved the Carbon Capture and Sequestration Protocol for use under that state's Low Carbon Fuel Standard Program. North Dakota, Texas, and Wyoming have passed laws under which CO_2-EOR companies may certify to state regulators the volumes of CO_2 that have been stored during specific operations. At the federal level, EPA has developed regulations under the UIC Program of the Safe Drinking Water Act (SDWA)[151] for the geological storage of CO_2.[152] Additionally, Congress has appropriated significant funds for CCUS technologies, and has evidenced its support for the technologies by recently passing a significant tax credit for anthropogenic carbon capture with the Furthering Carbon Capture, Utilization, Technology, Underground Storage, and Reduced Emissions Act (FUTURE Act).

States may also benefit from a national CO_2 pipeline network because it will promote access to CO_2 for the following uses of CO_2: chemical manufacture of methanol and nitrogen urea; production of fire-retardant agents (handheld and large-scale fire extinguishing systems); production of dry ice; treatment of alkaline water; enhancement of algae production to make biofuels; enhancement of agricultural plant growth; mineralization for production of aggregate products; and as feedstock for various fuels and chemical products.[153]

142. 26 U.S.C.A. §7704 (West 2019); Philip M. Marston & Patricia A. Moore, *From EOR to CCS: The Evolving Legal and Regulatory Framework for Carbon Capture and Storage*, 29 Energy L.J. 421, 461 (2008).
143. Marston & Moore, *supra* note 142, at 461.
144. Energy Improvement and Extension Act, Pub. L. No. 110-343, 122 Stat. 3765 (2008).
145. Mohammed D. Aminu et al., *A Review of Developments in Carbon Dioxide Storage*, 208 Applied Energy 1389, 1393 (2017).
146. *Id.*
147. *Id.*
148. Global Climate Change and U.S. Law 708 (Michael B. Gerrard ed., 2007).
149. *See* DOE, National Energy Technology Laboratory, *Carbon Sequestration: Regional Carbon Sequestration Partnerships*, https://www.netl.doe.gov/coal/carbon-storage/storage-infrastructure/regional-carbon-sequestration-partnerships-initiative.
150. IOGCC Task Force on Carbon Capture and Geological Storage, Storage of Carbon Dioxide in Geologic Structures: A Legal and Regulatory Guide for States and Provinces 10 (2007), http://iogcc.ok.gov/Websites/iogcc/docs/MeetingDocs/Master-Document-September-252007-FINAL-(2).pdf.
151. 42 U.S.C. §§300f to 300j-26, ELR Stat. SDWA §§1401-1465.
152. Office of Water, U.S. EPA, Geologic Sequestration of Carbon Dioxide Underground Injection Control (UIC) Program Class VI Well Testing and Monitoring Guidance (2013) (EPA 816-R-13-001), https://www.epa.gov/sites/production/files/2015-07/documents/epa816r13001.pdf.
153. Bliss et al., *supra* note 10, at 27.

D. Suggested Federal and Federal-State Regulatory Frameworks

While the existing regulatory model for CO_2 pipelines involves the federal government only as administer of safety regulations by the OPS, "developers will likely need access to a federal siting process and federal eminent domain authority to enable construction of the national CO_2 pipeline system."[154] Providing greater certainty regarding the extent of federal and state regulations may help to ease the burden of permitting and facilitate financing the build-out of a national CO_2 pipeline network.[155]

A national CO_2 pipeline system may be modeled after a variety of regulatory frameworks. The discussion below demonstrates this continuum, ranging from frameworks with the most federal involvement, such as the natural gas pipeline framework, to the least, such as the current state-dominated siting method with minimal federal oversight. The most practical option for a national CO_2 pipeline regulatory framework will involve a combination of characteristics from these existing cooperative federalism models.

1. Parallel the Natural Gas Regulatory Framework

If Congress were to provide a national CO_2 pipeline framework that was consistent with the natural gas pipeline framework, it would need to afford the federal government broad discretion.[156] The NGA allows construction or operation of an interstate natural gas pipeline or the interstate wholesale of natural gas *only* with prior approval by FERC. Under the NGA, FERC has authority to set "just and reasonable" and "not unduly discriminatory or preferential" transportation rates for pipelines and to site natural gas pipelines, and safety issues remain the concern of OPS.[157] FERC may also issue certificates of "public convenience and necessity" to assert its eminent domain power, which allows owners of natural gas pipelines the authority to condemn property for beneficial use.[158] Natural gas pipelines are also subject to "open season," during which potential shippers may bid for new capacity pipeline services (made available during expansions and greenfield construction) and operators must use a nondiscriminatory method to allocate available capacity to ensure equal treatment.[159]

Under a natural gas model, Congress would need to grant FERC or another federal agency the authority for siting pipelines, allow for federal eminent domain authority, and set "reasonable" and "nondiscriminatory" transportation rates for CO_2 under the natural gas regulatory framework. The "open season" option available in the natural gas regulatory model offers utility to an expanding CO_2 pipeline network because there would be greater access between pipelines and shippers, which would promote transactions that provide contractually defined levels of assured transportation service as compared to the common carrier rules that apply to oil pipelines.

While a FERC permitting process modeled after the NGA would provide exclusive and preemptive federal siting and would homogenize the regulatory process, it would introduce new costs and regulatory barriers. For instance, even interstate pipelines developed across private land and with private funding would be subject to federal environmental review. These steps could add significant expense and delay to the current permitting process. Accordingly, many developers criticize the natural gas regulatory approach as unnecessary because new CO_2 pipelines do not provide retail or residential service, and thus do not pose the same concerns relative to protection of the public and energy consumers.

In response, several commentators have suggested that Congress could create an "opt-in" system whereby pipeline developers could elect for federal siting to apply where the pipeline was in the public interest.[160] This would facilitate the build-out of a larger CO_2 network for CCUS activities, while still preserving state siting approaches for developers of intrastate pipelines. These proposals have been careful to note that they would not modify or limit current state siting regulations for existing CO_2 pipelines and that developers could continue to build new pipelines under existing state siting rules.

2. Mirror the Oil Regulatory Framework

Another federally involved model is the oil regulatory framework. An oil pipeline regulatory framework would provide states with more control, as compared to the natural gas pipeline model, while providing federal oversight of issues related to capacity and access.

Historically, the regulation of oil pipeline siting was left to states.[161] Oil pipelines developed as a technology to complement rail transportation of oil; however, to combat competition, railroad companies pushed back against state laws granting pipelines the eminent domain authority the railways enjoyed.[162] In 1906, the Hepburn Act was passed in response to Standard Oil Company's monopoly on rail shipments and its dominance in the pipeline infrastructure.[163] Once passed, the Hepburn Act expanded the Interstate Commerce Commission (ICC) authority to include interstate oil pipelines as "common carriers,"

154. Nordhaus & Pitlick, *supra* note 33, at 100-02.
155. *Id.*
156. *Id.*
157. 15 U.S.C. §717.
158. *Id.*
159. Interstate Natural Gas Association of America, America's Natural Gas Pipeline Network: Delivering Clean Energy for the Future 116 (Summer 2009 ed.).
160. Nordhaus & Pitlick, *supra* note 33, at 101-02.
161. Alexandra B. Klass & Danielle Meinhardt, *Transporting Oil and Gas: U.S. Infrastructure Challenges*, 100 Iowa L. Rev. 947, 953-61, 980-82 (2015).
162. *Id.*
163. *Id.*

which mandates "just and reasonable rates," "non-discriminatory treatment of shippers," and "ICC approval of filed rate tariffs."[164]

Although the regulation of oil pipelines originally fell under the purview of the ICA and thus the ICC's authority, in 1977, Congress transferred regulatory authority of oil pipelines from the ICC to FERC.[165] FERC regulates the rates assessed for interstate movement of oil as well as terms and conditions of service offered by oil pipelines involved in interstate commerce, requiring oil pipelines to publish tariffs and submit information regarding rates and service conditions.[166] Under the oil model, there is heavy federal influence over a pipeline operator's ability to earn revenue because the federal authority has exclusive authority over rates and tariffs.[167] Of note, FERC authority does not include siting and as a result does not grant federal eminent domain or condemnation authority.

If the regulation of CO_2 pipelines mirrored the regulation of oil pipelines, Congress would need to delegate jurisdiction to FERC or another agency to set walk-up capacity requirements and federal common carrier requirements, including regulation of tariffs and rates. Because FERC has historically disclaimed jurisdiction over the siting of CO_2 pipelines under the NGA, a congressional delegation of jurisdiction may be required.[168] Under a regime for CO_2 that models the oil regulatory framework, OPS would regulate for safety aspects of pipeline operation pursuant to PHMSA.[169] The federal rate-setting advantages may foster the expansion of a fuller CO_2 pipeline network, but such potential may be limited by obstacles to obtaining ROWs by eminent domain across state or private lands.[170]

3. The Utilizing Significant Emissions With Innovative Technologies Act

Congress is also considering legislation that would expedite and coordinate the federal permitting processes for CO_2 pipelines. The Utilizing Significant Emissions With Innovative Technologies Act (USE IT Act) would amend the Fixing America's Surface Transportation Act (FAST Act) to clarify that CCUS projects and CO_2 pipelines are eligible for the FAST Act's expedited permitting and review processes.[171] The FAST Act expanded the expedited review provisions that are typically only available to highways and other public transportation systems to include some rail and multimodal projects.[172] The USE IT Act would further expand the FAST Act's expedited permitting and review processes to CO_2 pipelines, essentially placing them on a quicker track toward development.[173]

On February 13, 2019, the U.S. House of Representatives introduced companion legislation (H.R. 1166) to the U.S. Senate (S. 383) version of the USE IT Act.[174] If passed, the USE IT Act would not eliminate state regulation and siting requirements for CO_2 pipelines, but it would amend the CWA to require EPA to use its existing authority to support carbon utilization and direct CO_2 air capture research.[175] The USE IT Act would also direct the Council on Environmental Quality to establish guidance for project developers and operators of CCS facilities and CO_2 pipelines and establish task forces to hear input from stakeholders so as to improve guidance based on successes and failures.[176] Specifically, the USE IT Act would facilitate "planning, siting and permitting of infrastructure" so CO_2 may be transported from industry locations to locations where it may be used and/or geologically stored.[177] This increase in congressional support for CCS accentuates the importance of a national CO_2 pipeline network.

4. Employ Backstop Permitting and Financing Authority

Another option for federal involvement in the regulation of CO_2 pipelines would be akin to that of §1221 of the Energy Policy Act of 2005 (EPAct), which provides "backstop" authority for the federal government in the instance where states fail to act.[178] Similar to CO_2 pipelines, utility transmission lines used to be primarily state-authorized, state-regulated monopolies that owned the power plants, transmission facilities, and local distribution systems, which were then sold to in-state retail customers.[179]

164. 34 U.S.C.A. §584 (1906) (Hepburn Act).
165. *Id.*
166. Colin P. O'Rourke, *Oil Pipeline Regulation: The Current Patchwork Model and an Improved National Solution*, J. Energy L. & Resources, Feb. 2, 2016, https://jelr.law.lsu.edu/2016/02/02/oil-pipeline-regulation-the-current-patchwork-model-and-an-improved-national-solution/.
167. *Id.*
168. Nordhaus & Pitlick, *supra* note 33, at 87.
169. *Id.* at 95.
170. *Id.*
171. USE IT Act, S. 2602, 116th Cong. (2018); Press Release, U.S. Senate Committee on Environment and Public Works, Senators Reintroduce USE IT Act to Promote Carbon Capture Research and Development (Feb. 7 2019), https://www.epw.senate.gov/public/index.cfm/2019/2/senators-reintroduce-use-it-act-to-promote-carbon-capture-research-and-development.
172. DOT, Office of Policy, *The FAST Act: Accelerating Project Delivery*, https://www.transportation.gov/fastact/project-delivery-factsheet (last visited Nov. 19, 2019); *see* 23 U.S.C. §139.
173. USE IT Act, S. 2602, 116th Cong. (2018).
174. *Carbon Capture Coalition Hails Bipartisan Introduction of the USE IT Act in the U.S. House of Representatives Today*, Carbon Capture Coalition, Feb. 13, 2019, http://carboncapturecoalition.org/carbon-capture-coalition-hails-bipartisan-introduction-of-the-use-it-act-in-the-u-s-house-of-representatives-today/; Press Release, U.S. Senate Committee on Environment and Public Works, *supra* note 172. The House Resolution has been referred to the Subcommittee on Water, Oceans, and Wildlife. *See* Congress.gov, *H.R. 1166—USE IT Act*, https://www.congress.gov/bill/116th-congress/house-bill/1166 (last visited Nov. 19, 2019).
175. Press Release, U.S. Senate Committee on Environment and Public Works, *supra* note 171.
176. *Id.*; *Carbon Capture Coalition Hails Bipartisan Introduction of the USE IT Act in the U.S. House of Representatives Today*, *supra* note 174.
177. *Carbon Capture Coalition Hails Bipartisan Introduction of the USE IT Act in the U.S. House of Representatives Today*, *supra* note 174.
178. Adam Vann, Cong. Research Ser., R40657, The Federal Government's Role in Electric Transmission Facility Siting 5 (2010), https://fas.org/sgp/crs/misc/R40657.pdf.
179. *Id.*

In 1935, when utility transmission lines began to rapidly expand to include interstate transmission lines, the Federal Power Act was passed to grant the federal government jurisdiction over interstate transmission of electric power and wholesale electric power transactions.[180] In response to blackouts and interruptions in service, Congress passed the EPAct in 2005, which authorized FERC to permit construction and operation of electricity transmission facilities within the boundaries of the National Interest Electric Transmission Corridors, but *only* when the state where the facility would be siting lacks authority to issue the permit, the applicant does not qualify for the permit in the state, or the state has "withheld approval."[181]

Further, the EPAct also authorizes federal involvement in transmission projects through support for financing. For instance, DOE recently used §1222 of the EPAct (also referred to as "Third Party Finance") to approve and permit Clean Line's Plains & Eastern Clean Line Project after the Arkansas Public Service Commission denied regulatory approval. In that section, Congress expands federal involvement in transmission line development, funding, and permitting.[182] Section 1222 authorizes DOE to act through two federal power administrators, either the Western Area Power Administration or the Southwestern Power Administration, to upgrade existing transmission facilities owned by either of the two administrators, or to develop new transmission facilities within any state where either administrator operates.[183] To effectuate upgrades and development, the statute permits DOE to "accept and use funds contributed by another entity for the purpose of carrying out" a transmission project.[184] Thus, §1222 broadly enhances federal authority to finance upgrades and developments to the transmission system, and this can be done independently or in partnership with third parties.[185]

DOE's authority was recently challenged when it authorized the Clean Line's Plains & Eastern Clean Line Project.[186] A federal district court found DOE did not act beyond its statutory authority approving the project, and states do not have veto power over DOE's approval of transmission lines.[187] The court determined, even though private investments will fund the transmission line, the statute provision does not authorize DOE preemption of state regulations, but merely allows, by permitting DOE to use funding from nonfederal sources, the federal government taking on a larger role in electricity transmission.[188]

Applying similar "backstop" authority to issue permits for siting and development of CO_2 pipelines may facilitate build-out of a more expansive CO_2 pipeline network, especially in conjunction with CCUS expansion through legislation such as the USE IT Act. The CO_2 pipeline network is expected to grow as a result of the increased multistakeholder interest in CCUS technologies. Ambiguity and inconsistent state regulations (over sources of CO_2, commingling streams, purity, permitting, and siting, etc.) may stymie growth of an interstate CO_2 pipeline network and inhibit the growth of CCUS technologies.

The EPAct, if transplanted as a model for CO_2 pipeline siting, would authorize FERC to permit the construction and operation of pipelines on state lands within the boundaries of the National Interest Electric Transmission Corridors, but *only* when the state where the facility would be siting lacks authority to issue the permit, the applicant does not qualify for the permit in the state, or the state has withheld approval. This change in siting authority would broadly expand the federal government's role in siting CO_2 pipelines beyond that which it currently enjoys.

Establishing a regulatory framework for interstate CO_2 pipelines is a necessary step for expanding the use of CCUS technologies. Ultimately, a cooperative regime of federal and state policy would be most conducive to the expansion of a CO_2 pipeline network. A combination of the existing energy infrastructure regulatory models may reduce barriers to entry to facilitate an expanding and adaptive CO_2 pipeline network. A comprehensive federal siting framework similar to that used for natural gas pipelines is, at this point, unnecessary.

However, other federal frameworks may resolve issues of capacity, access, and integration and could facilitate siting, financing, and regulatory coordination. For instance, pairing federal common carrier oversight (akin to gas and oil frameworks) and federal backstop authority (akin to the electric transmission framework) with state siting and FAST Act permitting, together, may offer the best option for an efficient and comprehensive development of a CO_2

---

180. Vann, *supra* note 178, at 5. "The ACT was first enacted in 1920 as the 'Federal Water Power Act.' It was amended to include interstate electricity transmission in 1935."
181. Pub. L. No. 109-58, §1221, 119 Stat. 594 (2005). In a rulemaking by FERC on November 16, 2006, the agency determined "withholding approval" included state denial of a permit. Regulations for Filing Applications for Permits to Site Interstate Electric Transmission Facilities, 71 Fed. Reg. 69440 (Dec. 1, 2006). This decision was later challenged in the U.S. Court of Appeals for the Fourth Circuit, where the court determined the language of the statute, when read as a whole,

> means that the action has been held back continuously over a period of time (over a year). . . . The continuous act of withholding approval for more than a year cannot include the finite act of denying an application within the one-year deadline. The denial of an application is a final act that stops the running of time during which approval was withheld on a pending application.

Piedmont Envtl. Council v. Fed. Energy Regulatory Comm'n, 558 F.3d 304, 309-10, 39 ELR 20036 (4th Cir. 2009), *cert. denied*, 130 S. Ct. 1138 (2010). Vann, *supra* note 178, at 5.
182. David Perlman & Jessica Miller, *Boost for Renewables Transmission: DOE Transmission Siting Authority Upheld*, Bracewell, Jan. 17, 2018, https://www.energylegalblog.com/blog/2018/01/17/boost-renewables-transmission-doe-transmission-siting-authority-upheld.
183. *Id.*
184. 42 U.S.C. §16421.
185. Perlman & Miller, *supra* note 182.
186. Downwind LLC v. U.S. Dep't of Energy, No. 3:16-cv-207-DPM (E.D. Ark. Dec. 21, 2017).
187. *Id.*
188. *Id.*

pipeline network that will not drastically upend current state or federal policies or practices.

E. Financing Recommendations

Despite the financial obstacles to pipeline development, numerous federal or state incentives exist to make pipeline development affordable, in addition to those methods already discussed. International governmental research partnerships have found that "governments with overlapping [research and development] missions can find value in leveraging financial resources to support the various promising [carbon] technologies in the pipeline. Resources can be pooled, redundancies eliminated, and ultimately more large-scale projects may reach successful completion."[189]

In 2014, the Carbon Utilization Research Council (CURC) held a technical workshop with representatives from major power-generating companies in the United States and DOE to discuss the existing financial barriers to expanding advanced CCUS projects at pilot-plant scales.[190] After this workshop, the groups reached a consensus that large pilots are a "necessary interim development step prior to commercial demonstration"; however, they will be costly and are "unlikely to generate enough revenue to support typical project-based financing."[191] CURC's resulting multinational report conducted by DOE, Japan's New Energy and Industrial Technology Development Organization, and other collaborators recognizes options for funding large pilots of advanced fossil-based power-generation technologies with carbon capture.[192]

The multinational report found that there are strong linkages between successful CCUS research and development projects and the oil and gas industry.[193] However, CCUS access to markets must grow beyond EOR to realize their full potential.[194] The report notes that the two markets with the most prospects include carbon markets, which have relatively low carbon prices and therefore may not offer as much incentive or utility, and electricity markets.[195] Growth of CCUS beyond EOR, however, is unlikely unless there are regulatory drivers, political support, and business models to create markets for CCUS.[196] Regulatory drivers may include performance standards for power plants and stricter carbon emission targets, which will incentivize the utility of CCUS technologies and projects.[197] Further, regulatory drivers and political support can foster business models that adopt CCUS technologies to meet new emission standards.[198]

The report cautioned that overreliance on governmental subsidies for large-scale projects could minimize success and public support because large projects take years to complete, and they have long time lines and changing politics throughout the project's development, which can impede project success if funding is cut or deadlines are not met.[199] For this reason, the report also suggests shorter deadlines for CCUS projects and diversified financing components.[200] Ultimately, the collaboration between nations may offer opportunities for countries to utilize combined resources, mitigate risks and costs, and succeed in expanding large CCUS pilot projects.[201]

Traditional financing methods for CO_2 pipelines include project finance, debt financing, and structured or cash flow financing. Generally, short pipelines (where a power plant is located at or near a sequestration site) can be financed with corporate debt, whereas long pipelines are likely to require up-front project financing supported by long-term contracts.[202] Pipeline developers may also obtain financing in the public equity markets. For instance, many existing CO_2 pipelines are formed as MLPs under 26 U.S.C. §7704(e) in order to take advantage of partnership tax rules and reduce the cost of capital.[203]

Qualified private activity bonds are another financing method to attract more private investors to CO_2-based projects. These bonds could act as complementary state and federal incentives to the 45Q tax credit. Qualified private activity bonds are tax-exempt bonds issued by a state or local government, whose proceeds are used for a defined purpose by an entity separate from the government entity issuing the bonds.[204] Because interest paid to bondholders is not included in gross income used for federal tax purposes, the bonds reduce financing costs through lower borrowing rates.[205] However, financing with tax-exempt bonds like these requires strict compliance with the IRC. For instance, many projects eligible for the tax-exempt financing are subject to a federally required annual volume cap, restricting the amount of tax-exempt private activity bonds that can be sold in a state, and the Internal Revenue Service occasionally reviews existing qualified private activity bonds to ensure projects for which they were issued

189. Carbon Utilization Research Council, *Approaches for International Collaboration and Financing of CCUS Pilot Projects*, http://www.curc.net/approaches-for-international-collaboration-and-financing-of-ccus-pilot-projects (last visited Nov. 19, 2019).
190. *Id*.
191. *Id*.
192. CURC, Analysis of Options for Funding Large Pilot Scale Testing of Advanced Fossil-Based Power Generation Technologies With Carbon Capture and Storage (2016), http://www.curc.net/webfiles/NEDO/Global%20CCS%20White%20Paper.pdf.
193. *Id*. at 46.
194. *Id*.
195. *Id*. at 47.
196. *Id*.
197. *Id*. at 48.
198. *Id*.
199. *Id*. at 49.
200. Carbon Utilization Research Council, *supra* note 189.
201. *Id*.
202. ICF International, Carbon Sequestration and Storage: Developing a Transportation Infrastructure 90 (2009), *available at* http://www.ingaa.org/cms/31/7306/7626/8230.aspx.
203. 26 U.S.C. §7704; ICF International, *supra* note 202, at 87.
204. M. Granger Morgan et al., Carbon Capture and Sequestration: Removing the Legal and Regulatory Barriers 170 (2012).
205. Carnegie Mellon University, Carbon Capture and Sequestration: Framing the Issues for Regulation 121-22 (2019), http://www.ccsreg.org/pdf/CCSReg_3_9.pdf.

still meet the two statutory conditions allowing them to remain tax-free.[206]

In the 1970s and 1980s, Congress created a qualified private activity bond allowance for clean air projects and to fund improvements for coal-fired power plants; however, in 1986, Congress eliminated this authorization.[207] Presently, CO_2 sequestration and infrastructure investments are not included as "exempt facilities" qualifying for tax-exempt private activity bonds.[208] However, there are two ways qualified private activity bonds could be made accessible financing tools for CO_2 pipeline projects.[209] First, the IRC could be amended to explicitly include CO_2 sequestration infrastructure projects as "exempt facilities" so they could utilize qualified private activity bonds, but these would still be subject to annual state volume caps.[210]

Another option for qualified private activity bond applicability to CO_2 pipeline projects would resemble recent legislation.[211] In response to the hurricane season of 2005, Congress passed the Gulf Opportunity Zone Act, which expanded the amount of private activity bonds; increased the volume cap in Alabama, Louisiana, and Mississippi; and broadly defined "qualified project costs" that could be financed with the bonds, including the cost of any qualified residential rental project under 26 U.S.C. §142(d)) and the cost of acquisition, construction, reconstruction, and renovation of nonresidential real property and public utility property under 26 U.S.C. §168(i)(10).[212] Under this legislation, NRG Energy was able to finance part of its Petra Nova CCUS facility using a qualified private activity bond.[213] Because the demand for tax-exempt bonds is often much higher than the volume-cap restrictions within each state, legislation that creates a separate allocation for CO_2 sequestration and infrastructure investments may be preferable to revising the IRC.[214]

VI. Conclusion

The projected growth of CO_2 markets in the United States will necessitate state innovation and cooperation to expand the national pipeline network in an efficient way. States can improve and expand their CO_2 transportation capacity to accommodate the growing industrial and consumer markets for CO_2 through regulatory changes to promote and streamline pipeline siting. Favorable policies for this expansion include fostering federal-state cooperation; establishing state pipeline authorities to work within DOE's RCSPs; coordinating openly and efficiently among agencies; creating common carrier requirements for CO_2 pipelines; and developing clear authority to use eminent domain.

As markets and pipelines for CO_2 continue developing, new challenges will surely emerge. However, coordination among states for the development of a more cohesive CO_2 pipeline network has the potential to meet these challenges, enlisting the support of both state, federal, and private entities, with solutions bearing benefits for the climate and the economy.

206. Steven Maguire & Joseph S. Hughes, Cong. Research Serv., RL31457, Private Activity Bonds: An Introduction 6-10 (2018), https://fas.org/sgp/crs/misc/RL31457.pdf.
207. National Energy Technology Laboratory & Great Plains Institute, Siting and Regulating Carbon Capture, Utilization, and Storage Infrastructure: Workshop Report 37 (2017), *available at* https://www.energy.gov/sites/prod/files/2017/01/f34/Workshop%20Report-Siting%20and%20Regulating% 20Carbon%20Capture%2C%20Utilization%20and%20Storage%20Infrastructure.pdf.
208. 26 U.S.C. §141(e)(1)(A); *id.* §142(a)(1)-(15).
209. Carnegie Mellon University, *supra* note 205.
210. *Id.*
211. *Id.*
212. Maguire & Hughes, *supra* note 206, at 6-10.
213. National Energy Technology Laboratory & Great Plains Institute, *supra* note 207, at 37; Maguire & Hughes, *supra* note 206, at 6-10.
214. Carnegie Mellon University, *supra* note 205.