COLORADO

Oil & Gas Conservation Commission

Department of Natural Resources

Creating Colorado's Carbon Sequestration Framework

A Legislative Proposal

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List of Abbreviations

APCD
Air Pollution Control Division

AQCC
Air Quality Control Commission

CCS
Carbon Capture and Storage

CCUS
Carbon Capture, Utilization, and Storage

CDPHE
Colorado Department of Public Health and Environment

CEO
Colorado Energy Office

CGIA
Colorado Governmental Immunity Act

CO_2
Carbon Dioxide

COGCC
Colorado Oil and Gas Conservation Commission

COPUC
Colorado Public Utilities Commission

CORA
Colorado Open Records Act

DAC
Direct Air Capture

DI
Disproportionately Impacted

DWR
Division of Water Resources

E&P
Exploration and Production

EIS
Environmental Impact Statement

EITE
Energy-intensive trade exposed

EJ
Environmental Justice

EJAB
Environmental Justice Advisory Board

EJ Act
Colorado House Bill 21-1266

EJ Task Force
Environmental Justice Action Task Force

EOR
Enhanced Oil Recovery

EPA
Environmental Protection Agency

GHG
Greenhouse gas

GPI
Great Plains Institute

IIJA
Infrastructure Investment and Jobs Act

IRA
Inflation Reduction Act

IUB
Iowa Utilities Board

OGCA
Oil and Gas Conservation Act

OGCERF
Oil and Gas Conservation and Environmental Response Fund

PHMSA
Pipeline and Hazardous Materials Safety Administration (US DOT)

SLB
State Land Board

SMR
Steam methane reforming

TABOR
Colorado Taxpayer's Bill of Rights

UIC
Underground Injection Control

USDW
Underground Source of Drinking Water

WDEQ
Wyoming Department of Environmental Quality

Executive Summary

The Colorado Oil and Gas Conservation Commission (COGCC) was directed by the Governor's office to prepare this legislative proposal to address the legal changes necessary to achieve a comprehensive regulatory regime for carbon capture, utilization, and storage (CCUS) in Colorado. In preparation of this proposal, the COGCC solicited input from numerous stakeholders, conducted extensive legal and regulatory research, and incorporated recommendations from the Colorado CCUS Task Force and the Environmental Justice Advisory Board. This proposal intends to help enable legal and regulatory pathways for Colorado to drive and oversee CCUS deployment in a manner that encourages community involvement, up-front land use planning, protective growth and adaptation of infrastructure, improved coordination for permitting authorities, and adequate funding for state programs. Moreover, it positions the state of Colorado as a leader in emerging technologies that support the reduction of greenhouse gas (GHG) emissions.

Colorado has established statewide emission targets to reduce GHG emissions based on the levels that existed in 2005, including a 26% reduction by 2025, a 50% reduction by 2030, and a 90% reduction by 2050. Meeting these goals will involve multiple simultaneously pursued strategies, as well as a streamlined administrative structure. CCUS has been identified as an essential tool for hard-to-decarbonize sectors. This includes the industrial sector where there has historically been a lack of alternatives to reduce on-site energy and process emissions including sectors such as cement, iron and steel, chemical production, and others where carbon emissions are prohibitively expensive or very difficult to abate with current technology.

Lack of clarity in the regulatory and permitting process has been identified as a significant barrier for emerging transitional energy industries including carbon sequestration. To address these barriers and ensure safe, protective, and effective deployment of CCUS in Colorado, this report reviews and discusses recommendations and considerations for Class VI primacy, pore space ownership, aggregating property rights in the subsurface, long-term site stewardship, programmatic funding, environmental justice, pipelines, other interrelated topics, and the relationship between CCUS and other emerging industries.

A summary of the recommendations and considerations discussed within this proposal is found in Table 1 on the following pages. Extensive discussion and justification for the recommendations is detailed within the body of the proposal, as is a review of other states' approaches to several of these considerations. These recommendations provide a legal and regulatory foundation for CCUS deployment in Colorado, will provide clarity for potential project developers, and may help direct federal funds to Colorado projects.

The topics covered within this proposal serve various purposes including providing legal clarity for the CCUS industry and its stakeholders, establishing an in-state regulatory regime that protects Colorado's communities and resources, and identifying topics that require additional consideration or discussion to understand the impact, challenges, and interconnected activities associated with CCUS deployment. As part of this process, we recommend incorporating environmental justice considerations throughout policy and project development to mitigate harm and be a part of the solution to remedy longstanding environmental inequities.

Due to the emerging nature of CCUS and other clean energy innovations, there are several related matters that policymakers should consider. These include topics such as externally-sourced CO_2, a process to determine storage amounts, greenhouse gas accounting, financial assurance, and confidentiality. Further, multiple existing and emerging industries may target similar subsurface formations as Class VI operations, may interact with subsurface pore space, or have potential to be interconnected with CCUS operations, including underground storage of hydrogen, deep geothermal energy projects, oil and gas production, and other UIC injection well classes (See Appendix for further details). These considerations are intended to provide additional context on how CCUS may interact with other industries in order to further enable interconnected operations, facilitate investment in supportive technologies, remove related legal and regulatory barriers, and encourage technologies that help reduce GHG emissions in Colorado.

Establishing a legal framework and consolidating regulatory responsibilities within a Colorado regulatory agency will provide a unified, state-driven, and structured approach to CCUS deployment in Colorado. This can encourage innovation, investment in state projects, reuse of existing infrastructure, and integrated operations all while prioritizing community involvement and environmental justice concerns and helping to reduce GHG emissions. Additionally, a comprehensive regulatory regime for CCUS may help better protect Colorado's resources by preventing gaps in regulatory oversight and encouraging a sustainable and protective approach to development. Recognizing CCUS projects can move forward through federal regulatory oversight, it is prudent for the state of Colorado to establish its own legal and regulatory framework for its citizens and new industries to support the reduction of pollution and protect Colorado communities and subsurface state resources. The COGCC looks forward to further discussions and collaboration on these important topics and working together to make a better future for all Coloradans.

Table 1. Recommendations and Considerations for CCUS Legislation

Topic	Recommendations
Definitions	1. Define relevant terms to provide clarity necessary to facilitate development of carbon sequestration projects in Colorado, including carbon dioxide, geologic storage, geologic storage operations, pore space, reservoir, storage facility, storage operator, and surface owner.
Class VI Primacy	1. Amend the Oil and Gas Conservation Act to grant the COGCC authority over all Class VI wells. 2. Direct the COGCC to seek blanket delegated authority (i.e., "primacy") from EPA over UIC Class VI wells. 3. Provide adequate resources for a state UIC Class VI regulatory program.
Pore Space	1. State that the surface owner is the owner of the underlying pore space unless it has been expressly conveyed. 2. Make clear that pore space may be severed from the surface estate and transferred the same way as minerals. 3. Provide that the mineral estate is dominant over pore space. 4. Extend the reasonable accommodation doctrine to pore space. 5. Include appropriate disclaimers. 6. Avoid provisions similar to those that were declared unconstitutional by the North Dakota Supreme Court. 7. Consider how this law may interact with UIC Class I and II programs.
Aggregating Property Rights and the Public Interest	1. Provide a mechanism for aggregating property rights for geologic storage, including nonconsenting owners. 2. Determine a threshold for consenting owners in a project that will be required prior to authorizing the combination of nonconsenting owners. 3. Issue a declaration that CCUS is in the public interest to create a pathway for involuntary aggregation of pore space rights. 4. Provide an explanation of why CCUS is in the public interest. 5. Ensure all pore space owners will be equitably compensated. 6. Determine if good-faith negotiations or other outreach is required. 7. Determine if a unit plan or agreement is required. 8. Direct COGCC to conduct a rulemaking to establish procedural requirements for aggregating pore space.
Long-Term Site Stewardship	1. Specify standards for project completion, and specify that the Commission may, but is not required to, issue a certificate of project completion after a minimum period of post-injection site monitoring. 2. Specify that upon issuance of the certificate of project completion: (a) the storage operator is released from liability and regulatory responsibility; (b) that the state assumes ownership of and responsibility for the stored CO_2 and storage facility; and (c) COGCC will release financial assurance associated with the closed facility. 3. Authorize COGCC to reimpose liability and regulatory responsibility, including financial assurance requirements, upon any storage operator that makes a material misrepresentation in its application for certificate of project completion. 4. Limit the state's liabilities for stored CO_2 and storage facilities to the greatest extent possible. 5. Limit recovery for civil claims against the state for stored CO_2 and storage facilities (to the extent such recovery is allowed) so that such a judgment cannot exceed the balance of funds contributed to the Carbon Storage Stewardship Fund for that specific facility.

Table 1. Recommendations and Considerations for CCUS Legislation (cont.)

Topic	Recommendations
Programmatic Funding	1. Create a Carbon Storage Stewardship Enterprise authorized to impose a fee(s) upon storage operators. 2. Define authority of the Carbon Storage Stewardship Enterprise board. 3. Create a Carbon Storage Stewardship Fund into which such fees will be deposited. 4. Define permissible uses of the Carbon Storage Stewardship Fund to include those post-closure activities associated with the state's long-term stewardship of stored CO_2 and storage facilities. 5. Exclude pre-closure COGCC activities (such as permitting and regulatory functions) as permissible uses of the Carbon Storage Stewardship Fund. 6. Direct the Commission to use the existing OGCERF for the administration of the Class VI program for any pre-closure regulatory or operational expenses. 7. Allow the Commission to impose a per-ton fee, an application fee, and/or an annual fee on storage operators to be deposited into OGCERF for pre-closure expenses. 8. Consider TABOR in the creation of the enterprise and any administrative fees.
Environmental Justice	1. Direct COGCC to promulgate rules aimed at avoiding adverse impacts to DI communities from Class VI projects. 2. Consider the EJAB's and EJ Task Force's recommendations and incorporate them into Class VI legislation and regulation. 3. Continue collaboration among state agencies and DI community members related to CCUS policy.
Pipelines	1. Instigate a focused pipeline project that will address state siting authority, pipeline safety regulation, pipeline corridor establishment, regional infrastructure planning, and use of eminent domain. 2. Consider a state agency to lead this project. 3. Consider collaboration with key stakeholders, related research groups, academia, pipeline companies, local governments, and additional agencies. 4. Consider the timing and resources required to complete this project and the desired deliverable.
Related and Future Considerations	1. Review more detailed considerations and recommendations for a focused pipeline project. 2. Consider if and how internally-sourced CO_2 is prioritized for Class VI projects in Colorado. 3. Contemplate if the COGCC should adopt a process for determining CO_2 storage amounts in EOR and Class VI projects. 4. Engage stakeholders and conduct additional research to develop CCUS-specific GHG accounting protocols. 5. Consider if financial assurance is better addressed in rulemaking versus in statute. 6. Consider if confidential information used for negotiating pore space agreements with state agencies is already protected from inspection under CORA or if a specific exemption is necessary. 7. Evaluate and consider how emerging industries and associated regulatory authority may interact with CCUS, oil and gas development, and other state energy policy priorities in Colorado, including underground gas storage, hydrogen, deep geothermal resources, subsurface injection, and direct air capture.

Introduction

Carbon capture, utilization, and storage (CCUS) is an emerging industry that will play an important role in the near future in reducing greenhouse gas (GHG) emissions throughout the nation and the world. With the development of the Greenhouse Gas Pollution Reduction Roadmap[1], the state of Colorado identified CCUS as having a potential role in meeting the emission targets established in HB19-1261. In 2021, the Colorado Energy Office (CEO) established a task force for CCUS to further investigate how CCUS could be appropriately enabled, deployed, and regulated. Additionally, with the passage of SB21-264, the General Assembly tasked the Colorado Oil and Gas Conservation Commission (COGCC) with compiling a report "to evaluate what resources are needed to ensure the safe and effective regulation of the sequestration of greenhouse gasses, as that term is defined in § 25-7-140(6), C.R.S., and to identify and assess the applicable resources that the commission or other state agencies have." The COGCC released the Class VI report[2] in November of 2021. The CCUS task force provided their recommendations[3] in February of 2022. Building on these efforts, Governor Polis directed COGCC to prepare this legislative proposal to address the legal changes necessary to achieve a comprehensive regulatory regime and create sequestration opportunities in Colorado.

Colorado established statewide climate goals to reduce GHG emissions based on the levels that existed in 2005, including a 26% reduction by 2025, a 50% reduction by 2030, and a 90% reduction by 2050.[4] Meeting these goals will include multiple simultaneously pursued strategies, as well as a streamlined administrative structure. The geologic sequestration of carbon dioxide (CO_2) in the subsurface is an important, emerging tool for reducing emissions, and will be necessary to reach net-zero emissions targets globally and may be equally critical to Colorado's own climate targets.[5]

CCUS is an essential tool to address emissions in the industrial sector where there has historically been a lack of alternatives to reduce on-site energy and process emissions. This includes "hard to abate" sectors such as cement, iron and steel, chemical production, and others where, with current technology, carbon emissions are prohibitively expensive or very difficult to abate. Industry is estimated to account for close to 25% of CO_2 emissions, and CCUS is modeled to make up nearly 20% of the needed emission reductions in the industrial sector in order to meet global climate goals.[6] In Colorado, the GEMM I[7] regulation adopted by the Colorado Department of Public Health and Environment (CDPHE) in 2021 requires the operators of certain cement and steel facilities (defined as energy-intensive trade exposed, EITE) to perform a feasibility assessment for carbon capture and sequestration (CCS) and could instigate further interest in CCUS from the industrial sector in Colorado. CDPHE is undergoing the development of an additional rulemaking for non-EITE manufacturers and industrial facilities in Colorado, which will require a sector-wide GHG reduction of 20% by 2030. While the exact role of CCS to achieve these targets is unknown, the intent of this legislative proposal is to remove disincentives and barriers that otherwise could hinder the development of potential projects.

Colorado has an estimated CO_2 sequestration potential of over 720 billion tons, according to the Colorado Geological Survey. The storage potential is primarily in the Denver Basin, Cañon City Embayment, Piceance Basin, and Sand Wash Basin.[8] A significant quantity of the storage potential in Colorado is classified as "very low storage cost" due to the location of carbon sources in relation to suitable geology for permanent storage and existing infrastructure including pipelines.[9] Considering these factors, the geologic sequestration of CO_2 through injection into the deep subsurface has the potential to become prevalent in Colorado as long as protective legal and regulatory pathways are established.

1 GHG Pollution Reduction Roadmap, Colorado Energy Office, pg 91, January 14, 2021. https://energyoffice.colorado.gov/climate-energy/ghg-pollution-reduction-roadmap

2 Requirements, Resources, Considerations, and Recommendations for the State of Colorado to Implement a Safe and Effective UIC Class VI Program, COGCC, November 2021. https://cogcc.state.co.us/documents/library/Technical/UIC/COGCC%20Class%20VI%20Report.pdf.

3 Colorado Carbon, Capture, Utilization, and Storage Task Force Recommendations, February 1, 2022. https://www.mines.edu/carboncapture/wp-content/uploads/sites/365/2022/02/Task-Force-Recommendations-Final.pdf

4 House Bill19-1261, Climate Action Plan to Reduce Pollution, http://leg.colorado.gov/bills/hb19-1261.

5 IPCC, Climate Change 2022: Mitigation of Climate Change, Chapter 3, Mitigation Pathways Compatible with Long-Term Goals, https://www.ipcc.ch/report/ar6/wg3/. IEA, CCUS in Clean Energy Transitions, 2020, pg 51-52. https://iea.blob.core.windows.net/assets/181b48b4-323f-454d-96fb-0bb1889d96a9/CCUS_in_clean_energy_transitions.pdf
Princeton University, Net-Zero America: Potential Pathways, Infrastructure, and Impacts, October 29, 2021, pg 10. https://netzeroamerica.princeton.edu/img/Princeton%20NZA%20FINAL%20REPORT%20SUMMARY%20(29Oct2021).pdf

6 IEA, Transforming Industry through CCUS, May, 2019, pg 7-10. https://iea.blob.core.windows.net/assets/0d0b4984-f391-44f9-854f-fda1ebf8d8df/Transforming_Industry_through_CCUS.pdf

7 CDPHE, Greenhouse Gas Emissions and Energy Management for Manufacturing in Colorado, https://cdphe.colorado.gov/greenhouse-gas-emissions-and-energy-management-for-manufacturing-in-colorado#:~:text=The%20Colorado%20Air%20Quality%20Control,effective%20starting%20December%2015%2C%220021.

8 Young G., Lintz V., Widmann B., Bird D., Cappa J., CO_2 Sequestration Potential of Colorado, Colorado Geological Survey Resource Series 45, 2007, pg 1-13.

9 Abramson E., McFarlane D., Brown J., Transport Infrastructure for Carbon Capture and Storage: Whitepaper on Regional Infrastructure for Midcentury Decarbonization, Great Plains Institute, June 2020, pg 17, Figure 13. https://www.betterenergy.org/wp-content/uploads/2020/06/GPI_RegionalCO_2Whitepaper.pdf

Colorado has an extensive history of oil and gas extraction, with active operations remaining throughout the state, providing locally-sourced hydrocarbons. This established industry is an immense resource for emerging industries including CCUS. The CCUS industry will utilize many technologies and skill sets developed for or by the oil and gas industry including drilling, wellbore construction, subsurface injection, reservoir characterization, and much more. Existing expertise will help advance projects and innovations in CCUS throughout Colorado. Further, CCUS will likely instigate job creation in industries including ethanol, hydrogen, cement, refineries, steel, and power plants.[10] Colorado is well-positioned to successfully incorporate the CCUS industry into its robust economy and encourage a just workforce transition.

At both the federal and state level, there are financial incentives for pursuing and implementing CCUS. The Infrastructure Investment and Jobs Act (IIJA)[11] that became law in November 2021 includes several billion dollars in funding related to CCUS, including funding for carbon dioxide transportation infrastructure, carbon storage validation and testing, direct air capture hubs, state Class VI regulatory programs, and other related funding opportunities. In Colorado, there is $25 million in funding available through the Industrial and Manufacturing Operations Clean Air Grant Program established by SB22-193[12] that can provide funding to projects that include carbon capture at industrial facilities and direct air capture projects. Additionally, the recently passed Inflation Reduction Act (IRA)[13] includes significant financial incentives and changes to current law that will allow the federal 45Q tax credits to be more effective for and available to additional companies for CCUS projects. This includes an increase in tax credit values for storage, utilization, and direct air capture projects, an extension of the commence-construction window for projects applicable to 45Q credits, a decrease in the required amount of captured carbon per year per project, and direct pay options for operators. These incentives will greatly increase the economic returns for CCUS activities, increase the amount of interest among entities that emit carbon, and will likely instigate additional feasibility studies and projects.

There are several entities in Colorado already pursuing CCS projects or conducting feasibility studies to determine if CCS is viable for their business including ethanol plants, cement facilities, utility companies, and others. For example, Colorado School of Mines is actively working with operators and the U.S. Department of Energy to conduct feasibility studies for sequestration projects in Colorado.[14] With state and federal funding opportunities available, as well as having suitable subsurface geology for storage near sources of carbon, the state of Colorado has potential to become a sequestration hub with an increased ability to meet climate targets and reduce GHG emissions while supporting emerging low- or no-carbon energy industries.

CCUS provides benefits to local communities and the state beyond GHG emission reduction and employment. In addition to carbon removal, capture facilities have the ability to remove other pollutants from the point source (or directly from the air in the case of direct air capture), including sulfur dioxide, nitrogen oxides, and particulates, resulting in improvement of local air quality.[15] Additionally, the potential for synergies between CCUS and other renewable energy technologies could lead to greater environmental gains and reduced impacts from energy generation in Colorado.

The safe and effective implementation of CCUS in Colorado requires addressing legal, policy, and regulatory barriers as well as incorporating community input and ensuring protective development. Lack of clarity in the regulatory and permitting process has been identified as a significant barrier for emerging industries such as carbon sequestration.[16] To address these barriers and ensure safe, protective, and effective deployment of CCUS in Colorado, this report reviews and discusses recommendations and considerations for Class VI primacy, pore space ownership, aggregating property rights in the subsurface, a CCUS public interest declaration, long-term site stewardship, programmatic funding, environmental justice, pipelines, related considerations, and the relationship between CCUS and other emerging industries.

In preparation of this proposal, the COGCC has solicited input from numerous stakeholders, conducted extensive legal and regulatory research, and incorporated the Colorado CCUS Task Force and Environmental Justice Advisory Board recommendations. In consideration of these issues, this proposal intends to help enable legal and regulatory pathways for CCUS that encourage community involvement, up-front land use planning, protective growth and adaptation of infrastructure, improved coordination for permitting authorities, adequate funding for state programs, as well as positioning the state of Colorado as a leader in emerging technologies that support the reduction of GHG emissions.

10 Rhodium Group, The Economic Benefits of Carbon Capture, April 20, 2021, https://rhg.com/wp-content/uploads/2021/04/The-Economic-Benefits-of-Carbon-Capture-Investment-and-Employment-Opportunities_Phase-III.pdf.

11 Infrastructure Investment and Jobs Act, H.R.3684, 117th Cong. November 15, 2021. https://www.congress.gov/bill/117th-congress/house-bill/3684/text

12 Air Quality Improvement Investments, SB22-193. https://leg.colorado.gov/bills/sb22-193

13 Congress.gov, Inflation Reduction Act, 117th Cong. (2022). https://www.congress.gov/bill/117th-congress/house-bill/5376/text

14 Ning, Y., Tura, A., Feasibility Study of a Potential CCUS Project in Colorado, June 1, 2022, CUSP, https://www.cuspwest.org/wp-content/uploads/2022/08/CSM_Feasibility-Study-on-a-Potential-CCUS-Project-in-Colorado-CO2-Capture-from.pdf

15 International CCS Knowledge Centre, Summary for Decision Makers on Large-Scale CCS on Cement, pg 6, Figure 2, November, 2021, https://ccsknowledge.com/pub/Publications/2021Nov_Summary_for_decision%20makers-CCS-LEHIGH-FINAL%20(2022-05-11).pdf.

16 Great Plains Institute, Regional Carbon Dioxide (CO_2 Transport Infrastructure Action Plan, pg 7-9, October 12, 2021. https://www.betterenergy.org/wp-content/uploads/2021/10/Regional-CO_2-Transport-Infrastructure-MOU-Action-Plan.pdf
NREL.gov, An Analysis of Non-Technical Barriers to Geothermal Deployment and Potential Improvement Scenarios, pg 49-62, May 2019. https://www.nrel.gov/docs/fy19osti/71641.pdf

Definitions

To provide the clarity necessary to facilitate development of carbon sequestration projects in Colorado, legislation should define terms related to property rights, ownership, and site stewardship, including the terms listed below. This list is not exhaustive and may change depending on the scope and direction of the legislation.

Carbon Dioxide (CO_2)
Naturally occurring, geologically sourced, or anthropogenically sourced carbon dioxide including its derivatives and all mixtures, combinations, and phases, whether liquid, gaseous, solid, stripped, segregated, or divided from any other fluid stream thereof.

Geologic Storage
The injection and underground storage of Carbon Dioxide or other substances in subsurface geologic formations pursuant to a valid UIC Class VI permit.

Geologic Storage Operations
Any work performed by a Storage Operator for the purposes of engaging in Geologic Storage, including, but not limited to, conducting seismic operations and the drilling of test bores; siting, drilling, deepening, recompleting, reworking, or abandoning a well for Geologic Storage and/or monitoring; all operations related to any such well, including installing flowlines, but excluding any work, equipment, or disturbances associated with Carbon Dioxide pipelines; injecting Carbon Dioxide for the purposes of Geologic Storage; and any constructing, site preparing, or reclaiming activities associated with such operations.

Pore Space
A cavity or void, whether natural or artificially created, in a subsurface stratum, which can be used as storage space for Carbon Dioxide or other substances.

Reservoir
A subsurface geologic formation, aquifer, cavity, or void, whether natural or artificially created, suitable for or capable of Geologic Storage.

Storage Facility
That part of the specific Reservoir which is utilized for Geologic Storage, together with all surface equipment and disturbances associated with Geologic Storage Operations.

Storage Operator
Any person or entity who exercises the right to control the conduct of Geologic Storage Operations in the state of Colorado pursuant to a valid UIC Class VI permit.

Surface Owner
Any person or entity owning all or part of the surface of land upon which surface disturbance associated with Geologic Storage Operations occurs.

Class VI Primacy

Underground injection control (UIC) Class VI wells are regulated by the U.S. Environmental Protection Agency (EPA) unless or until a state obtains primacy to administer the UIC Class VI program for wells within its borders. Under the Safe Drinking Water Act and the EPA's Class VI Rule, the EPA is authorized to review and approve state UIC program applications for primacy. The EPA provides detailed guidance for states interested in pursuing Class VI primacy[17] and encourages states to seek primacy to increase permitting speed by distributing the permitting and enforcement responsibilities to qualified states.

Interest in geologic sequestration projects is increasing throughout the nation and in Colorado. Currently, only two states have Class VI primacy, and the EPA may be limited in the amount of time and resources to commit to future permitting projects from states without primacy. With these considerations, states with primacy may be positioned to process permit applications at a comparatively accelerated rate. Given the increase in CCUS funding opportunities and additional projects moving forward, it is expected that several states will be seeking primacy to help encourage CCUS development. Therefore, obtaining state primacy in the near future could play an important role in the success of future Class VI projects in Colorado and Colorado's competitiveness for federal CCUS and related competitive project funding.

To apply for Class VI primacy, states are required to set up a regulatory framework that will ensure the protection of underground sources of drinking water (USDW). The application must show that the state's statutes and rules are at least as stringent as all federal requirements and demonstrate the state's capability to implement a safe and effective UIC Class VI program. This requires the state and its delegated agency to have applicable laws, rules, processes, and other requirements in place before submitting the primacy application.

A threshold requirement for Colorado to obtain primacy and administer an effective Class VI program is a regulatory agency with authority to promulgate rules, administer the program, conduct oversight, and provide guidance for operators. Currently, the General Assembly has not expressly vested any state agency with that authority. Within Colorado, the COGCC is uniquely positioned to effectively pursue and implement a safe and effective UIC Class VI program from an established process and technical expertise perspective.[18]

The Oil and Gas Conservation Act (OGCA) explicitly grants the COGCC authority to regulate UIC Class II wells, but does not reference Class VI wells. The OGCA also includes "underground injection wells"—not qualified by the type of well—as part of "oil and gas operations," over which the COGCC has broad authority. Legislation that grants authority to regulate Class VI wells to the COGCC is therefore a prerequisite for the implementation of the state's Class VI program. To provide clarity, the OGCA should be amended to expressly grant COGCC authority to pursue Class VI primacy, promulgate related rules, and regulate UIC Class VI wells.

Resource Requirements for a State Class VI Regulatory Program

While the COGCC has relevant existing expertise and processes, additional staff and resources are required to safely and effectively implement a state Class VI regulatory program. A thorough analysis of the requirements and resources necessary for a state Class VI regulatory program can be found in the COGCC's Class VI report.[19] States that have gained or applied for primacy have a broad range of cost estimates for program implementation and gaining primacy. A Class VI State Program Cost Analysis[20] by the GroundWater Protection Council includes an estimate of $270,000 to obtain primacy and estimates the cost of implementing a state UIC Class VI program over 5 years as ranging from $1.3 million to $22 million. Louisiana estimates that the cost of the first 2 years of its program will be nearly $1.5 million, which is largely associated with the phased hiring of 7 new staff. The cost of implementing a UIC Class VI regulatory program is highly dependent on the number of active projects and permits within a state.

17 EPA, UIC Program Class VI Primacy Manual for State Directors, April, 2014. https://www.epa.gov/sites/default/files/2015-07/documents/epa816b14003.pdf

18 Requirements, Resources, Considerations, and Recommendations for the State of Colorado to Implement a Safe and Effective UIC Class VI Program, COGCC, November 2021. https://cogcc.state.co.us/documents/library/Technical/UIC/COGCC%20Class%20VI%20Report.pdf

19 Id.

20 State of Louisiana Department of Natural Resources, CLASS VI PRIMACY APPLICATION, pg 309-314, http://www.dnr.louisiana.gov/assets/OC/im_div/uic_sec/FinalClassVIUSEPAPrimacyApplication.pdf.

Class VI projects in Colorado are moving forward and more projects may be instigated due to additional funding opportunities. There are currently 3 projects that are moving towards permitting a stratigraphic well for Class VI feasibility testing. There is also interest in converting the 2 existing natural CO_2 producing reservoirs in southern Colorado to sequestration sites which would require 2 additional permits. There is also interest in evaluating capture projects at smaller point sources for sequestration at a centrally located site. The GEMM I regulation[21] adopted by the CDPHE in October of 2021 requires certain industrial facilities in Colorado to perform feasibility assessments for CCS. This could initiate additional capture and sequestration projects in the industrial sector. Additionally, the recently passed IRA contains significant, additional financial incentives for CCUS and amends thresholds within the existing law that makes 57 additional facilities eligible for 45Q tax credits in Colorado.[22] With several projects already moving forward, additional funding becoming available, and added interest in CCUS throughout the state, Colorado may become a CCUS hub in the not so distant future.

For Colorado to move forward with obtaining primacy and implementing a safe and effective Class VI program, additional staff and resources are required. Initial program development requires certain resources including a Class VI coordinator and UIC scientist to work towards gaining primacy and to assist in building the regulatory program. Additionally, resources will need to be allocated for the integration of Class VI projects into the existing mapping and database systems, including potential use of consultants and adding outside modules developed for Class VI regulation. Computer hardware and software will be required for the state to be able to verify models used in Class VI projects.

While the staffing requirements for program implementation are highly dependent on the amount of sequestration projects and permitting within the state, it is clear that CCUS is moving forward and interest is growing throughout Colorado. With that in mind, there will be numerous staffing requirements for program implementation once COGCC gains primacy including UIC scientist(s), UIC engineer(s), environmental specialist(s), a UIC program technician, a data management specialist, and potentially other staff. Further, consulting costs should be a consideration as there are several potential scenarios that could require outside expertise including complex modeling, analysis of complex financial assurance instruments, risk analysis, environmental justice analysis, and possibly other items.

Lastly, funding for training and staff development will be integral to program success as sequestration is an emerging industry and staff must keep current with industry knowledge.

The Infrastructure Investment and Jobs Act includes federal funding for state Class VI programs.[23] Through this law, the EPA is authorized to provide $50 million in grants to state agencies seeking Class VI primacy and agencies with primacy to offset the cost of program implementation. The EPA is currently developing the criteria to determine what states are eligible for the grants and how much funding will be available for each state. The EPA estimates that the grant details and funding should become available by the middle or end of 2023. This funding does not have an expiration but will end once all funds are distributed. Once grants become available, the need for state funding may become reduced. However, at present, there is not a long-term federal funding option for Class VI programs after these initial funds are depleted.

Recommendations

For the COGCC to seek and obtain primacy, and subsequently implement a safe and effective Class VI regulatory program, we recommend the following:

- The General Assembly should amend the OGCA to expressly grant the COGCC authority over all categories of UIC Class VI wells in the state of Colorado and ensure COGCC has all necessary authority to administer a Class VI regulatory program.
- The General Assembly should direct the COGCC to seek blanket delegated authority (i.e., "primacy") from EPA over UIC Class VI wells.
- Example statutory language was contemplated to address Class VI primacy within SB22-138, which was proposed but not passed last legislative session. We think that this or similar language is adequate in addressing the legislative needs to grant COGCC the required jurisdiction and authority to pursue a Class VI rulemaking and seek primacy from the EPA.
- Primacy Staff and Training
  - Beginning in FY 2023–24, in order to complete the primacy process and facilitate building the Class VI regulatory program at the COGCC, 2 FTE is required. This process will likely take 1–2 years and is contingent on the timely processing of the application by the EPA.
  - As sequestration is an emerging technology, new staff will require annual training costs of $2,000 to attend relevant conferences, seminars, and workshops beginning in FY 2023–24.

21 CDPHE, Greenhouse Gas Emissions and Energy Management for Manufacturing in Colorado, https://cdphe.colorado.gov/greenhouse-gas-emissions-and-energy-management-for-manufacturing-in-colorado#:~:text=The%20Colorado%20Air%20Quality%20Control,effective%20starting%20December%2015%2C%202021.

22 Carbon Capture Coalition, The Inflation Reduction Act of 2022, August 2022, https://carboncapturecoalition.org/wp-content/uploads/2022/08/IRA-2022-Fact-Sheet-8.16.pdf.

23 Congress.gov, Infrastructure Investment and Jobs Act, H.R.3684, 117th Cong. Sec. 40306, Secure Geologic Storage Permitting, https://www.congress.gov/bill/117th-congress/house-bill/3684/text.

- Regulatory Staff
    - Leading up to and after obtaining primacy, additional staff will be required to effectively implement the Class VI program. COGCC will require at least 5 additional FTE to address all program needs including conducting pre-application meetings, reviewing permits, reporting to the EPA, incorporating data into the COGCC's databases, communicating with the public and operators, and ensuring compliance with rules and permit conditions, among other responsibilities.
- Computer Hardware and Software
    - Leading up to or after obtaining primacy, the COGCC will require a computer and software to verify model simulations provided by the operator for Class VI projects. Based on other states that have gained primacy, the hardware required for simulations will be a one-time cost of $15,000. Annual software license fees of $10,000 will be required.

Pore Space

When CO_2 is injected, it occupies pore space, which is a cavity or void, whether natural or artificially created, in a subsurface stratum, which can be used as storage space for Carbon Dioxide or other substances. In geologic sequestration, CO_2 is intended to occupy the pore space in perpetuity. Therefore, a key legal consideration to enable a Class VI program in Colorado is who owns, and therefore controls access to, the pore space where CO_2 will be stored. This issue is not yet addressed in Colorado law, and ambiguity in this area has been identified as a significant barrier to large-scale CCS development.[24] A legislative determination on pore space ownership is thus important to enabling CCUS in Colorado.

Longstanding common law principles and the experiences of other states indicate that pore space ownership should be vested in the owner of the surface estate. Pore space legislation should also address more nuanced issues, such as how to balance competing uses of the surface and subsurface.

Pore Space Ownership

Common law principles indicate that pore space is most properly considered part of the surface estate. At common law, real property owners traditionally own property in "fee simple," generally meaning that they own the surface and everything above and below it, unless specific rights or interests have been conveyed. Following this principle, courts typically interpret deeds and other conveyances narrowly, applying a presumption that any rights not expressly carved out are retained by the surface owner. It follows that, if pore space has not been separately conveyed, it remains the property of the surface owner. Courts in other states resolving pore space ownership disputes have followed this logic to hold that the pore space belongs to the surface owner unless it has been expressly conveyed.[25]

This has also been the conclusion reached by other state legislatures that have addressed pore space ownership.[26] As shown in Table 2, most states to address pore space ownership in statute expressly state that title to the underlying pore space is vested in the surface owner, unless it has been severed and separately conveyed. Montana takes a slightly different approach, establishing a rebuttable presumption that the surface owner owns the pore space. This approach was likely developed to minimize concerns that a declaration of pore space rights could affect a taking, but this concern can be addressed in other ways, and a simpler, direct declaration of ownership may be preferable for clarity and certainty.

Some commentators have suggested that states should declare that pore space is owned by the state and/or authorize eminent domain authority to acquire property rights for geologic sequestration. Louisiana has taken this approach. Louisiana does not define pore space ownership in its CCUS legislation, but rather treats pore space as being within the public domain. Louisiana empowers state regulators to grant a certificate of public convenience and necessity to a storage operator upon a finding that a proposed storage facility meets the statutory requirements; the storage operator is then authorized to exercise eminent domain authority to acquire the necessary land.[27]

However, given Colorado's longstanding tradition of respecting private property rights, as well as concerns about causing unconstitutional takings of private property, we do not recommend this approach. Instead, we recommend that the legislature adopt the majority position and declare that, in Colorado, ownership of pore space is vested in the surface owner unless it has been severed and separately conveyed. This approach is supported by the common law, protective of private property rights, and creates a clear rule that will facilitate the acquisition of pore space rights for geological sequestration.

24 Lepore, M., Turner, D., Legislating Carbon Sequestration: Pore Space Ownership and Other Policy Considerations, The Colorado Lawyer, Volume 40, No. 10, October 2011.

25 *See, e.g., Burlington Resources Oil & Gas Co., LP v. Lang and Sons Inc.*, 259 P.3d 766, 770 (Mont. 2011); *Humble Oil & Refining Co. v. West*, 508 S.W.2d 812, 815 (Tex. 1974); *Tate v. United Fuel Gas Co.*, 71 S.E.2d 65, 71 (W. Va. 1952); *Jones-Noland Drilling Co. v. Bixby*, 282 P. 382, 383 (N.M. 1929).

26 Gray T., A 2015 Analysis and Update on U.S. Pore Space Law-The Necessity of Proceeding Cautiously With Respect to the "Stick" Known as Pore Space, pg 283, January 2015. https://digitalcommons.law.ou.edu/cgi/viewcontent.cgi?article=1013&context=onej; Koski, K., Richardson, J., Righetti, T., Taylor, S., Study on States' Policies and Regulations, pg 123, September 2020. https://usea.org/sites/default/files/event-/Study%20on%20States%E2%80%99%20Policies%20and%20Regulations%20per%20CO_2-EOR-Storage%20%281%29.pdf.

27 LA. Rev. Stat. Ann. § 30:1107.

Table 2. State Approaches to Pore Space Ownership

	Wyoming	North Dakota	Louisiana	Nebraska	Montana
Citation	Wyo. Stat. § 34-1-152	N.D. Cent. Code § 47-31-01 et seq.	La. Stat. § 30:1101 et seq.	Neb. Rev. Stat. §§ 57-1604, 1615	Mont. Code §§ 82-11-101, 180 (contingent)
Pore Space Definition	Subsurface space which can be used as storage space for carbon dioxide or other substances.	A cavity or void, whether natural or artificially created, in a subsurface sedimentary stratum.	Not defined. "Reservoir" means that portion of any underground geologic stratum, formation, aquifer, or cavity or void, whether natural or artificially created, including oil and gas reservoirs, salt domes or other saline formations, and coal and coalbed methane seams, suitable for or capable of being made suitable for the injection and storage of carbon dioxide therein.	Not defined. "Reservoir" means a subsurface stratum, formation, cavity, or void, whether natural or artificially created, suitable for or capable of receiving through a well and geologically storing a carbon dioxide stream. "Reservoir estate" means ownership of any portion of a storage reservoir.	Not defined. "Geologic storage reservoir" means a subsurface sedimentary stratum, formation, aquifer, cavity, or void, whether natural or artificially created, including vacant or filled reservoirs, saline formations, and coal seams suitable for or capable of being made suitable for injecting and storing carbon dioxide.
Ownership	Owner of surface above the strata.	Owner of overlying surface estate.	Not addressed. Storage operators authorized to acquire reservoir using eminent domain authority.	Owner of the overlying surface estate unless it has been severed and separately conveyed.	Rebuttable presumption that the surface owner owns the geologic storage reservoir.
Transfer and Severability	• Surface conveyance includes pore space unless severed or explicitly excluded. • Pore space may be conveyed in same manner as mineral interests. • Instrument transferring pore space must describe scope of right to use surface estate. • Transfers of pore space must specifically describe location of pore space.	• Surface conveyance includes pore space. • Pore space may not be severed from surface estate	Not addressed.	• Surface conveyance includes pore space unless severed or explicitly excluded • Pore space may be conveyed in same manner as mineral interests • Instrument transferring pore space must describe scope of right to use surface estate. • Transfers of pore space must specifically describe location of pore space.	Not addressed.
Dominance of Mineral Estate	• Legislation does not alter the existing common law regarding dominance of the mineral estate. • Mineral estate is dominant over pore space.	Legislation does not alter the existing common law regarding dominance of the mineral estate.	Not addressed.	• Legislation does not alter the existing common law regarding dominance of the mineral estate. • Mineral estate is dominant over surface and pore space.	Not addressed.

Table 2. State Approaches to Pore Space Ownership (cont.)

	Wyoming	North Dakota	Louisiana	Nebraska	Montana
Disclaimers	Nothing in this legislation shall be construed to: Alter, amend, diminish, or invalidate rights to the use of pore space acquired prior to effective date of act.	Nothing in this legislation shall be construed to: • Alter, amend, diminish, or invalidate rights to the use of pore space acquired prior to effective date of act. • Limit or impair the obligations of any contract for disposal operations entered prior to effective date of act. • Note: Other statutory provisions regarding the relationship between the pore space estate and other property rights have been declared unconstitutional.	Nothing in this legislation shall be construed to: • Prevent EOR utilizing carbon dioxide. • Prevent a mineral owner or mineral lessee from drilling through or near a storage reservoir to explore for and develop minerals. • Prejudice the rights of the owners of surface or minerals not acquired for the storage facility and not reasonably necessary for the use of the storage facility.	Nothing in this legislation shall be construed to: • Alter, amend, diminish, or invalidate rights to the use of pore space acquired prior to effective date of act. • Prejudice the rights of property owners within a storage facility to exercise rights that have not been committed to a storage facility. • Prevent a mineral owner or mineral lessee from drilling through or near a storage reservoir to explore for and develop minerals. • Amend or alter any statute, rule, or regulation in effect related to EOR.	Nothing in this legislation shall be construed to: • Alter, amend, diminish, or invalidate rights to the use of pore space acquired prior to effective date of act. • Prejudice the rights of property owners within a storage facility to exercise rights that have not been committed to a storage facility. • Prevent a mineral owner or mineral lessee from drilling through or near a storage reservoir to explore for and develop minerals. • Impede or impair the ability of an operator to inject CO_2 for EOR. • Change or alter common law or statutory provisions regarding the ownership of surface or subsurface rights. • Diminish, impair, or in any way affect the rights of a natural gas public utility to own, operate, or control a gas storage reservoir in use prior to effective date of act.

Severance and Transferability

To provide clarity and stability for property owners, it may be prudent to follow the approach of other states that have included provisions related to the severance and transfer of pore space in their CCUS statutes. These provisions typically state:

- Any conveyance of the surface estate of real property will include the pore space below the surface unless that ownership has previously been severed or is explicitly excluded from the conveyance;
- Pore space ownership may be conveyed in the same manner as mineral interests;
- No agreement conveying mineral or other subsurface interests shall be construed to include pore space unless explicitly stated; and
- All instruments transferring pore space will include a description of the pore space being transferred and any rights of the pore space owner to use the surface estate.

We recommend the adoption of similar provisions in Colorado.

In contrast to the majority of states, North Dakota and West Virginia prohibit the severance of pore space from the surface estate. We do not recommend this approach, as enabling severance and transfer of pore space will provide maximum flexibility to facilitate CCUS projects.

Dominance of the Mineral Estate

Legislation should also anticipate, and attempt to minimize, conflicts between competing rights and uses of the subsurface. Colorado law regarding conflicts between surface owners and mineral owners is already highly developed, but these issues have not been addressed in relation to pore space.

Most states with pore space legislation either expressly state that rights to the mineral estate are dominant over pore space rights, or provide that nothing in the legislation should be construed to alter the common law as it relates to the dominance of the mineral estate (See Table 2).

A declaration that the mineral estate is dominant over pore space is in keeping with existing Colorado law and also makes sense given the mechanics of sequestration. Mineral and pore space rights will typically interact where a storage operator wishes to inject CO_2 into pore space in or near mineral deposits. Where commercially valuable minerals occupy the pore space, Colorado's public policy in favor of developing minerals and preventing waste dictates that the minerals should be developed, and the pore space depleted, before the commencement of any pore space use that would interfere with mineral development.

The legislature should therefore provide guidance on the interaction between mineral rights and pore space rights. Other states have done this by providing in statute that:

- The mineral estate is dominant over pore space rights;[28]
- Where pore space contains commercially valuable minerals, a permit for geologic sequestration may not be issued unless the regulatory body finds that the rights and interests of the mineral owners will not be adversely affected;[29] and
- Mineral owners or lessees may drill through or near a storage reservoir to access minerals, subject to regulatory approval.[30]

Reasonable Accommodation

While in Colorado, the mineral estate is generally considered dominant over the surface estate, the Colorado Supreme Court has stated that the surface and mineral estates are "mutually dominant and mutually servient because each is burdened with the rights of the other."[31] This declaration has come to be known as the reasonable accommodation doctrine: The owner of a severed mineral estate retains a right of "reasonable use" in the surface estate, which allows the mineral owner to access and use the surface to the extent that is "reasonable and necessary to the development of the mineral interest."[32] In turn, mineral developers have an obligation to "accommodate surface owners to the fullest extent possible consistent with their right to develop the mineral estate."[33] The reasonable accommodation doctrine was adopted by statute in the OGCA.[34]

The reasonable accommodation doctrine should be extended to pore space with respect to rights and obligations related to the severed surface estate. Legislation should provide that pore space developers will minimize damage and intrusion to the surface of the land, and that the severed pore space estate retains a right of reasonable use in the surface that allows pore space owners to access and use the surface to the extent that is reasonable and necessary to utilize the pore space. For example, storage operators may need to access and use the surface for installation of a monitoring well or other necessary facilities.

Takings Considerations

Legislation declaring ownership of pore space should contain provisions to safeguard against allegations that doing so constitutes a taking of private property in violation of the Colorado and United States Constitutions. Specifically, the legislation should contain disclaimers to protect prior conveyances of pore space and make clear that the legislation should not be construed to change or alter the common law with respect to the ownership of real property or mineral rights. The legislation should also state that its provisions do not apply to extractable mineral resources, and it should not be construed to impair the rights of mineral developers to utilize enhanced recovery methods for the development of oil and gas.

28 L.B. 650, 107th Leg., 1st Reg. Sess. (Neb. 2021) ("For the purpose of determining the priority of subsurface uses between a severed mineral estate and reservoir estate as described in this section, the severed mineral estate is dominant regardless of whether ownership of the reservoir estate is vested in the several owners of the surface or is owned separately from the surface."; *see also* Wyo. Stat. Ann. § 34-1-152; H.B. 1209, 122nd Gen. Assemb., 2nd Reg. Sess. (Ind. 2022).

29 L.B. 650, 107th Leg., 1st Reg. Sess. (Neb. 2021); H.B. 4491, 85th Leg., Reg. Sess. (W. Va. 2022).

30 E.g., L.B. 650, 107th Leg., 1st Reg. Sess. (Neb. 2021); Mont. Code § 82-11-180.30

31 *Gerrity Oil & Gas Corp. v. Magness*, 946 P.2d 913, 927 n.8 (Colo. 1997).

32 *Gerrity Oil & Gas Corp.*, 946 P.2d at 926-27.

33 *Id.* at 927.

34 § 34-60-127, C.R.S.

Interaction with UIC Class II Program

Policymakers should consider—and try to avoid—potential unintended consequences that Class VI legislation could have for Class I and II wells in the state.

UIC Class I and II Wells

Class I wells are used to inject hazardous and nonhazardous municipal and industrial waste deep into pore space.[35] Class I wells are permitted and regulated by EPA in Colorado. Class II wells are used to inject fluids associated with oil and gas production, and include exploration and production (E&P) waste disposal wells, injection of fluid for enhanced oil recovery (EOR), and hydrocarbon storage wells.[36] COGCC obtained primacy from EPA to regulate Class II wells in Colorado. Accordingly, this discussion will focus on potential impacts to Colorado's Class II program, though many of the same considerations could impact Class I wells in the state. Class I and II wells inject fluid into pore space, typically saline aquifers (Class I and II) or depleted hydrocarbon reservoirs (Class II). Therefore, new legislation establishing ownership rights and obligations related to pore space could impact these existing programs.

Under the OGCA and 2 C.C.R. 404-1:800–811, operators must obtain a permit from COGCC prior to drilling a Class II well. The Rules include measures to protect USDWs, limits on injection rate and pressure, permitting procedures, and other matters.[37] The Rules require operators to provide notice of their application to all surface and mineral owners within a half-mile radius of the well, the relevant local government, owners and operators of oil and gas wells operating within the Injection Zone, and, for EOR wells, each mineral owner within the unit and within 1/2 mile of the proposed unit boundary.[38] The injector must obtain consent from the surface owner where the injection well will be located.[39] However, the Rules do not require approval from or compensation for the other impacted pore space owners, and there is no regulatory mechanism for aggregating pore space interests for Class II injection. While operators can negotiate pore space leases and other agreements with other pore space owners, there is no statutory or regulatory requirement that they do so.

Once the General Assembly makes a declaration on pore space ownership and the rights and obligations of pore space owners with respect to CCUS, it is conceivable that pore space owners could object to the fact that Class I or II fluids have been injected into their pore space without compensation. This occurred in North Dakota, and that state's experience may be instructive for Colorado.

Lessons from North Dakota

In 2009, North Dakota enacted CCUS legislation defining pore space and declaring that pore space ownership is vested in the owner of the overlying surface estate.[40] Subsequently, a surface owner sued an oil and gas operator, Denbury Resources, Inc., alleging claims for nuisance, trespass, and damages under North Dakota's Oil and Gas Production Damage Compensation Act (N.D.C.C. ch. 38-11.1) because Denbury injected E&P waste into the pore space underlying his land without permission or compensation. In 2017, the North Dakota Supreme Court held that, "under [the state Oil and Gas Production Damage Compensation Act], a mineral developer may be liable to a surface owner for saltwater disposal into pore space."[41]

Concerned that such litigation would interfere with the state's Class II program, North Dakota amended its pore space statute in an attempt to make clear that the provisions in the CCUS legislation only applied to Class VI wells, and not Class II wells. The amended legislation attempted to do so through the following provisions:

- "Notwithstanding any other provision of law, a person conducting . . . disposal operations, or any other operation authorized by the commission under this chapter may utilize subsurface geologic formations in the state for such operations or any other permissible purpose under this chapter. Any other provision of law may not be construed to entitle the owner of a subsurface geologic formation to prohibit or demand payment for the use of the subsurface geologic formation for . . . any other operation conducted under this chapter."
- North Dakota's Damage Compensation Act was amended to exclude pore space from the definition of "Land."
- "Injection or migration of substances into pore space for disposal operations . . . by itself, does not constitute trespass, nuisance, or other tort."[42]

The combined effect of these provisions would have been to prevent pore space owners from suing to prevent Class II disposal operators from injecting into their pore space, seeking compensation for the same, or bringing tort suits based on migration of injected disposal fluid into their pore space.

35 For more information on Class I wells, see https://www.epa.gov/uic/class-i-industrial-and-municipal-waste-disposal-wells.
36 https://www.epa.gov/uic/class-ii-oil-and-gas-related-injection-wells.
37 *See generally*, 2 C.C.R. 404-1:800-811.
38 2 C.C.R. 404-1:803.g.(14).
39 2 C.C.R. 404-1:803.g.(3).
40 N.D. Cent. Code § 47-31-02, -03. *See also* N.D. Cent. Code. § 38-22-02(5).
41 *Mosser v. Denbury Resources, Inc.*, 898 N.W.2d 406, 408 (N.D. 2017).
42 *N.W. Landowners Assn. v. State*, 2022 ND 150, ¶ 2-6, reh'g denied (Aug. 25, 2022).

However, in August 2022, the North Dakota Supreme Court struck down these provisions under the Takings Clause of the North Dakota Constitution. The court first found that landowners have a constitutionally protected property interest in the underlying pore space and a right to compensation for use of their pore space. The court then determined that the legislation was an unconstitutional taking because it authorized a "physical invasion" of pore space owners' property by allowing third-party oil and gas operators to inject substances into the landowner's pore space without compensation (citing US Supreme Court precedent holding "where government requires an owner to suffer a permanent physical invasion of her property—however minor—it must provide just compensation.").[43] The court further explained, "By prohibiting the right to compensation for use of the surface owner's pore space and eliminating the right to exclude, S.B. 2344 removes all rights that make ownership of pore space valuable."[44]

The court's holding was specific to Class II waste disposal outside of the associated production unit, not Class VI wells or other Class II wells. The court did not address Class VI, but specifically distinguished Class II EOR operations and disposal operations within the production unit, where under ND law, mineral developers have an implied easement to utilize the pore space within the production unit in order to develop the minerals.[45] Assuming that in Colorado, pore space ownership is part of the surface estate, under the reasonable accommodation doctrine mineral developers in Colorado also have the right to access and use pore space as reasonably necessary to develop minerals.[46]

Key Takeaways for Colorado

While the court construed North Dakota's Constitution, statutes,[47] and case law, and the opinion is not binding in Colorado, Colorado courts would likely reach similar conclusions if Colorado were to enact similar statutory provisions. Therefore, Colorado should not adopt legislation containing provisions like those struck down in North Dakota that would strip pore space owners of central rights of property ownership, such as the ability to exclude, seek compensation for damages, and bring tort claims.

In order to protect Colorado's existing Class II program, policymakers should instead consider making clear that the proposed legislation is intended to apply only to Class VI projects, and that none of its provisions should be interpreted to alter the Class II program, including oil and gas operators' rights to inject E&P waste into pore space for disposal or EOR operations.

43 *Id.* ¶¶ 25-26.

44 *Id.*. ¶ 27.

45 For further discussion, see id. ¶¶ 28-30.

46 § 34-60-127, C.R.S.

47 For example, Colorado does not have an equivalent statute to North Dakota's Oil and Gas Production Damage Compensation Act.

Recommendations

Clear statutory provisions regarding pore space ownership will create a strong backbone for Colorado's Class VI program. Therefore, we recommend that the General Assembly adopt legislation that:

- Clearly defines pore space, surface owner, and other relevant terms;
- States that ownership of pore space is vested in the owner of the overlying surface estate, unless pore space has been expressly conveyed;
- Makes clear that pore space is severable from the surface estate and may be transferred the same way as mineral interests;
- Provides that the mineral estate is dominant over pore space rights, including that a mineral owner has the right to drill through pore space to develop minerals, subject to regulatory approvals;
- Extends the Reasonable Accommodation Doctrine to pore space;
- Contains disclaimers to ensure that the legislation will not be deemed an unconstitutional taking of private property, including that the legislation should not be construed to:
    - Alter the common law as it relates to property ownership;
    - Effect prior conveyances of pore space; or
    - Impair the rights of mineral developers to utilize enhanced recovery methods for the development of oil and gas.
- Avoids provisions similar to those that were declared unconstitutional by the North Dakota Supreme Court; and
- Considers how Class VI legislation may interact with Colorado's Class I and II programs.

Aggregating Property Rights and the Public Interest

When CO_2 is injected into the subsurface, it naturally spreads out to cover a large area—potentially tens to hundreds of square kilometers.[48] Therefore, Class VI projects will typically span numerous parcels of land under different ownership. A mechanism to combine subsurface property interests is thus necessary to enable large-scale projects. Creation of such a mechanism was recommended by the CCUS Task Force and a wide variety of stakeholders with whom COGCC consulted in preparation for this proposal.

While Colorado already has mechanisms for combining mineral interests for oil and gas development (pooling), and combining property interests in subsurface oil and gas reservoirs for enhanced oil recovery (unitization), neither of these mechanisms were designed for aggregating pore space rights for geologic storage. Therefore, we recommend that the legislature authorize a process to combine pore space rights specifically for geologic sequestration of CO_2.

48 Klass, Alexandra B. & Wilson, Elizabeth J., Climate Change, Carbon Sequestration, and Property Rights, 2010, pg 378, https://scholarship.law.umn.edu/cgi/viewcontent.cgi?article=1175&context=faculty_articles.

Table 3. State Approaches to Aggregating Pore Space Rights

	Wyoming	North Dakota	Montana	Nebraska	Kentucky	West Virginia
Citation	Wyo. Stat. § 35-11-314 et seq.	N.D. Cent. Code § 38-22-08	Mont. Code §§ 82-11-204, 205 (contingent)	Neb. Rev. Stat. §§ 57-1610 et seq.	Ky. Rev. Stat. §§ 353.806, 808	Ky. Rev. Stat. W. Va. Code § 22-11B-4
Aggregation of nonconsenting owners allowed	Yes	Yes	Yes	Yes	Yes	Yes
% threshold of consenting owners	80%	60%	60%	60%	51%	75%
Good faith negotiation required.	Nonconsenting owner threshold drops to 75% if operator can demonstrate at least 9 months of good faith negotiations.	Yes	No	Yes	Yes	Yes
Plan or agreement required	Yes	No	Yes	No	No	No
Compensation structure	Unit plan must include method by which pore space owners will be allocated the economic benefits generated by unit operations.	All nonconsenting pore space owners must be equitably compensated.	Not addressed	All nonconsenting pore space owners must be equitably compensated.	Must be addressed in pooling order.	All nonconsenting pore space owners must be justly and reasonably compensated.
Process	Separate Hearing	Part of Class VI permit application	Separate Hearing	Part of Class VI permit application	Not addressed	Part of Class VI permit application

Inclusion of Non-Consenting Owners

To facilitate large-scale sequestration projects in the State, the statutory mechanism for aggregating property rights should allow for inclusion of non-consenting owners. Ideally, a storage operator will be able to secure the consent of all pore space owners through voluntary contractual agreements to lease or sell pore space. However, given the large anticipated size of geologic storage reservoirs, a single sequestration project could require the use of pore space owned by hundreds or even thousands of individual landowners. It is therefore necessary to authorize the inclusion of non-consenting pore space owners to prevent a small number of holdouts from stopping a project from moving forward. However, due to unique Constitutional constraints on COGCC's authority to aggregate property held in trust by the State Land Board (SLB) without SLB's consent, the mechanism for aggregating the property rights of non-consenting owners would not apply to state trust pore space.[49]

Appropriate models can be found in Colorado's existing oil and gas pooling and EOR unitization statutes. These statutory and regulatory frameworks allow operators to pool the property interests of nonconsenting owners in situations, like carbon sequestration, where it is physically impossible to wall off individual property interests in a large area. While these frameworks provide helpful models, policymakers should not feel constrained to choose one or the other. Rather, decision-makers should feel free to design the most efficient process to facilitate CCUS projects while protecting the interests of all parties involved.

When an oil and gas operator is unable to obtain consent of all mineral owners in a common pool of oil or gas, the oil and gas pooling statute allows COGCC to enter an order pooling all interests in the drilling unit for the development and operation of the unit, provided that the operator owns or has secured the consent of at least 45 percent of the mineral interests to be pooled and meets all other statutory and regulatory requirements.[50] The legislature has authorized a different mechanism, referred to as unitization, to combine subsurface interests in an oil and gas reservoir for enhanced oil recovery (EOR). Recognizing the challenge of securing consent from all owners in a large area, the statute allows the COGCC to approve a unitization plan for unit operations that has been approved by 80 percent of the owners in the unit.[51] In essence, these statutory schemes recognize the public interest in aggregating property rights for these purposes, and therefore allow the involuntary consolidation of a subset of the property owners in the units (up to 55 percent for oil and gas pooling and 20 percent for EOR unitization), provided that the operator obtains consent from a threshold percentage of owners.

The necessity of involuntary pooling for geologic sequestration is arguably even greater than for conventional oil and gas development or EOR because the size of the storage reservoir will typically be much larger, and therefore more property owners will be involved. As with the existing pooling and unitization statutes, the legislature should establish a threshold percentage of consenting pore space owners for geologic storage. As shown in Table 3, other states have established a consenting owner threshold between 51 and 80 percent for CCUS. In establishing Colorado's threshold, policymakers will need to balance the desire to facilitate geologic sequestration projects with property rights concerns. The lower the threshold, the easier it will be to secure pore space rights for geologic sequestration projects.

Public Interest Declaration

To facilitate the aggregation of nonconsenting owners' pore space rights, the legislature should issue a declaration that carbon sequestration is in the public interest. A public interest declaration will help guard against claims that pooling nonconsenting owners constitutes an unconstitutional taking of private property.

Under the Colorado and United States Constitutions, private property may only be taken for "public use" and upon payment of just compensation. Colo. Const. art. II, §§ 14-15; U.S. Const. amend. V; see also § 38-1-201, C.R.S. In 2020, a group of mineral owners sued COGCC claiming that involuntary pooling constituted an unconstitutional taking. Plaintiffs argued that oil and gas pooling did not serve a public purpose, but rather was solely for the benefit of private oil and gas operators. The court rejected this argument, holding that forced pooling serves the public interests in curbing waste, protecting correlative rights, and protecting the state's economy.[52] Because oil and gas pooling served a public purpose, there was no unconstitutional taking.

A legislative declaration that CCUS is in the public interest would similarly aid the state in defending takings claims related to aggregating pore space for sequestration. Courts make the ultimate determination about whether a challenged use is in the public interest.[53] However, the Colorado Supreme Court has held that the General Assembly's public use determination "is entitled to careful consideration and great weight, as the judgment of a co-ordinate branch of the government of the necessities of the state for the development of its resources and the

49 See, e.g., Sunray Mid-Continent Oil Co. v. State, 368 P.2d 563, 566 (Colo. 1961); In re Canal Certificates, 34 P. 274, 276 (Colo. 1893).

50 § 34-60-116, C.R.S.

51 § 34-60-118, C.R.S.

52 *See, e.g., Wildgrass Oil and Gas Comm. v. Colorado*, 447 F. Supp. 3d 1051, 1069 (D. Colo. 2020), aff'd, 843 Fed. Appx. 120 (10th Cir. 2021)(unpublished).

53 Colo. Const. art. II, § 15

needs of the people in this respect."[54] Therefore, courts will defer to the legislature's reasonable determination of a public use, and accordingly a legislative declaration that CCUS is in the public interest is an important step toward facilitating and enabling CCUS projects in Colorado.

A "public use" is one that is "essentially for public benefit."[55] Colorado courts consider the following factors in determining whether a use is public: "the physical conditions of the country, the needs of a community, the character of the benefit which a projected improvement may confer upon a locality, and the necessities for such improvement in the development of the resources of a state."[56]

Other states have included public interest declarations in their carbon sequestration legislation. These declarations typically state that geologic storage of CO_2 is in the public interest for reasons including benefits to the state and global environment from reducing GHG emissions, ensuring the ongoing viability of the state's industries, and storage of a valuable commodity for potential later use.[57]

Equitable Compensation

Additionally, to avoid taking private property without just compensation in violation of the Colorado and U.S. Constitution, it is important to ensure that all nonconsenting pore space owners are equitably compensated. Because CCUS and pore space leasing are relatively new developments, there is likely insufficient data to set the rate of compensation for nonconsenting owners by statute. Similarly, we do not recommend the approach taken by Wyoming, which statutorily requires storage operators to include in any unitization application "the formula or method by which pore space will be allocated the economic benefits generated by use of pore space in the unit area" and "[a] proposed plan for generating economic benefits for the use of pore space within the unit area," as such a requirement could be unnecessarily complex and difficult to administer. Rather, it may be best to simply state that nonconsenting owners must be equitably compensated, and leave the details to be determined through rulemaking, COGCC hearings, market forces, or other means.[58]

Negotiation and Informational Requirements

Policymakers should also consider whether to require storage operators to negotiate in good faith with pore space owners before seeking an order pooling nonconsenting owners. Most states have included such a requirement in their CCUS statutes. (See Table 3.) It may also be prudent to consider requiring operators to provide information regarding the benefits and risks of carbon sequestration to pore space owners to aid their determination on whether to provide consent, as is required for oil and gas pooling.

Plan or Agreement

Some states' CCUS statutes,[59] and Colorado's EOR unitization statute[60] require operators to submit and obtain approval of a plan or agreement governing unit operations. For example, Wyoming requires operators to submit the following in support of a Class VI permit application:

- A proposed plan of unitization applicable to the proposed unit area which the applicant considers fair, reasonable and equitable and which shall include provisions for determining the pore space to be used within the area, the appointment of a unit operator and the time when the plan is to become effective;
- A proposed plan for determining the quantity of pore space storage capacity to be assigned to each separately owned tract within the unit and the formula or method by which pore space will be allocated the economic benefits generated by use of pore space in the unit area;
- A proposed plan for generating economic benefits for the use of pore space within the unit area;
- A proposed operating plan providing the manner in which the unit area will be supervised and managed and, if applicable, costs allocated and paid, unless all owners within the proposed unit area have joined in executing an operating agreement or plan providing for such supervision, management and allocation and, if applicable, payment of costs. All operating plans shall comply with all applicable environmental requirements.[61]

As shown in Table 3, several states allow aggregation of pore space rights without a legislative requirement to submit a plan or agreement. Requiring storage operators to submit a plan or agreement would ensure that COGCC obtained a great deal of detailed information about proposed operations, which may aid state regulators and policymakers. On the other hand, such requirements could impose additional burdens on operators.

54 *Tanner v. Treas. Tunnel, Mining & Reduction Co.*, 83 P. 464, 465-66 (Colo. 1906); *see also Hawaii Hous. Auth. v. Midkiff*, 467 U.S. 229, 244 (1984) (U.S. Supreme Court holding that, "if a legislature, state or federal, determines there are substantial reasons for an exercise of the taking power, courts must defer to its determination that the taking will serve a public use.").

55 *Carousel Farms Metro. Dist. v. Woodcrest Homes, Inc.*, 442 P.3d 402, 409 (Colo. 2019).

56 *Id.*

57 *See, e.g.*, L.B. 650, 107th Leg., 1st Reg. Sess. § 2 (Neb. 2021); N.D. Cent. Code § 38-22-01; La. Stat. Ann. § 30:1102; KY. Rev. Stat. § 154.27-100.

58 *See, e.g.*, L.B. 650, 107th Leg., 1st Reg. Sess. § 10(15) (Neb. 2021) (before issuing a permit, the commission shall find "[t]hat all nonconsenting reservoir estate owners are or will be equitably compensated.").

59 See Table 3.

60 § 34-60-118, C.R.S.

61 Wyo. Stat. Ann. § 35-11-315.

Process

The process required to establish a geologic sequestration project is another important consideration for the legislature. Any procedural requirements should strive to balance fairness to operators and pore space owners, property rights, and administrative efficiency.

Other states have taken a variety of approaches with respect to how much detail regarding process to require by statute for aggregation of property interests for CCUS (See Table 3). North Dakota, Nebraska, and West Virginia specify that a request for unitization and the associated materials should be submitted as part of the Class VI permit application, while Wyoming and Montana provide for a separate hearing before the state oil and gas commission. Kentucky is silent as to the required process, which leaves room for the regulatory agency to determine the process through rulemaking.

For Colorado, administrative efficiency would be served by deferring detailed procedural considerations at the legislative stage and directing COGCC to establish the process through rulemaking. COGCC has detailed procedural rules and experience in balancing multiple interests while ensuring due process through its hearing procedures. COGCC's experience in processing applications for oil and gas pooling and EOR unitization could further inform the appropriate procedure for aggregating pore space rights for CCUS.

Therefore, we recommend that the legislature empower COGCC to conduct a rulemaking to address the requirements for aggregating pore space rights, which would allow for greater flexibility and stakeholder input. Some key procedural considerations that should be addressed through COGCC rulemaking include:

Hearing Requirements

A hearing should be required any time an operator seeks to combine the property interests of nonconsenting owners so that the COGCC can ensure that aggregation is in the public interest and that any nonconsenting owners receive proper notice of the application, among other things. However, where a storage operator is able to obtain the consent of all relevant pore space owners, a hearing on aggregating those interests may be unnecessary, and principles of administrative efficiency weigh against a required hearing. Additionally, because we anticipate that COGCC will require a hearing prior to granting all UIC Class VI permit applications, it will likely be most efficient to include a request to aggregate pore space rights as part of the permit hearing.

Modification of Permitted Area

There should be a mechanism for amending an approved permit to incorporate additional pore space owners in an approved unit as needed as a CCUS project progresses. Initial models of the project area are not expected to be 100% accurate, particularly in early stages of this emerging industry's use of technology. Therefore, storage operators will need a mechanism to return to the COGCC to modify the area of their projects. The availability of such a mechanism could be established in statute, as in Wyoming and Montana, or through rulemaking.

Recommendations

To facilitate Class VI projects in Colorado, we recommend that Colorado adopt the following statutory provisions regarding aggregation of property rights:

- Provide a mechanism, applicable only to geologic storage, for aggregating property rights, including nonconsenting owners. We recommend an approach similar to the statutory mechanisms for oil and gas pooling or EOR unitization;
- Establish a threshold for consenting owners in a project that will be required prior to authorizing the pooling of nonconsenting owners;
- Issue a declaration that CCUS is in the public interest, which would create a pathway for involuntary aggregation of pore space rights. The declaration should be accompanied by an explanation of why CCUS is in the public interest—for example, because it will benefit the state by reducing GHG emissions, help Colorado meet its emission reduction goals, help ensure the viability of Colorado industries by providing a tool to reduce pollution and emissions, and/or protect and maintain carbon dioxide for potential future use;
- Ensure all pore space owners will be equitably compensated;
- Determine if good-faith negotiations and/or informational outreach are required prior to including nonconsenting owners;
- Determine if a unit plan or agreement is required; and
- Direct COGCC to conduct a rulemaking to establish the procedural requirements for aggregating pore space rights.

Long-Term Site Stewardship

Stored CO_2 will remain in the pore space in perpetuity. As storage operators will not exist in perpetuity, this creates a dilemma for long-term stewardship of stored CO_2 and storage facilities. The law can only hold a storage operator liable and regulatorily responsible so long as the storage operator exists. When a storage operator ceases to exist, for example through bankruptcy, no one would be liable or responsible for monitoring the storage facility. This would create a similar situation to orphaned wells. Further, perpetual liability for storage projects could chill investment in CCUS in the state.

Therefore, it is prudent and common for states to address long-term liabilities associated with storage facilities. This includes establishing mechanisms for long-term site stewardship and monitoring. States have commonly established legal regimes in which, after a period of post-injection monitoring by the storage operator, the states assume ownership, liability, and responsibility for the stored CO_2 and storage facility. In return, the states charge storage operators a fee which is deposited into a programmatic fund to defray the state's long-term costs.

Such a legal regime is prudent in that it addresses the perpetuity dilemma associated with geologic sequestration. The state assumes responsibility for the stored CO_2 and storage facility after injection is complete and the storage operator demonstrates that the CO_2 is stable. The operator-paid fee(s) defray the state's costs, and the state takes ownership of the stored CO_2 and storage facility.

Approaches to Long-Term Stewardship

Wyoming requires a 20-year post-injection monitoring period during which the storage operator retains all associated liabilities and ownership of the stored CO_2.[62] Upon expiration of the 20-year post-injection monitoring period, the storage operator can apply for a certificate of project completion. The department will only issue a certificate of project completion if the storage operator demonstrates that:

- The storage operator is in full compliance with all laws governing injection and storage of CO_2;
- The storage operator has addressed any pending claims regarding injection and storage;
- The pore space is not expected to expand vertically or horizontally and poses no threat to human health, human safety, the environment, or USDW;
- The CO_2 is unlikely to cross underground or pore space boundaries and is not expected to endanger USDW, human health, human safety, or the environment;
- All wells, equipment, and facilities are in good condition and will retain mechanical integrity; and
- The operator has properly plugged and abandoned any injection wells and has completed any required reclamation.[63]

Upon issuing the certificate of project completion, and without compensation, Wyoming acquires all rights, interests, and liabilities associated with the stored CO_2 and storage facilities. Wyoming releases the operator from all regulatory responsibilities and releases all associated financial assurance. Wyoming assumes responsibility for managing and monitoring the stored CO_2 and storage facilities until such time as the federal government may assume responsibility.[64]

Other states take similar, though slightly different, approaches. North Dakota, Louisiana, and West Virginia only require a 10-year post-injection monitoring period before the operator can apply for a certificate of project completion.[65] Nebraska does not specify a post-injection monitoring period, but uses available data to make case-by-case determinations on whether to issue a certificate of project completion.[66]

Louisiana, after issuing the certificate of project completion, may reimpose liability upon the operator if the operator is found to have intentionally and knowingly concealed or misrepresented material facts related to mechanical integrity or the chemical composition of injected CO_2.[67]

62 Wyo. Stat. Ann. § 35-11-319(b) (Effective 7/1/2023.)
63 Wyo. Stat. Ann. § 35-11-319(c) (Effective 7/1/2023.)
64 Wyo. Stat. Ann. § 35-11-319(d) (Effective 7/1/2023.)
65 N.D. Cent. Code Ann. § 38-22-17(4); La. Stat. Ann. § 30:1109(A)(1); and W. Va. Code, § 22-11B-12(c).
66 Neb. Rev. Stat. § 57-1619(1).
67 La. Stat. Ann. § 1109(A)(3).

Common characteristics other states' long-term stewardship provisions include that:

- The storage operator remains liable for the stored CO_2 and storage facilities during the post-injection monitoring period;
- The state will not issue a certificate of project completion until the storage operator demonstrates that the stored CO_2 does not reasonably pose a risk to USDWs, public health and safety, or the environment;
- The state assumes liability, ownership, and monitoring responsibilities after issuing the certificate of project completion; and
- The state charges storage operators fees to establish programmatic funds which cover the costs of post-closure long-term stewardship.

Some states also collect fees to fund pre-closure administrative, permitting, and regulatory activities. Programmatic funding is discussed in detail later in this recommendation. Some states also specify that, after issuing the certificate of project completion, the state owns the stored CO_2 and storage facility, but only until such time as the federal government assumes ownership thereof.[68] Whether such a provision should be included in Colorado's statute is a policy decision which the General Assembly will need to determine.

68 Wyo. Stat. Ann. § 35-11-319(d)(vi) (Effective 7/1/2023.); and N.D. Cent. Code Ann. § 38-22-17(6)(e).

Table 4. State Approaches to Long-Term Site Stewardship

	Wyoming	North Dakota	Louisiana	Nebraska
Citation	Wy. Stat., §35-11-319 (Eff. 7/1/2023).	N.D. Cent. Code Ann., §38-22-17	La. Rev. St., §30:1109	Neb. Rev. Stat. Ann., §57-1618 and §57-1619
Minimum post-injection monitoring period.	20 years	10 years	10 years	None. Case-by-case evaluation.
Agency required to issue certificate?	No. Agency ***may*** issue certificate.	No. Agency shall ***consider*** issuing certificate.	Yes. Agency ***shall issue*** a certificate upon demonstrations by storage operator.	No. Agency shall ***consider*** issuing certificate.
State owns CO_2 upon completion?	Yes	Yes	Yes	Yes
Storage operator released from liability upon completion?	Yes	Implied, but not explicitly stated.	Yes	Implied, but not explicitly stated.
Storage operator released from regulatory responsibility upon completion?	Yes	Yes	Yes	Yes
State reimposes liability and responsibility if storage operator makes misrepresentation?	No	No	Yes. If operator intentionally or knowlingly misrepresented facts related to mechanical integrity or chemical composition.	No
State's statute specifies that CO_2 ownership and responsbility can transfer to federal government?	Yes	Yes	No	No

Limiting State Liability

It is possible to limit state liabilities associated with long-term stewardship and ownership of stored CO_2 and associated facilities. Generally, Colorado's Governmental Immunity Act (CGIA) limits many state liabilities, except for those enumerated as waived areas.[69] Though "gas facilities" are a waived area,[70] Colorado courts have thus far limited the definition of "gas facilities" to those facilities used to distribute natural gas.[71] However, Colorado courts have not specifically addressed whether UIC Class VI sites and storage facilities constitute a "gas facility" and therefore a waived area under CGIA.

For the sake of clarity and limiting state liability, we recommend that the General Assembly specify that stored CO_2 and associated facilities are not included as a waived area for the purposes of § 24-10-106, C.R.S. The General Assembly could also specify that the broadest possible interpretation of governmental immunity applies to state-owned stored CO_2 and storage facilities.

It is also possible to limit any awarded monetary damages, to the extent they could possibly be imposed under the CGIA, so that such damages cannot exceed the balance of funds contributed to the Carbon Storage Stewardship Fund (discussed in the Programmatic Funding section) for the storage facility at issue. This is similar to Wyoming's approach.[72] Doing so would ensure that any damages awarded will not exceed those funds available in the Carbon Storage Stewardship Fund for the storage facility at issue. Wyoming also specifies that the existence, management, and expenditure of monies from Wyoming's post-closure stewardship fund does not constitute a waiver of governmental immunity or assumption of any liability by the state for geologic sequestration.[73] We recommend this approach.

Minimum Timeline and Project Completion

As discussed above, other states specify various post-injection monitoring periods before which the storage operator can apply for a certificate of project completion. Regardless of the timeline, all states require a technical demonstration that the geologic storage project no longer poses an endangerment to USDWs, as this and other requirements are included in the federal Class VI rules for site closure.[74] This is likely part of the reason that Nebraska did not include a minimum timeline.

Plume behavior within a saline aquifer has been modeled to help estimate the length of time required for stabilization and determine the factors that impact the plume migration.[75] In this model, 1 million tons of CO_2 was injected over 4 years into a saline aquifer. Model results indicate that the plume effectively immobilized at 25 years after injection ceased. Further, the modeling suggests that higher volumes of CO_2 injected over longer periods of time would take longer to stabilize. For example, a recently approved permit in North Dakota for an ethanol plant is planned to inject 3.7 million tonnes of CO_2 over 20 years[76] and other projects are expected to inject at higher volumes and rates. Such large storage projects may take over 20 years for plume migration to stabilize depending on several factors including the structure, confining layer, permeability of the storage formation, and other factors.

Based on federal rule and a state's project completion requirements, an operator of a large project with high volumes of CO_2 may be unable to provide an acceptable demonstration for project completion for at least 20 years. Therefore, a higher minimum timeline in statute would likely put a larger monitoring burden on both smaller projects with lower injected volumes and projects that are well contained and stable since these projects may be able to provide an acceptable demonstration prior to 20 years. These considerations should be included in determining a minimum timeline for post-injection site care.

Conversely, some stakeholders have expressed concerns that an excessively short post-injection monitoring period, and the prospect of early liability release, will provide insufficient incentives for storage operators to responsibly conduct storage operations. In an attempt to balance these concerns with the available data, we

69 § 24-10-106(1), C.R.S.

70 § 24-10-106(1)(e)-(f), C.R.S.

71 *Smokebrush Found. v. City of Colorado Springs*, 410 P.3d 1236.

72 Wyo. Stat. Ann. § 35-11-319(d)(iii). (Effective 7/1/2023.)

73 Wyo. Stat. Ann. § 35-11-320(d). (Effective 7/1/2023.)

74 40 C.F.R. § 146.93(b) and (c).

75 Doughty, C., Investigation of CO_2 Plume Behavior for a Large-Scale Pilot Test of Geologic Carbon Storage in a Saline Formation. Transport in Porous Media 82, 49-76, 2010, https://doi.org/10.1007/s11242-009-9396-z

76 DMR.nd.gov, Class VI Wells, Red Trail Energy Permit, pg 201, https://www.dmr.nd.gov/oilgas/C28848.pdf

recommend that Colorado establish a minimum 20-year post-injection monitoring period, during which the storage operator remains liable for the stored CO_2. After the 20-year period, the storage operator can apply for a certificate of project completion. In their application, and subsequent hearing, the storage operator must demonstrate that the CO_2 plume is stable and that all remaining facilities are in good condition and retain mechanical integrity (among other demonstrations listed in the following Recommendations). Once the storage operator applies for a certificate of project completion and makes the required demonstrations, COGCC should be authorized, but not required, to issue the certificate. This will give COGCC flexibility to make case-by-case evaluations on whether a particular storage facility is eligible for closure. It also addresses concerns that a short post-injection monitoring period will create incentives for irresponsible operatorship. We also recommend that, should a storage operator make a material misrepresentation in their application and/or hearing for project completion, COGCC is authorized to reimpose liability and regulatory responsibility upon that storage operator and require the storage operator to resubmit financial assurance for that facility.

Ownership of CO_2

For clarity related to liability and site stewardship, it is helpful to specify who owns the stored CO_2. Many states with Class VI legislation specify that, prior to project completion, the stored CO_2 and storage facility are owned by the storage operator.[77] After the agency issues the certificate of project completion, ownership of the stored CO_2 transfers to the state. We recommend this approach as it is consistent with our recommendations on state long-term stewardship and ownership of stored CO_2.

Further, some states specify that, after issuing the certificate of project completion, the state owns the stored CO_2 and storage facility only until such time as the federal government assumes ownership thereof.[78] At this time, it is unpredictable whether the federal government will agree to take over stored CO_2 ownership in the future. It is also unpredictable what the state's future priorities will be should the federal government offer to take over. If the General Assembly opts to address this issue, we recommend leaving that provision open-ended so that future policymakers can make the determination whether it is in the state's best interest to transfer ownership to the federal government.

While other states do not specify who owns the CO_2 prior to storage (i.e., during the capture and transportation phases), this may be an important consideration because the capture and transportation phases may have potential risks of environmental incidents. Therefore, it will be helpful to easily determine who owns the CO_2 during those phases. Typically, CO_2 ownership during the capture and transportation phases will be determined either contractually or according to the common law. We do not recommend altering contract or common law for this situation. However, you should consider whether to establish a statutory default for who owns the CO_2 during the capture and transportation phases only in the event that neither contract nor common law are determinative on that point.

Recommendations

Clarity from the General Assembly will be helpful when the COGCC begins Class VI rulemaking. Therefore, we recommend that Colorado adopt the following statutory provisions regarding project completion, long-term stewardship, and state liability for ownership of stored CO_2 and storage facilities:

- Establish a 20-year post-injection monitoring period during which the operator retains ownership of and liability for the stored CO_2 and storage facility. After the 20-year post-injection monitoring period, the storage operator can apply for a certificate of project completion.
- Specify standards by which the COGCC may, but is not required to, issue certificates of project completion. Such standards should include demonstrations by the storage operator, and considered sufficient by the Director, that:
    - The storage operator is in full compliance with all laws, rules, and regulations governing injection, storing, and monitoring of CO_2;
    - The storage operator has no outstanding claims against it associated with injecting and/or storing CO_2 or the storage facility at issue;
    - The stored CO_2 is stable and is not reasonably expected to migrate either into other subsurface formations or to the surface;
    - The stored CO_2 is not reasonably expected to endanger public health, safety, welfare, the environment, wildlife resources, or USDW;
    - The storage operator appropriately plugged and abandoned all injection wells in accordance with applicable COGCC Rules;

77 Wyo. Stat. Ann. § 35-11-318(b)(effective 7/1/2023); N.D. Cent. Code Ann., § 38-22-16; Neb. Rev. Stat. Ann., § 57-1618; and Ind. Code Ann. § 14-39-2-13(e).

78 Wyo. Stat. Ann. § 35-11-319(d)(vi) (Effective 7/1/2023.); and N.D. Cent. Code Ann. § 38-22-17(6)(e).

- All remaining storage facilities (including monitoring wells) are in good condition and are reasonably expected to retain mechanical integrity; and
- The storage operator has completed reclamation work in accordance with applicable COGCC Rules.

- Specify that, prior to COGCC issuing a certificate of project completion, title to the stored CO_2 and storage facilities remains with the storage operator who injected the CO_2 or the party to which said storage operator duly transferred title.
- Specify that upon issuance of a certificate of project completion, the storage operator is released from all regulatory requirements applicable to the UIC Class VI Program as to the storage facility for which the certificate is issued.
- Specify that, should the storage operator make any misrepresentations in its application for a certificate of project completion, the COGCC may reimpose regulatory responsibility, liability, and financial assurance obligations upon the storage operator for the storage facility at issue. In such a case, the storage operator's regulatory responsibility, liability, and financial assurance obligations should revert to the situation as it existed before the COGCC issued the certificate of project completion.
- Specify that upon issuance of a certificate of project completion and without compensation, the state assumes ownership of the stored CO_2 and storage facility.
- Specify that upon issuance of a certificate of project completion, the state assumes long-term stewardship of and liability for the stored CO_2 and storage facilities, including responsibility for monitoring the stored CO_2. Specify that state liability is limited, to the fullest extent allowable, by the Colorado Governmental Immunity Act.
- Specify that upon taking ownership of the stored CO_2 and associated facilities, that state-owned stored CO_2 and storage facilities are not considered "gas facilities" or "waived" area(s) under § 24-10-106, C.R.S.
- Specify that, should any party obtain a judgment against the state for any tort or other claim(s) associated with state-owned stored CO_2, storage facility(ies), or associated liabilities, that such judgment must be reduced so that the monetary award does not exceed the balance of funds contributed to the Carbon Storage Stewardship Fund for that specific storage facility.
- Specify that the existence, management, and expenditure of monies from the Carbon Storage Stewardship Fund does not constitute a waiver of governmental immunity or assumption of any additional liability by the state.
- Consider whether to include a provision that the state will transfer ownership of the stored CO_2 and storage facility if the federal government assumes ownership thereof. If the General Assembly opts to address this issue, we recommend leaving that provision open-ended so that future policymakers can make the determination whether it is in the state's best interest to transfer ownership to the federal government.

Programmatic Funding: Funds and TABOR Implications

To defray the costs of long-term stewardship and monitoring, we recommend that Colorado establish a state enterprise (Carbon Storage Stewardship Enterprise), direct the Carbon Storage Stewardship Enterprise to set a fee charged to operators on a per-ton–injected basis, direct that the fees be deposited into a fund (Carbon Storage Stewardship Fund), and authorize use of the Carbon Storage Stewardship Fund to cover the state's post-closure expenses associated with state ownership and stewardship of stored CO_2 and storage facilities.

While other states have taken similar approaches, Colorado has an added complication in that the Colorado Constitution's Taxpayer's Bill of Rights (TABOR) effectively restricts the state government's expenditures each year. Thus, we recommend establishing the Carbon Storage Stewardship Enterprise so that expenses associated with long-term stewardship are not counted against discretionary state spending.

Throughout this section and proposal, per-ton or per-tonne fees are included in a variety of contexts. While other states have not addressed in statute or rule what kind of ton is used (US or metric), we recommend the metric ton (or tonne) since it is the unit used in federal regulations. The 45Q tax credits are based on the amount of stored metric tons, and the calculations within Subpart RR for GHG accounting also utilize metric tons.[79] Other states did not define this detail in either statute or rule, but will likely base their fees on metric tons for consistency. North Dakota utilizes this strategy despite not defining this detail anywhere. Therefore, we do not think it is required to define this detail in statute, but if deemed necessary, this can be addressed in rulemaking. For simplicity and consistency, all uses of the word ton in regards to Colorado-based fees are intended to mean metric ton. For uses of "ton" in relation to other states' fees, this likely means metric ton but has not been confirmed outside of North Dakota.

Other States' Approaches to Stewardship Funds

Wyoming's statute establishes a "geologic sequestration special revenue account" (the "Wyoming Fund").[80] The Wyoming Legislature directed the Wyoming Department of Environmental Quality (WDEQ) to set a fee,[81] which is currently set at seven cents per ton of injected CO_2.[82] The fee is deposited into the Wyoming Fund. The WDEQ can only use the Wyoming Fund for: testing, monitoring, and long-term inspections of geologic sequestration sites; remediation of mechanical problems associated with remaining wells and infrastructure; plugging and abandoning monitoring wells; and future claims associated with CO_2 releases following site closure, release of the operator's financial assurance, and termination of the injection permit.[83] Wyoming also specifies that the existence, management, and expenditure of monies from the Wyoming Fund does not constitute a waiver of governmental immunity or assumption of any liability by the state for geologic sequestration.[84]

Louisiana's fund, the "carbon dioxide geologic storage trust fund" (the "Louisiana Fund"), is derived from a similar per-ton-injected fee in addition to an application fee and an annual fee charged to storage operators.[85] Louisiana caps the maximum amount of per-ton fees at $5 million per storage operator, subject to complex exceptions.[86] The Louisiana Fund is also derived from penalties, bond forfeitures, and other sources associated with CCUS. Unlike the Wyoming Fund, the Louisiana Fund can be used for a much broader range of CCUS activities.[87]

Rather than establishing only one fund for Class VI state expenses, other states, like North Dakota, Nebraska, and West Virginia, established two separate funds. The first is used to defray pre-closure commission expenses associated with permitting and regulation.[88] Those state commissions can also use their pre-closure fund

79 26 U.S. Code § 45Q and 40 C.F.R. § 98.443
80 Wyo. Stat. Ann. § 35-11-320. (Effective 7/1/2023.)
81 Wyo. Stat. Ann. § 35-11-320(b). (Effective 7/1/2023.)
82 Wyo. Admin. Code 020.0011.29, §4.
83 Wyo. Stat. Ann. § 35-11-320(c).
84 Wyo. Stat. Ann. § 35-11-320(d).
85 La. Stat. Ann. § 30:1110(C)(1)-(3).
86 La. Stat. Ann. § 30:1110(C)(1).
87 La. Stat. Ann. § 30:1110(E)-(F).
88 N.D. Cent. Code § 38-22-14; Neb. Rev. Stat. § 57-1616; and W. Va. Code, § 22-11B-13.

to compensate another state agency for any expenses incurred carrying out regulatory responsibilities.[89] North Dakota charges one cent per ton for its pre-closure fund, subject to certain exceptions discussed below.[90] Nebraska's pre-closure per-ton fee is to be set by rule.[91]

North Dakota, Nebraska, and West Virginia also each created a second fund to defray post-closure

89 N.D. Cent. Code § 38-22-14(2); Neb. Rev. Stat. § 57-1616(2); and W. Va. Code, § 22-11B-13(b).
90 N.D. Cent. Code § 43-05-01-17(1)(a)(1).
91 Neb. Rev. Stat. § 57-1616(1).

Table 5. State Approaches to Programmatic Funding

	Wyoming	North Dakota	Louisiana	Nebraska
Separate funds for pre- and post-closure costs?	No	Yes N.D. Cent. Code Ann, §38-22-05.	No	Yes Neb. Rev. St. §57-1607(1) & (2), generally
Sources of pre-closure fund	N/A	Per-ton-injected fee set by rule N.D. Cent. Code Ann, §38-22-14(1).	N/A	Per-ton injected fee Neb. Rev. St. §57-1616(1)
Cents per ton for pre-closure fund	N/A	1 cent per ton for CO_2 sources which "contribute to the... economy of North Dakota"; for all other sources of CO_2, to be set on case-by-case basis at hearing N.D. A.D.C., §43-05-01-17(1)."	N/A	To be set by rule (not set yet) Neb. Rev. St. §57-1616(1)
Sources of post-closure fund	Determined by rule Wyo. Stat. Ann. §35-11-320(b) (Eff. 7/1/2023).	Per-ton-injected fee set by rule N.D. Cent. Code Ann, §38-22-15(1).	Fees, penalties, bond forfeitures, private contributions, interests from monies deposited, civil penalties, etc. La. Rev. St. §30:1110(B).	Per-ton-injected fee Neb. Rev. St. §57-1617(1).
Cents per ton for post-closure fund	7 cents per ton Wyo. Rules 020.0011.29, §4(a)	7 cents per ton for CO_2 sources which "contribute to the... economy of North Dakota"; for all other sources of CO_2, to be set on case-by-case basis at hearing N.D. A.D.C., §43-05-01-17(1)."	Complex formula: Fx144<m F=per-unit-fee set by agency 144=total number of months for collecting fee M=maximum payment of $5MM at which point operator payment is suspended La. Rev. St. §30:1110(C)(1)."	To be set by rule (not set yet) Neb. Rev. St. §57-1617(1)

commission expenses for long-term monitoring and management of a closed storage facility.[92] Like the pre-closure funds, the post-closure funds may be used to compensate another state agency for carrying out regulatory requirements.[93] Those states which charge a per-ton-injected fee for their post-closure funds range from seven to eight cents per ton injected.[94]

North Dakota's legislature directed its commission to calculate its pre- and post-closure fund fees "based on the contribution of the storage facility and the source of the carbon dioxide to the energy and agriculture production economy of North Dakota."[95] In response, the North Dakota commission created two categories of fees. The first is for "[c]arbon dioxide sources that contribute to the energy and agriculture economy of North Dakota," and those fees are set at 1 cent per ton for the pre-closure fund and 7 cents per ton for the post-closure fund. For all other sources of carbon dioxide, the commission will determine the amounts to be paid at hearing based on the commission's expected expenses.[96] We do not recommend this approach as it will likely lead to burdensome administrative issues easily avoided by set per-ton-injected fees. Further, that the proposed Carbon Storage Stewardship Enterprise (discussed in the Post-Closure Stewardship Expenses section) would be required to set the post-closure fees would exacerbate such administrative burdens.

Pre-Closure Permitting and Regulatory Expenses

We recommend separating pre-closure and post-closure administrative expenses similar to the North Dakota, Nebraska, and West Virginia models. As the COGCC's current permitting and regulatory functions are already funded through the Oil and Gas Conservation and Environmental Response Fund (OGCERF), we recommend that COGCC pre-closure Class VI activities, including permitting and regulatory functions, be funded through the OGCERF. We also recommend that the COGCC be authorized to charge regulatory and permitting fees for Class VI projects. Those fees could include application fees, annual fees, and a small per-ton-injected fee.

Such fees should be deposited into the OGCERF and used to defray the COGCC's pre-closure administrative and regulatory costs. Authorized uses of the fees should include pre-permitting activities such as COGCC staff consultations conducted in preparation for an operator submitting an application. As the state's projected costs for permitting and regulatory activities will be best understood by the regulating agency, we recommend that the COGCC be authorized to set the pre-closure permitting and regulatory fees through rulemaking.

Post-Closure Stewardship Expenses & TABOR

We recommend that the General Assembly establish the Carbon Storage Stewardship Fund to defray the state's costs for stewardship and ownership of stored CO_2 and storage facilities. Such a fund must address TABOR, which imposes limits on government expenditures.[97] TABOR, and its associated statutory and case law, establish an exception for those fees imposed by state enterprises.

The state can establish a "Carbon Storage Stewardship Enterprise," which will qualify as a state enterprise if it is a government-owned business authorized to issue its own revenue bonds and receives less than 10% of its annual revenue from state- and local-government grants.[98] Rather than levy a tax, the Carbon Storage Stewardship Enterprise should be authorized to charge a fee to only storage operators. To qualify as a "fee" under TABOR, and thus be exempt from TABOR limitations, the fee must be "reasonably related to the overall cost of providing the service and is imposed on those who are reasonably likely to benefit from or use the service."[99]

In our proposal for a per-ton-injected fee imposed on storage operators, only the storage operators would be charged the fee. The fee is used to provide a service from which the storage operators benefit in that they are released of regulatory responsibility and liability for the stored CO_2 and associated facilities. Thus, the fee will qualify as defined under TABOR, and it would not limit the state's discretionary spending in other areas.

Our proposal for the Carbon Storage Stewardship Enterprise is similar to the enterprise and fund created for orphaned oil and gas wells.[100] The Carbon Storage Stewardship Enterprise board would impose the per-ton-injected fee on storage operators. The board would also be authorized to periodically adjust the fee based on projections of state costs for long-term stewardship and ownership.

All fees (except those imposed directly by COGCC for pre-closure expenses) would be deposited into the Carbon Storage Stewardship Fund, which would be continually appropriated to the COGCC for the purposes of conducting post-closure stewardship activities. As the COGCC already has the staff and technical expertise to conduct post-closure stewardship activities, the

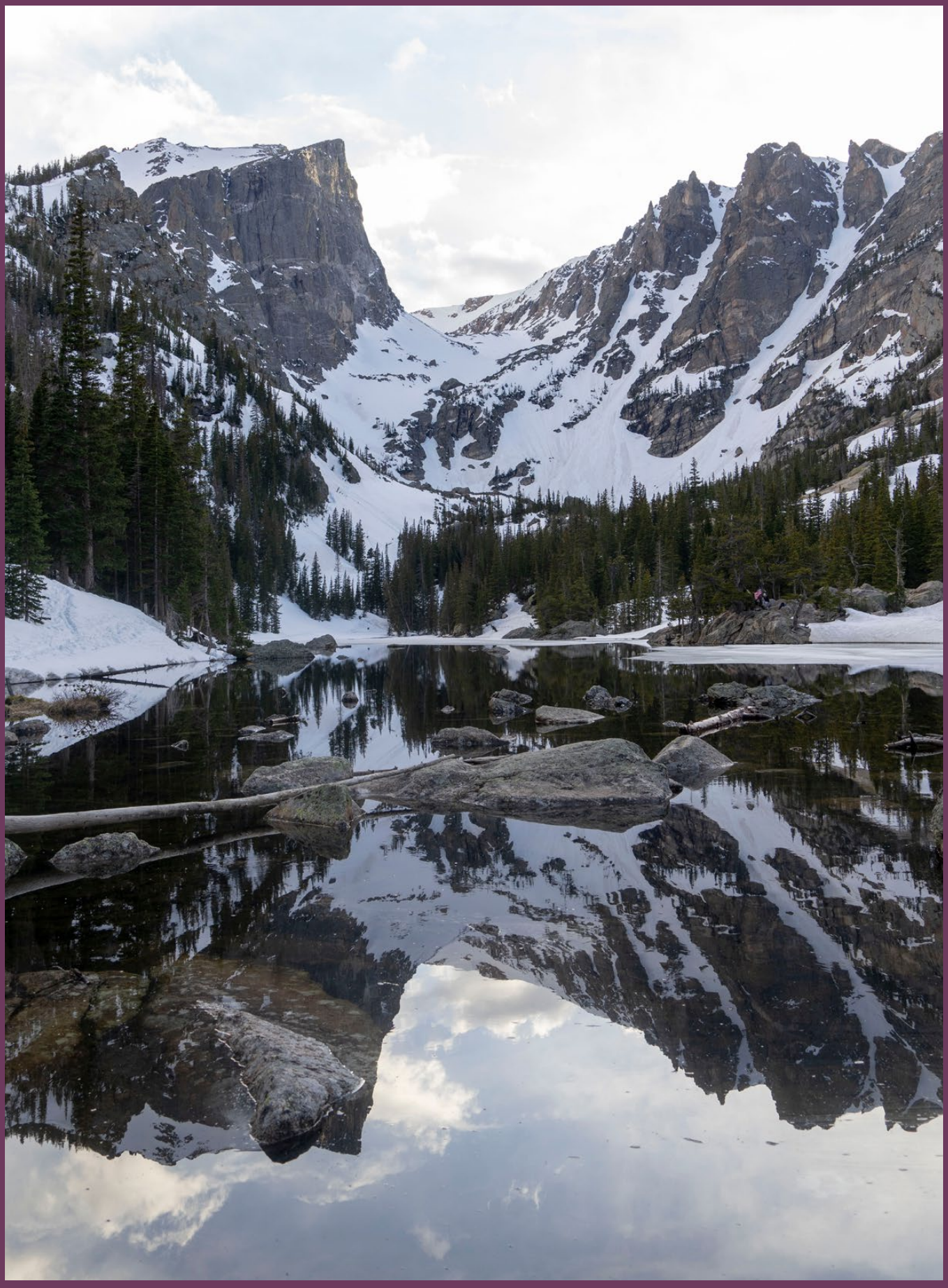
92 N.D. Cent. Code § 38-22-15; Neb. Rev. Stat. § 57-1617; and W. Va. Code, § 22-11B-15.
93 *Id.*
94 Wyo. Admin. Code 020.0011.29, §4(a); N.D. Cent. Code § 43-05-01-17(1)(a)(2); and H.B. 1209, 122nd Gen. Assemb., 2nd Reg. Sess. (Ind. 2022), §9(a) & (c) (Indiana fee is eight cents per ton set by statute).
95 N.D. Cent. Code § 38-22-14(1); and N.D. Cent. Code § 38-22-15(1).
96 N.D. Admin. Code § 43-05-01-17(1).
97 Colo. Const., art. X, § 20, generally.
98 Colo. Const., art. X, § 20; § 24-77-102(3), C.R.S.
99 *Tabor Found. v. Colorado Bridge Enter.*, 353 P.3d 896 (Colo. App. 2014).
100 § 34-60-133, C.R.S.

COGCC would be responsible for actually conducting these activities. From the fund, the COGCC would be reimbursed for its costs. The Carbon Storage Stewardship Enterprise would be responsible for periodically recalculating the per-ton-injected fee to adjust for updated cost projections.

Recommendations

Based on the foregoing, we recommend that the General Assembly adopt the following statutory provisions to address pre- and post-closure costs of a UIC Class VI Program:

- Create a Carbon Storage Stewardship Enterprise.
- Authorize the Carbon Storage Stewardship Enterprise to impose a fee on storage operators and enumerate the authorized source(s) of the fee. We recommend a per-ton-injected fee. The Carbon Storage Stewardship Enterprise board should periodically adjust this fee based on projected costs associated with the state's post-closure CO_2 ownership, long-term stewardship (including monitoring sites and maintaining mechanical integrity of monitoring wells), and potential liabilities associated with stored CO_2 and storage facilities.
- Specify that the COGCC will collect the fee on behalf of the Carbon Storage Stewardship Enterprise.
- Create a Carbon Storage Stewardship Fund into which the per-ton-injected fees will be deposited.
- Specify that the Carbon Storage Stewardship Fund is continually appropriated to the COGCC to defray COGCC costs associated with post-closure CO_2 ownership, stewardship, and potential liabilities associated with stored CO_2 and storage facilities.
- Define the authorized uses of the Carbon Storage Stewardship Fund to include any COGCC post-closure activities from the UIC Class VI Program, including those associated with state ownership and long-term stewardship of stored CO_2 and storage facilities and potential liabilities.
- Authorize use of the Carbon Storage Stewardship Fund to compensate other state agencies for any expenses incurred carrying out regulatory responsibilities associated with post-closure activities of Colorado-based Class VI projects.
- Specify that the existence, management, and expenditure of monies from the Carbon Storage Stewardship Fund does not constitute a waiver of governmental immunity or assumption of any liability by the state for geologic sequestration.
- Exclude pre-closure COGCC activities as permissible uses of the enterprise fund. We recommend that, instead, the Oil and Gas Conservation and Environmental Response Fund be used to cover pre-closure COGCC Class VI activities (e.g., permitting, regulation, enforcement). This should include authorization to compensate other state agencies for any expenses incurred carrying out pre-closure regulatory responsibilities associated with Colorado-based Class VI projects.
- Authorize the COGCC to set and collect permitting and regulatory fees to defray the COGCC's and other state agencies' pre-closure costs of the UIC Class VI Program, including, but not limited to, permitting and regulatory costs. These fees can include application fees, annual fees, and/or a per-ton-injected fee, but should be based on actual permitting and regulatory costs. This should include fees to cover COGCC pre-permitting activities such as staff consultations conducted in preparation for an operator submitting an application.



Environmental Justice

It is essential that environmental justice (EJ) principles be incorporated throughout Colorado's UIC Class VI program, both because promoting EJ is an important public policy goal of the state and because doing so is required to gain Class VI primacy and obtain grants from EPA.

With House Bill 21-1266 (the "EJ Act"), the General Assembly declared that environmental justice is a priority in the state of Colorado, and that "state government has a responsibility to achieve environmental justice, health equity, and climate justice for all communities by avoiding and mitigating harm."[101] Measures to promote environmental justice, including avoiding adverse impacts to DI communities and ensuring additional stakeholder outreach where state permitting processes could impact DI communities, are important for protecting Colorado's communities and beginning to remedy longstanding environmental inequities.

EJ principles have already been incorporated into the COGCC's regulatory framework. [102] However, statutory and regulatory provisions should be enacted to ensure that EJ is properly addressed in the specific context of Colorado's proposed UIC Class VI program. The CCUS Task Force put forward the following principles to guide implementation of CCUS in Colorado:

- In order to mitigate harms and prioritize benefits, it is important to identify where locations of carbon capture, transport, and storage might affect DI communities, as defined in HB21-1266, and to prioritize those community voices in decision-making.
- Governments and industries should pursue meaningful community involvement—early and often in all decision-making—to learn from and respond to community concerns.
- Carbon reduction technologies like CCUS must not exacerbate existing harms in DI communities, and wherever possible, should reduce those harms.
- CCUS deployment should prioritize environmental, health, and economic benefits in DI communities.
- When CCUS is deployed at facilities, improvements should be made to the facilities to ensure that there is no increase, and where possible are decreases, in localized pollution in the communities where they are deployed, especially in DI communities.[103]

The Environmental Justice Advisory Board (EJAB) within CDPHE—a board composed of members of DI communities, nongovernmental organizations with expertise in EJ, and others—reviewed these recommendations and provided input on them.[104] Given the EJAB's expertise in EJ, policymakers should carefully consider the group's recommendations, including siting projects to avoid adverse impacts to DI communities, conducting meaningful EJ analyses for CCUS projects, and ensuring robust community involvement in the permitting process.

In addition to the EJAB, the EJ Act created the Environmental Justice Action Task Force (EJ Task Force), tasked with recommending and promoting strategies for incorporating EJ into state agency decision making.[105] The EJ Task Force issued recommendations relevant to the implementation of Colorado's Class VI program, including recommendations that agencies utilize environmental equity and cumulative impact analyses in permitting decisions, community engagement best practices, and revisions to the statutory definition of DI community.[106] Policymakers should consider the EJ Task Force's forthcoming recommendations in carrying out the legislative and regulatory actions discussed in this proposal.

101 H.B. 1266, 73rd Gen. Assemb., 2nd Reg. Sess. (Colo. 2022), § 2(c)(I).

102 *See, e.g.*, 2 C.C.R. 404-1:303, 304, 309, 314, 434, 604.

103 CCUS Task Force Report at 3-4, https://www.mines.edu/carboncapture/wp-content/uploads/sites/365/2022/02/Task-Force-Recommendations-Final.pdf

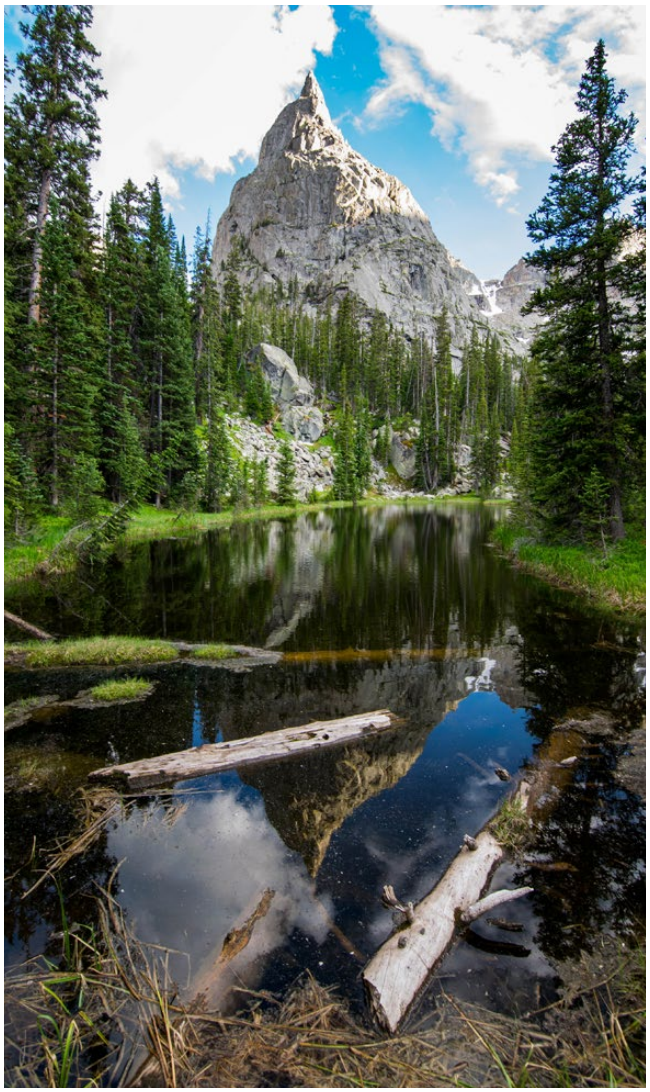
104 Final Report: EJAB Feedback on CCUS Task Force Recommendations, October 27, 2022, https://drive.google.com/drive/folders/1EcIlpYy7-ceu82iSd2ZzOz8qiZh7mviu

105 C.R.S. 25-1-133.

106 Colorado Environmental Justice Action Task Force, Final Report of Recommendations, November 14, 2022, https://drive.google.com/drive/folders/1mOt94sVmWZVj3GKo8CXCndvc7JfODuk2

Additionally, EPA and CDPHE have established a memorandum of understanding and work plan aimed at collaborating to advance EJ through prioritizing environmental enforcement efforts in DI communities, enhancing community engagement, and ensuring the benefits of settlements flow to impacted communities.[107] It may be appropriate for COGCC to incorporate similar principles into agency policy and/or rules.

Further, EPA will require that Colorado's Class VI program incorporate EJ as a condition for granting primacy. For instance, Colorado's Class VI regulations must be at least as protective as EPA's, which require a thorough EJ review for all Class VI permits. In Colorado, this may be best accomplished by using CDPHE's interactive mapping EJ tool, Colorado EnviroScreen,[108] to determine whether a disproportionately impacted community is located within or near a project's Area of Review. If so, additional risk analysis, targeted outreach, public participation, and siting reconsideration may be required. And importantly, EPA has indicated that EJ will be a required component for states to obtain federal grant funding authorized by the IIJA. However, these requirements have not been defined.



These detailed considerations are most appropriately addressed through rulemaking.[109] Additionally, because EPA must approve COGCC's Class VI regulations prior to granting primacy, it may be prudent to avoid overly prescriptive statutory language that could hamstring COGCC's rulemaking authority. One approach to this was the language proposed last session in SB22-138, which provided that "In issuing and enforcing permits pursuant to this Subsection (9)(c), the Commission shall ensure that the permitting of Class VI injection wells does not adversely and disproportionately affect the health and well-being of Disproportionately Impacted Communities." An approach that could further ensure flexibility to address EJ as required by EPA to obtain primacy would be legislative language directing COGCC to adopt regulations aimed at promoting EJ and avoiding adverse impacts to DI communities.

Recommendations

We recommend that EJ be incorporated in statute and throughout the CCUS regulatory process. Specifically:

- The General Assembly should enact statutory language directing COGCC to promulgate rules aimed at avoiding adverse impacts to DI communities.
- Policymakers should consider the recommendations of the EJAB and EJ Task Force and incorporate those recommendations into Colorado's Class VI program.
- COGCC, CDPHE, the EJAB, and stakeholders including DI community members should continue to work together to develop CCUS policy.

107 Memorandum of Understanding on Advancing Environmental Justice through Enforcement and Compliance Assurance Efforts in Disproportionately Impacted Communities between the United States Environmental Protection Agency Region 8 and the Colorado Department of Public Health and Environment, March 8, 2022. https://drive.google.com/file/d/14o0E-LhS7c_uzifH4xaztrmhJA9mh4la/view; EPA-CDPHE Memorandum of Understanding (MOU) on Advancing Environmental Justice through Enforcement and Compliance Assurance Efforts in Disproportionately Impacted Communities, Draft Work Plan for Fiscal Year 2023, https://drive.google.com/drive/folders/1NJZTZYTZPcAlAll25B4yxvFmMwLitX6H.

108 CDPHE.colorado.gov, Colorado Enviroscreen, https://cdphe.colorado.gov/enviroscreen

109 The COGCC has experience in analyzing environmental justice issues that will aid the agency in reviewing Class VI applicants' EJ analyses. For new oil and gas locations, the COGCC requires the operator to include an analysis of disproportionately impacted communities in its Oil and Gas Development Plan. Depending on the project, the DI community analysis may require extended public comment, extended consultation, additional outreach, a Community Outreach Plan, and/or an alternative location analysis to determine if a different site is better suited for the project. This existing review process could be adopted and altered to fit the needs of a Class VI project, including incorporating additional screening tools as needed. See COGCC.state.co.us, Disproportionately Impacted Communities: Rules, GIS Mapping, Scenarios, & Outreach - Operator Training, February 2, 2021. https://cogcc.state.co.us/documents/sb19181/Guidance/Mission_Change_Guidance/DIC_Presentation_2-2-2021.pdf.

Pipelines

Pipelines are essential for the success of numerous subsurface operations in Colorado, including CO_2 sequestration, oil and gas, waste disposal, underground gas storage, geothermal operations, and more. As CCUS activity increases in Colorado, the need to transport CO_2 is expected to increase significantly. Further, reliable transport from CO_2 sources to sequestration sites is important for the success of Class VI projects. Additionally, it is vital to ensure all pipelines and flowlines are operating safely and are abandoned properly when no longer in use.

While sequestration is an emerging industry, transportation of CO_2 through pipelines has been successfully carried out in Colorado for several decades, primarily for use in EOR projects. There are 3 existing CO_2 pipelines in Colorado presently transporting fluid for use in EOR operations. This includes 2 pipelines transporting CO_2 from natural underground reservoirs in southern Colorado to the Permian Basin of West Texas, and the Rangely Weber Sand Unit in northwest Colorado, where CO_2 captured and produced in Wyoming is transported for use in the Rangely Field for EOR.

There is currently just over 5,000 miles of active CO_2 pipeline within the United States. Based on modeling, it is estimated that over 29,000 miles of CO_2 pipeline will be needed in western, midwestern, plains, and gulf regions of the United States to transport CO_2 from sources to storage and usage sites in the near to medium term in order to meet climate goals.[110] A portion of this additional mileage will be required in Colorado.

The safety of CO_2 pipelines and flowlines is an important consideration. Generally, the operational and overall risks associated with CO_2 pipelines is less than other types of pipelines including oil and natural gas.[111] With that said, there was an incident in Mississippi in February 2020 in which a landslide caused a CO_2 pipeline to rupture.[112] This incident highlighted some issues with existing regulatory processes. In response, the Federal Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) is conducting a CO_2 pipeline rulemaking, among other actions, that will address safety concerns for all CO_2 pipelines and will also specifically address gaseous CO_2 transport under 49 C.F.R. § 192.[113]

The Colorado Energy Office's CCUS Task Force identified pipeline siting and regulation as a potential barrier to the deployment of CCUS in Colorado. Their recommendations for pipelines include identifying existing rights-of-way and ideal locations for CO_2 pipeline corridors, clarifying the regulatory process, addressing state siting authority, encouraging coordination between state and local governments, developing an infrastructure action plan, and other potential solutions.[114]

To evaluate potential state approaches, COGCC conducted research and outreach on topics related to pipelines including state siting authority, corridor establishment, regional infrastructure planning, pipeline safety regulation, and eminent domain for CO_2 pipelines. As pipelines are a vital consideration for existing and emerging energy industries, and the impact of the siting and the safety of pipelines is a contested topic, a more focused scoping project is likely appropriate for a topic of this magnitude.

State Siting Authority

Pipeline siting is an elaborate process that can include the establishment of rights-of-way through multiple jurisdictions that may require numerous permitting and siting processes with various requirements. Additionally, the siting of pipelines commonly includes the use of eminent domain authority to acquire property along the pipeline route as long as it is for the public good. The CCUS Task Force recommendations included encouraging direct coordination between state and local governments for permitting and regulating CO_2 pipeline construction and operation standards and to consider state siting authority that appropriately addresses the concerns of local governments.

In Colorado, there is no state-level pipeline permitting or siting authority. Pipelines are sited parcel by parcel and may include pipeline companies working with private landowners, the State Land Board, local governments, counties, and others for each separately owned parcel

110 Abramson E., McFarlane D., Brown J., Transport Infrastructure for Carbon Capture and Storage: Whitepaper on Regional Infrastructure for Midcentury Decarbonization, Great Plains Institute, June 2020, pg V. https://www.betterenergy.org/wp-content/uploads/2020/06/GPI_RegionalCO_2Whitepaper.pdf

111 Hawkins, J., Duguid, A., Keister, L., CO2 Pipeline Risk Assessment for a Regional-Scale Pipeline in the Midcontinental United States, April, 2021, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3821323.

112 PHMSA.dot.gov, Failure Investigation report, May 26, 2022, https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/2022-05/Failure%20Investigation%20Report%20-%20Denbury%20Gulf%20Coast%20Pipeline.pdf.

113 PHMSA.dot.gov, PHMSA Announces New Safety Measures to Protect Americans From Carbon Dioxide Pipeline Failures After Satartia, MS Leak, May 26, 2022, https://www.phmsa.dot.gov/news/phmsa-announces-new-safety-measures-protect-americans-carbon-dioxide-pipeline-failures.

114 CCUS Task Force Recommendations, Colorado Energy Office, February 1, 2022, https://www.mines.edu/carboncapture/wp-content/uploads/sites/365/2022/02/Task-Force-Recommendations-Final.pdf

along the proposed route of the pipeline. Depending on the jurisdiction, counties and local governments will likely have different siting requirements and processes for pipelines. Any use of eminent domain for locating pipelines must abide by state law and is administered by district courts. Colorado eminent domain law pertaining to CO_2 pipelines is outlined in further detail later in this section.

Pipeline siting is typically regulated at the local level. An example of a state with full siting authority for all pipelines is Iowa through the Iowa Utilities Board (IUB).[115] Generally, the IUB issues pipeline permits for any pipeline that will go through public land within Iowa. This process is largely independent of local and federal processes, but all jurisdictions and stakeholders may give input during the permitting process. Some of the provisions in Iowa law include:

- Requirements for outreach and notification to affected counties and landowners;
- Prohibiting negotiation or purchase of lands by a pipeline company until after a public informational meeting;
- Granting eminent domain authority to a pipeline company for specific land parcels on a project basis through the permitting process;
- Petition, hearing, and objection processes;
- The ability to charge fees for related meetings, hearings, and inspections;
- Granting the pipeline company reasonable access for the project including land surveying;
- Ensuring proper compensation for all damages to landowners including processes for determining damages; and
- Bonding and reclamation requirements.

The IUB has had siting authority for decades and has a well established program that encourages collaboration with impacted communities and counties.[116] Through the permitting process, local governments and other stakeholders may give input, petition, or object to the permit. The process also requires a public informational meeting in every impacted county that is administered by the IUB and the pipeline company.[117] Additionally, counties impacted by the pipeline must designate a county inspector for each pipeline project to ensure the project abides by all state and local laws and meets all permitting requirements.[118] The county inspector communicates any issues to the IUB and all reasonable costs of inspection are the responsibility of the pipeline company. Further, through the permitting process, eminent domain can be granted but involves a parcel-by-parcel decision within the permit including an evaluation of public use and benefit as well as alternative routing.[119]

In Colorado, local governments have taken the lead in siting pipelines and some have established related rules and regulations.[120] At the COGCC, with the passage of SB19-181, new regulatory relationships were established with local governments, which enabled them to have increased oversight of land use related to oil and gas activities in their communities. As such, any state siting authority will likely need to address state and local concerns and requirements. Extensive outreach to and cooperation with local governments will be a requirement if pursuing and implementing state siting authority, including establishing agreements where necessary.

State pipeline siting authority provides some potential benefits to the state including:

- Providing siting consistency across all local jurisdictions;
- A state agency to coordinate information for each project;
- Ensuring the siting of pipelines incorporates an EJ analysis and properly involves all impacted communities;
- A comprehensive notification process; and
- Being consistently protective of public health and safety, wildlife resources, and the environment across all state and county lands.

While there are benefits to state siting authority, there are also associated concerns that include:

- State siting authority could add an extra layer of regulation to the existing complicated process;
- Local governments may have concerns over the state taking control of any portion of pipeline siting in their jurisdiction;
- The required state resources needed to implement a siting program;
- Legal barriers such as changes to eminent domain law; and
- Eminent domain abuse and related issues.

115 Iowa Code §§ 479, 479B.

116 Iowa Utilities Board, Pipeline Permits, https://iub.iowa.gov/regulated-industries/natural-gas-pipeline-permits.

117 IUB.IOWA.gov, Hazardous Liquid Pipeline Permit Process, https://iub.iowa.gov/sites/default/files/documents/2020/12/hazardous_liquid_pipeline_permit_process_rev._12.2020_0.pdf.
Example of an Informational meeting document from the IUB for a CO2 pipeline, October 13, 2021, https://wcc.efs.iowa.gov/cs/idcplg?IdcService=GET_FILE&allowInterrupt=1&RevisionSelectionMethod=latest&dDocName=2073917&noSaveAs=1.

118 IUB.iowa.gov, County's Role in the IUB's Pipeline Permit Process, https://iub.iowa.gov/sites/default/files/documents/2021/10/countys_role_in_pipeline_projects_10.20.2021.pdf.
IUB.iowa.gov, Instructions for County Inspectors - Pipeline Construction Projects, https://iub.iowa.gov/sites/default/files/documents/2021/10/rmu-2020-0009_instructions_for_county_inspectors_10.2021_reduced.pdf.

119 Iowa Code § 479.24 and 479B.16.
IUB.iowa.gov, Frequently Asked Questions about Eminent Domain, https://iub.iowa.gov/sites/default/files/documents/2021/09/eminent_domain_faqs_rev_9.2021.pdf

120 Weldgov.com, Weld County Location Assessment for Pipelines, https://www.weld.gov/Government/Departments/Oil-and-Gas-Energy/Location-Assessment-for-Pipeline-LAP

Further outreach is required on this topic to determine if state siting authority is appropriate for Colorado and, if desired, how to approach siting authority. If pipeline siting authority is to be pursued, it must be done in a way that is protective of communities, the environment, and state resources while seeking to improve the efficiency of the existing arduous processes.

Corridor Establishment

A corridor initiative is a state-led project that seeks to establish corridors on public lands and allocate them for future use of CCUS pipelines. The intention of the project would be to help coordinate the expansion of CO_2 transport infrastructure at the state level, reduce overall impact of CO_2 transport, utilize existing corridors as much as possible, incorporate the input from various stakeholders, and help reduce the time associated with siting and permitting these large infrastructure projects. With several existing rights-of-way running along the front range, including interstates, railroad networks, and existing pipelines, co-locating new pipelines along existing routes can increase efficiency and reduce impact.[121] Corridor establishment would likely include extensive outreach to stakeholders and state and local authorities pertaining to existing and potential rights-of-way, utilizing data to create maps of potential CO_2 pipeline corridors, and establishing agreements as needed with agencies and entities that identify and potentially reserve access across public lands for future use of CO_2 pipelines. The mapping portion of the project would include compiling data of existing pipelines, rights-of-way, point sources, potential sequestration sites, and other items. Beyond mapping, extensive outreach would be required with CDOT, SLB, counties, municipalities and other stakeholders to determine what corridors are feasible for use and would satisfy Colorado's needs for CO_2 transport.

Wyoming has established pipeline corridors for future CO_2 transport through their pipeline corridor initiative.[122] By coordinating with researchers, industry, and state organizations, Wyoming has identified about 2000 miles of pipeline corridors as essential for future CO_2 transport and the majority of these miles, which fall on federal lands, have been authorized by the BLM.[123] While this project would be similar in concept to a project in Colorado, Wyoming has significant federal lands where infrastructure is required for carbon transport and therefore, the biggest investment for Wyoming in this project was associated with working with the BLM on the environmental impact statement (EIS). Wyoming estimated that they spent nearly $2 million on this project with the majority associated with the EIS. Based on Colorado's CO_2 infrastructure needs, there are few federal lands where corridors would be needed and therefore, a corridor establishment project in Colorado would likely look different than the Wyoming project and may require different resources.

If Colorado pursues a corridor project, the state will need to evaluate data availability and determine options for analysis and mapping based on outreach and discussion. Great Plains Institute (GPI) has completed related work at a broader level that included compiling point source emission data, identifying 45Q-eligible facilities, and modeling optimized CO_2 transport infrastructure.[124] While this work provides a foundation for future work, it does not incorporate the use of all existing rights-of-way, specific siting issues, the planned retirement of coal-fired power plants in Colorado, the updated tax credit economics, nor additional 45Q-eligible facilities based on the recently passed IRA, among other Colorado-specific issues. Therefore, data acquisition and mapping will need to be completed on a more detailed and local scale. There are a variety of potential data sources that could help inform this project including emission data from the EPA, pipeline location data from PHMSA's National Pipeline Mapping System, flowline location data from the COGCC, intrastate gas pipeline location data expected to be obtained by the Colorado Public Utilities Commission (COPUC), rights-of-way information from CDOT, and other sources. Additionally, modeling similar to GPI's study could be useful in determining realistic CO_2 volumes and pipeline requirements.[125] To address this project, collaboration or even the use of consultants may be beneficial to compiling comprehensive mapping data. This could involve working with Colorado School of Mines, other research groups, or consultants. Further outreach and discussion on this topic is required.

In parallel with mapping and data acquisition, discussion and outreach will be required to narrow the corridor possibilities and involve all potentially impacted stakeholders, entities, and agencies. Thorough communication is essential to the success of this project and must be done early, often, and prior to releasing any maps with potential future corridors for CO_2 transport. This will involve working with a variety of state agencies, counties, municipalities, and will likely require local community engagement. As an additional benefit to this process, the state could incorporate EJ analyses and ensure disproportionately impacted communities (DI communities) have input throughout the process. We do not recommend that the state establish corridors over private lands as this is more appropriately addressed by the pipeline company on a project-specific basis.

121 Great Plains Institute, US Carbon and Hydrogen Hubs Atlas, The Rockies: Denver Hub, pg 3, February 2022, https://carboncaptureready.betterenergy.org/wp-content/uploads/2022/01/Rockies_Carbon_Hydrogen_Hub.pdf.

122 Wyoming Energy Authority, Wyoming Pipeline Corridor Initiative, https://wyoenergy.org/energy-strategy-energy-generation/.

123 Bureau of Land Management National NEPA Register, Wyoming Pipeline Corridor Initiative Project, Documents, https://eplanning.blm.gov/eplanning-ui/project/1502028/570.

124 Great Plains Institute, Colorado: Implementing Carbon Capture and Storage Technology, August, 2020, https://carboncaptureready.betterenergy.org/wp-content/uploads/2020/09/CO_8_26_2020.pdf.

125 SimCCS Gateway, Open Source software for designing Carbon dioxide capture, transport and storage, https://simccs.org/.

A state-led pipeline corridor project, while different from Wyoming's project, is likely possible and may help reduce overall impact of CO_2 transport by taking a broader, state-wide approach to corridor placement versus a patchwork approach project by project. This initiative would likely require up to 2 years of work, depending on available dedicated resources for the project and other factors discussed above.

Regional Infrastructure and Project Planning

Regional infrastructure planning and coordination with other states is another important consideration as CCUS activity increases throughout the nation. It could be beneficial for Colorado to coordinate with other states in the region to share lessons learned and discuss barriers encountered and any other issues relevant to CCUS and CO_2 transport. Additionally, cooperation on Class VI projects that span jurisdictional boundaries is likely to occur at some point, and may even require establishing agreements with other agencies.

GPI is coordinating an effort to implement a Regional CO_2 Transport Infrastructure Action Plan[126] and encourage communication and collaboration between states for issues related to CCUS. As part of the original action plan, an MOU[127] was signed by several states including some that are adjacent to or near Colorado (KS, WY, ND, PA, MD, OK, MT, LA). At present, this group includes contributors from various state agencies across the nation and meets 2–4 times per year to discuss CCUS. Colorado should join this effort and encourage further communication with other states.

CCUS project development is evolving, and one emerging trend is the establishment of CCUS transportation networks that aggregate CO_2 from multiple sources to reduce cost and increase feasibility for individual capture projects.[128] This is the ongoing strategy for the large infrastructure project in the mid-continent led by Summit Carbon Solutions.[129] Shared storage facilities and transportation infrastructure reduces the cost burden for individual projects and can encourage smaller point source emitters to pursue CCUS. In Colorado, a corridor establishment project and regional infrastructure planning may help in linking additional carbon emitters to storage and usage sites, and improve CO_2 transportation economics.

Colorado could also establish communication and collaborate with neighboring state agencies for specific projects. The COGCC already communicates with agencies in other states and attends related conferences to encourage interstate communication on CCUS. There has been initial discussion pertaining to establishing agreements to clarify responsibilities for projects that span jurisdictional boundaries. Further, the COGCC has begun working with the GWPC's Class VI State Primacy Support Workgroup and the IOGCC's Legal and Regulatory Affairs Committee. Cooperating and collaborating with experts around the nation will help ensure safe and effective regulation and help with establishing pathways for emerging industries.

Safety Regulation

Pipeline safety regulation is focused on implementing policies and regulations to ensure safe, reliable, and environmentally protective regulation of existing gas and liquid pipelines. While not involved in siting, safety regulators are involved once a pipeline is constructed to verify that its construction standards abide by federal or state safety rules. PHMSA has regulatory responsibility over the safety of hazardous liquid and gas pipelines. The federal government has established minimum pipeline standards under 49 C.F.R. §§ 190-199.

PHMSA may delegate safety responsibilities to state agencies for intrastate pipelines through a certification process and agreement.[130] A state agency can obtain inspection and enforcement authority through a 49 U.S.C. 60105 agreement. To be able to obtain a 60105 agreement, a state agency must meet certain requirements including having regulatory authority granted by state law and having rules in place that are at least as stringent as federal standards.[131] PHMSA also delegates only inspection authority of intrastate facilities through a 60106 agreement if the state agency does not meet all of the requirements of a 60105 certification. In order to obtain a 60106 agreement, the state must establish an adequate program for reporting and inspection designed to assist PHMSA with safety compliance.

In Colorado, PHMSA is the inspection and enforcement authority for all interstate pipelines and for hazardous liquid intrastate pipelines, including the transport of oil and supercritical CO_2. Safety standards for supercritical (liquid) CO_2 transport are under 49 C.F.R. § 195 (Transportation of Hazardous Liquids by Pipeline). All three existing CO_2 pipelines in Colorado are liquid interstate pipelines.

126 Great Plains Institute, Regional Carbon Dioxide (CO2) Transport Infrastructure Action Plan, October 12, 2021, https://www.betterenergy.org/wp-content/uploads/2021/10/Regional-CO2-Transport-Infrastructure-MOU-Action-Plan.pdf.

127 Great Plains Institute, MOU for Regional CO2 Transport Infrastructure Action Plan, October 1, 2020, https://carboncaptureready.betterenergy.org/wp-content/uploads/2020/11/Final-MOU-on-CO2-Transport-Infrastructure-10-1-2020_signatures.pdf.

128 Global CCS Institute, Global Status of CCS 2021, pg 53, https://www.globalccsinstitute.com/wp-content/uploads/2021/11/Global-Status-of-CCS-2021-Global-CCS-Institute-1121.pdf.

129 Summit Carbon Solutions, Project Footprint, https://summitcarbonsolutions.com/project-footprint/.

130 PHMSA.dot.gov, State Programs Overview. https://www.phmsa.dot.gov/working-phmsa/state-programs/state-programs-overview

131 PHMSA.dot.gov, Guidelines for States Participating in the Pipeline Safety Program, Section 2.1, pg 8-9, Revised January 2020. https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/2020-07/2020-State-Guidelines-Revision-with-Appendices-2020-5-27.pdf

COPUC's Gas Pipeline Safety Program[132] has a 60105 agreement with PHMSA for intrastate natural gas pipelines in Colorado.[133] COPUC adopted, by reference, federal pipeline safety rules for the transportation of natural gas listed under 49 C.F.R. § 192 and is currently undertaking a rulemaking[134] in response to the amendments of § 40-2-115, C.R.S. by SB21-108 including requirements for mapping pipeline facilities under their jurisdiction. Additionally, PHMSA is developing new rules for gaseous CO_2 that will likely be part of 49 C.F.R. § 192 and would fall under COPUC's jurisdiction.

The COGCC regulates the safety of flowlines related to oil and gas and UIC Class II operations, which fall outside the regulatory jurisdiction of PHMSA and COPUC. Flowlines are defined by rule as a segment of pipe transferring oil, gas, or condensate between a wellhead and processing equipment to the load point or point of delivery to a PHMSA or COPUC regulated gathering line or a segment of pipe transferring produced water between a wellhead and the point of disposal, discharge, or loading.[135] Pipeline design and operation standards for transport of CO_2 are already included in COGCC rules. COGCC references the ASME (American Society of Mechanical Engineers) Pipeline codes in its Flowline Regulations,[136] which includes transport of oil, gas, CO_2, and associated waste. Flowlines related to sequestration operations could be regulated similarly to oil and gas flowlines.

Both COPUC in regards to gas pipelines and the COGCC in relation to flowlines can and do implement regulatory programs that are more stringent than that of PHMSA. Additionally, PHMSA does not have a record keeping database for pipelines, and the majority of records are kept by the operator. If the State wants more stringent regulations and record keeping applicable to liquid intrastate pipelines including the transport of oil and supercritical CO_2, the state should pursue a 60105 agreement with PHMSA. This includes the ability to require GPS location information for liquid intrastate pipelines.

In Colorado, there are 9,180 miles of interstate gas and liquid pipelines, 3,206 miles of intrastate gas pipelines, 999 miles of intrastate hazardous liquid pipelines, and around 10,000 miles of flowlines.[137] For sequestration projects, the COGCC will likely regulate the safety of related flowlines, COPUC would regulate the safety of any intrastate gaseous CO_2 pipelines, and PHMSA will regulate the safety of all interstate CO_2 pipelines and intrastate supercritical CO_2 pipelines. Jurisdiction of a particular portion of pipeline depends on numerous factors including size and length of pipeline or flowline, the fluid it carries, if it is related to an interstate or intrastate facility, if the line contains separated fluid from numerous sources, and other criteria.[138] It can be challenging to determine where one regulator's jurisdiction ends and another begins. PHMSA, COPUC, and the COGCC regularly collaborate and may all be involved in a single project. Jurisdictional transitions and the presence of multiple regulators can cause some inefficiencies or complications to the safety regulation process. Although common practices are used, each regulator has different requirements and administrative processes.

Eminent Domain for CO_2 Pipelines

Any proposal for state pipeline siting authority should address eminent domain authority for privately-owned entities. For a private entity like a pipeline company to exercise the power of eminent domain, (1) that entity must have statutory authorization to exercise condemnation authority, and (2) the exercise of eminent domain must serve a public purpose.[139]

Colorado law already includes eminent domain provisions for certain pipeline projects. These include:

- § 7-43-102, C.R.S., which allows three or more persons to form a pipeline corporation and specify "the places from and to which it is intended to construct the proposed line…" The corporation will then have a right-of-way over the "line named" and the right to convey gas, water, or oil through the line. If the corporation cannot agree with the landowner(s) for the purchase of the necessary real estate, "the corporation may acquire such title in the manner provided by law."
- § 38-1-101.5, C.R.S., which requires that, when eminent domain is used for pipelines, the lands taken must be "the most direct route practicable", the pipeline company must "consider existing utility rights-of-way before any new routes are taken," and the pipeline company must "post a bond with the court equal to double the amount which the court determines to be the estimated cost of restoring the affected land to the same or as good a condition as it was in prior to the installation of the pipeline."

132 PUC.Colorado.gov, Pipeline Safety Program. https://puc.colorado.gov/gaspipelines

133 PHMSA.dot.gov, Gas Transmission and Hazardous Liquid Pipeline Safety Program Participating States, October 2021, https://www.npms.phmsa.dot.gov/Documents/CoopAgreementsMap.pdf.

134 PUC.colorado.gov, Part 11 Rulemaking, https://puc.colorado.gov/gpsrulemaking

135 COGCC.state.co.us, 100 Series, Definitions. https://cogcc.state.co.us/documents/reg/Rules/LATEST/100%20Series%20-%20Definitions.pdf

136 COGCC.state.co.us, 1100 Series, Flowline Regulations. https://cogcc.state.co.us/documents/reg/Rules/LATEST/1100%20Series%20-%20Flowline%20Regulations.pdf

137 PHMSA.dot.gov, Gas Transmission and Hazardous Liquid Pipeline Safety Programs, June 2022, https://www.npms.phmsa.dot.gov/Documents/CoopAgreementsMap.pdf.

138 American Petroleum Institute, Recommended Practice 80, Guidelines for the Definition of Onshore Gas Gathering Lines, April 2000, https://law.resource.org/pub/us/cfr/ibr/002/api.80.2000.pdf.

139 *Potashnik v. Pub. Serv. Co. of Colo.*, 247 P.2d 137, 138 (Colo. 1952); *Town of Parker v. Colorado Div. of Parks and Outdoor Recreation*, 860 P.2d 584, 586 (Colo. App. 1993).

- § 38-2-101, C.R.S., which grants condemnation authority to any corporation formed for the purpose of constructing a pipeline.
- § 38-4-102, C.R.S., which allows any foreign or domestic corporation organized or chartered for the purpose of constructing or maintaining a pipeline for the transmission of gas for any public purpose to obtain a right-of-way for the construction, operation, and maintenance of such pipeline through the any lands without the consent of the owner.

While these statutes grant eminent domain authority to privately-owned entities, they do not sufficiently define which pipeline entities or which transported substances qualify. The Colorado Supreme Court narrowly construes statutes "which confer condemnation power upon private entities."[140] Accordingly, the Colorado Supreme Court held that §§ 38-5-101, -102, and -105, C.R.S. do not grant condemnation authority to petroleum pipeline companies despite the fact that the statutes grant rights-of-way to "[a]ny…pipeline company." Rather, the Court held that the statutes in question must be narrowly construed so that they only apply to lines used to deliver electric power services.

Therefore, if the General Assembly undertakes eminent domain for CO_2 pipelines as part of this or later legislative action, we recommend it specifically address siting and eminent domain authority as it applies to CO_2. To accomplish this, the General Assembly should specify that eminent domain or condemnation authority granted under the above-described statutes specifically applies to entities which construct, operate, and/or maintain pipeline(s) for the purposes of transporting CO_2. The General Assembly should also specify that, in this context, CO_2 includes any phase in which CO_2 could be transported—liquid, gaseous, or supercritical.

Recommendations

In order to determine the best approach to siting and regulating pipelines in Colorado, we recommend the following:

- Building on this initial research and outreach, instigate a focused project for pipelines in Colorado to address state siting authority, a pipeline corridor initiative, regional infrastructure planning, pipeline safety regulation, and the use of eminent domain.
- Consider a state agency to coordinate this project.
- Consider collaboration with key stakeholders, related research groups, academia, pipeline companies, local governments, and additional agencies.
- Consider the timing and resources required to complete this project and the desired deliverable.
- The legislature should not take up eminent domain authority as part of the CCUS legislation proposed here. Policymakers should defer consideration of whether such authority is necessary and appropriate until after the recommended pipeline project has been completed.
- Review more detailed considerations and recommendations for pipeline related topics in the following section, Related and Future Considerations.

140 Larson, 284 P.3d at 44.

Related and Future Considerations

As CCUS is an emerging industry, continued review of legal and regulatory considerations is ongoing throughout the nation. This section provides an overview and brief introduction to certain topics that are not fully discussed elsewhere in this proposal, and is intended to give additional context for certain topics that policymakers should consider related to CCUS.

Pipeline Project Considerations

State Siting Authority

- Determine if siting authority is appropriate for Colorado and what exactly could be included in the process.
- Engage stakeholders and government agencies to determine the best strategies.
- Formulate strategies that are protective of community, the environment, and state resources while seeking to improve the efficiency of existing siting and permitting processes.
- Determine the resources needed to implement recommended strategies.

Corridor Establishment

- Determine the extent of CO_2 infrastructure needs and if a corridor project is appropriate for Colorado
- Initiate outreach and consider how to address the mapping requirements for a corridor project.
- Consider collaboration with academia, research groups, and state agencies to assist in developing the potential corridors.
- Compile maps of the likely corridors by incorporating carbon sources, storage sites, existing infrastructure, and potential rights-of-way that could be utilized. This research and mapping project may be contingent on the ability to acquire all necessary data and could require involving outside experts.
- Conduct outreach to any potentially impacted counties, local governments, state agencies, and federal agencies.
- Establish agreements as needed over public land and through existing rights-of-way for future use of CO_2 pipelines.
- Do not pursue agreements with private landowners. This should be addressed by the pipeline company on a project basis.

Regional Infrastructure and Project Planning

- Encourage Colorado's involvement in regional infrastructure planning.
- Join the existing effort through the Great Plains Institute.
- Consider whether establishing CO_2 intrastate or regional transportation networks for multiple capture projects would be appropriate for Colorado to improve the economics of individual projects and what kind of role the State could play in this process.
- Consider establishing agreements with adjacent states to clarify responsibilities for projects that span state borders.
- Continue collaboration with experts from around the nation and within Colorado.
- As CCUS projects progress further, consider additional interstate collaboration on specific projects as needed.

Safety Regulation

- Determine the best administrative structure for pipeline safety regulation in Colorado.
- Consider if reducing jurisdictional transition points could improve efficiency and overall protection of community, the environment, wildlife, and state resources.
- Determine the legal pathway for recommended strategies.
- Determine the resources necessary to implement the recommended strategies.

Eminent Domain

- The General Assembly should specify that eminent domain specifically applies to entities which construct, operate, and/or maintain pipeline(s) for the purposes of transporting CO_2.
- The General Assembly should also specify that, in this context, CO_2 includes any phase in which CO_2 could be transported—liquid, gaseous, or supercritical.

Externally-Sourced CO_2

With various CCUS projects progressing throughout the country, some of them may include transporting carbon captured out of state to a sequestration site in another state. How to address externally-sourced CO_2 has become a consideration for some states. Specifically, can and should a state prioritize carbon captured from within the state? This has been addressed in law only by North Dakota, but other states are discussing this topic.

North Dakota amended their CO_2 storage statute in 2021 to include additional provisions for prioritizing internally-sourced CO_2. This topic was likely addressed due to a large ongoing infrastructure project that plans to connect over 30 point sources in 5 states with the intention of transporting the captured CO_2 to North Dakota for sequestration.[141] The statute includes general guidance for permitting that directs the commission to, "give priority to storage operators who intend to store carbon dioxide produced in North Dakota."[142] Further, the administrative fees required for program implementation and long-term site care "must be based on the contribution of the storage facility and the source of the carbon dioxide to the energy and agriculture production economy of North Dakota and the commission's anticipated expenses that it will incur in regulating storage facilities"[143] Combined, these provisions give North Dakota's Industrial Commission the ability to prioritize review of permits associated with internally-sourced CO_2 and to invoke higher fees for externally-sourced CO_2 based on the project's contribution to North Dakota's energy and agriculture economy.

One of the primary reasons for encouraging Class VI projects in Colorado is to reduce the state's GHG emissions. Additionally, while Colorado has significant geologic storage potential, the resource is not unlimited, and significant investment is required for a successful sequestration project. Considering these factors, externally-sourced CO_2 would not reduce emissions in Colorado, but it would utilize a portion of the state's storage resources. With this in mind, consideration should be given to if and how internally-sourced CO_2 is prioritized.

Determining CO_2 Storage Amounts

CO_2-EOR operations permanently store CO_2 in an oil bearing formation while increasing total recoverable hydrocarbons. There is only 1 active CO_2-EOR field in Colorado, but this may increase due to the additional financial incentives within the Inflation Reduction Act. Other states including North Dakota, Wyoming, Montana, and Nebraska have given authority to the oil and gas divisions to certify the amount of stored CO_2 in EOR and Class VI operations for the purpose of facilitating using stored CO_2 for such matters as carbon credits.[144] The CCUS Task Force recommendations include having the Air Pollution Control Division (APCD) and Air Quality Control Commission (AQCC) adopt GHG accounting protocols related to CCUS including EOR. For this reason, and for any other carbon-related credits, it may be prudent to consider a certification process for determining carbon storage amounts in Class VI and EOR operations.

The certification process in other states typically includes a voluntary application by an operator that will include a plan for stored carbon accounting for the state agency to recognize that carbon is being stored and to certify the quantity of CO_2 being stored. States have taken slightly variable approaches that include charging fees for this service, adding clarification that this process is not an application for a Class VI well, clarifying that the state agency may promulgate rules related to this process, and adding the ability to utilize this process for Class VI stored carbon in addition to EOR. If the General Assembly chooses to include this consideration, we recommend including the purpose of this authority, the ability to charge a fee for this service, adding clarification that this is not related to a Class VI application, and ensuring that the COGCC has the authority to establish rules or criteria for this process.

141 Summit Carbon Solutions, Project Footprint, https://summitcarbonsolutions.com/project-footprint/.

142 N.D. Cent. Code § 38-22-05(2).

143 N.D. Cent. Code §§ 38-22-14(1), 15(1).

144 N.D. Cent. Code Ann. § 38-22-23; Wyo. Stat. Ann. § 30-5-502; Mont. Code Ann. § 82-11-188; and Neb. Rev. Stat. § 57-1624.

Greenhouse Gas Accounting

Implementing specific CCUS GHG accounting protocols in Colorado has been identified by stakeholders as an important tool in understanding the cumulative impacts of this emerging industry. The CCUS task force included a recommendation to "Adopt GHG accounting protocols for CCUS projects to appropriately account for these projects in assessing progress made toward state climate targets." Further, the recommendations included that "the APCD/AQCC adopt appropriate EOR-specific GHG accounting protocols."

While our internal workgroup did not focus research or outreach on the specifics of GHG accounting strategies, we recognize that this is an important topic and a useful tool in understanding the overall impacts of the CCUS industry on reducing emissions in Colorado. With this in mind, we recommend that additional stakeholder outreach, including input from the EJAB, and research occur in coordination with the APCD/AQCC's broader efforts in order to develop the most appropriate strategies for GHG accounting related to the CCUS industry. Further, if pursuing CCUS-specific GHG accounting, a process for determining storage amounts (as outlined above) will likely complement this strategy.

Financial Assurance

Financial assurance is an important consideration for Class VI projects. It is required by federal rule[145] and must be a part of all state programs. While financial assurance was proposed in SB22-138, it is not a requirement for a state statute as it would be required during any state Class VI rulemaking in order to gain primacy from the EPA. For flexibility in incorporating financial assurance into existing processes, we recommend the requirements for Class VI wells be addressed through rulemaking.

Class VI Project Collaboration

A robust, comprehensive, and protective Class VI program will require collaboration with other regulatory agencies and stakeholders. Class VI projects may include collaboration with additional departments and agencies of the state of Colorado, federal agencies, local governments, tribal agencies, agencies in bordering states, and research institutes.[146]

Collaboration with COGCC's sister agencies will be important during the primacy process and throughout permitting and implementation of a Class VI project. In pursuing primacy, COGCC should work closely with the Colorado Attorney General's Office as well as CDPHE, CEO, and other Colorado agencies with expertise in various aspects related to CCUS. Once primacy is granted, consultation and collaboration with CDPHE, the Division of Water Resources (DWR), Colorado Parks and Wildlife (CPW), the Colorado Geological Survey (CGS), and other regulatory partners will be important during COGCC rulemaking and permitting. COGCC has strong relationships with its sister agencies and existing consultation processes that could be adapted to the Class VI process. Since the extent of involvement from other state agencies is not fully determined, the programmatic funding section recommendations include the ability to compensate other state agencies for expenses incurred carrying out regulatory responsibilities associated with Colorado-based Class VI projects.

In addition to Colorado state agencies, COGCC may need to engage with federal, tribal, local, and bordering state agencies on a project-specific basis. In particular, projects that cross jurisdictional boundaries will require collaboration between Class VI permitting authorities. This could entail working with states that already have primacy, like Wyoming, or collaborating with the EPA if a bordering state does not yet have primacy. And even a project that is completely within the state of Colorado may require working with federal or tribal agencies if the project area contains federal or tribal lands. Finally, local governments will likely play an important role in siting Class VI projects and should be engaged in the permitting process.

Each Class VI project will have unique challenges associated with outreach and collaboration. Discussions should occur with applicants in the pre-permitting phase to determine who needs to be involved in the permitting and outreach process. It may also be beneficial to establish or amend existing memoranda of understanding between the COGCC and other agencies and/or local governments to set forth processes for interagency consultation, sharing of confidential information, and other aspects of the Class VI process.

145 40 C.F.R. § 146.85.

146 For a more in-depth discussion of collaboration with other agencies, see Requirements, Resources, Considerations, and Recommendations for the State of Colorado to Implement a Safe and Effective UIC Class VI Program, COGCC, November 2021. https://cogcc.state.co.us/documents/library/Technical/UIC/COGCC%20Class%20VI%20Report.pdf.

Confidentiality of Operator Information

Some stakeholders expressed concern that to obtain the necessary permits and pore space access, storage operators may be required to submit otherwise confidential business information which may then be subject to requests under the Colorado Open Records Act (CORA). This situation is likely to arise in pre-permitting discussions with COGCC staff, negotiations for state-owned pore space (for example with the State Land Board (SLB)), and for projects which cross jurisdictional boundaries. Therefore, confidentiality issues are likely to affect COGCC, SLB, and possibly other agencies involved in CCUS, either in a regulatory capacity or as owners of state-owned pore space.

For example, while engaged in the permitting process with COGCC, storage operators may be required to submit geologic or geophysical data to comply with modeling and other permitting requirements. Another example is if a storage operator is negotiating for pore space access with SLB. SLB anticipates requiring the storage operator(s) to submit financial, geologic, and/or geophysical data so that SLB and the storage operator can arrive at a market price for the pore space. However, in submitting such data, it could become subject to CORA requests.

COGCC Rules already include provisions by which operators can keep certain submitted materials confidential.[147] However, under CORA, public records are generally open for inspection, subject to specific exceptions.[148] Among these exceptions are trade secrets, privileged information, and confidential commercial, financial, geological, and geophysical data.[149] Whether information or documentation qualifies for the trade secrets exception is dependent on whether the information provided meets the requirements of the Uniform Trade Secrets Act.[150] Under the Uniform Trade Secrets Act, a trade secret is "information, including a formula, pattern, compilation, program, device, method, technique, or process, that: (i) derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use, and (ii) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy."[151]

CORA also provides an exception for confidential business information. However, a document is not entitled to protection merely because it has been classified as confidential by either an agency or the party that submitted the information.[152] Simply claiming that the document includes information that is typically confidential within the industry is insufficient to invoke this exception.[153]

Rather, "[i]f disclosure of financial information would be likely to either: '(1) to impair the government's future ability to gain necessary information; or (2) to cause substantial harm to the competitive position of the person providing the information' the financial information is confidential for purposes of the statutory exemption." Much of the information that COGCC and SLB anticipate storage operators to submit in negotiation would likely fall under either the trade secrets exception or the confidential business information exception to CORA or under COGCC's Rule 223.

There are two sets of data at issue. The first is financial, economic, geologic, and/or geophysical data submitted to SLB or other state agencies for the purposes of negotiating pore space access. Such data is not protected under COGCC Rule 223, but may be protected under the trade secrets or confidential business information exceptions to CORA. However, stakeholders have asked for clarity on this topic to facilitate pore space negotiations. Therefore, the General Assembly should consider if confidential financial, economic, geologic, and/or geophysical data submitted by a storage operator to a state agency for the purposes of negotiating a pore space agreement and informing related discussions is already protected from inspection under CORA pursuant to § 24-72-204(3)(a)(IV) or if a specific exemption is necessary.

The second is all other financial, economic, geologic, and/or geophysical data submitted to COGCC for any purposes. These purposes could include pre-permitting consultations, permit applications, post-permitting reporting, etc. COGCC already has rules for keeping certain operator data confidential when submitted to COGCC. COGCC is also capable of further developing, in rulemaking, its confidentiality rules to address unique scenarios which may arise under CCUS. Therefore, no action by the General Assembly is required as to such data.

Recommendation

- Consider if confidential financial, economic, geologic, and/or geophysical data submitted by a storage operator to a state agency for the purposes of negotiating a pore space agreement and informing related discussions is already protected from inspection under CORA pursuant to § 24-72-204(3)(a)(IV) or if a specific exemption is necessary.

147 COGCC Rule 223, generally.
148 § 24-72-201 & -203(1)(a), C.R.S.
149 § 24-72-204(3)(a)(IV), C.R.S.
150 Todd v. Hause, 371 P.3d 705, 710 (Colo. App., 2015).
151 § 1. Definitions., Unif. Trade Secrets Act § 1.
152 *Int'l Bhd. of Elec. Workers v. Denver Metro. Major League Baseball Stadium Dist.*, 880 P.2d 160, 167 (Colo. App. 1994) (emphasis added).
153 *Id.*

Appendix: Emerging Industry Considerations

With the passage of SB19-181, the COGCC was directed to regulate the development and production of the natural resources of oil and gas in the state of Colorado in a manner that protects public health, safety, and welfare, including protection of the environment and wildlife resources.[1] The COGCC has focused on division organization and staff expertise to effectively administer this new mission and has developed numerous rules and processes to address this directive. The new mission of the COGCC and existing expertise and processes within the Division provide a foundation for additional regulatory responsibility.

New opportunities are emerging and new technologies are being developed. Some of these newer industries and technologies require coordination between multiple regulatory entities, and at times, the process is unclear, undefined, or incomplete. Consolidating and expanding regulatory responsibility, where appropriate, can help increase efficiency, encourage innovation, provide clarity, and support a sustainable and protective approach to development of energy resources, while helping the state of Colorado meet its greenhouse gas emission goals.

The COGCC's mission change has demonstrated the agency's ability to expand and adapt. The COGCC has a well-established record of regulating in a manner at least as stringent as the federal government, and often exceeds federal requirements for the protection of public health, safety, and welfare, the environment, and wildlife resources. Significant existing resources, staff expertise, and the new mission provide a foundation to expand and incorporate oversight of additional, closely-related operations. Due to its existing regulation of oil and gas operations, flowlines, and UIC Class II injection operations, the COGCC has a variety of resources that would be beneficial in efficiently and effectively regulating CCUS, underground gas storage facilities, deep geothermal operations, and potentially other activities in the subsurface or activities necessary to energy development.

Underground Storage, Hydrogen, and Regulation

Underground storage of natural gas has occurred for decades as it provides a retrievable energy resource. With the increase of renewable energy generation and use, underground storage beyond natural gas is becoming a vital consideration for retrievable and dispatchable renewable energy.

Underground hydrogen storage has been identified as an important factor for the success of future, large-scale hydrogen production and use.[2] Additionally, large-scale underground hydrogen storage can be coupled with variable renewable energy to provide power during periods of high energy demand and low renewable energy production.[3] This can help reduce the amount of energy wasted during times of excess energy generation. It can also allow for dispatchable energy when renewable energy does not meet market demands such as during large storms and other periods of lower energy production. Potential storage reservoirs for hydrogen include salt caverns, deep saline reservoirs, and depleted oil and gas reservoirs. In Colorado, some of these reservoirs are being utilized or will potentially be utilized for other operations including CO_2 sequestration, Enhanced Oil Recovery (EOR), disposal, and deep geothermal operations. Understanding any potential interactions between projects will be essential to protecting subsurface resources and supporting clean energy goals.

In addition to hydrogen, compressed air energy storage is another strategy for utilizing excess renewable energy to provide a dispatchable energy source during periods of lower energy generation. This technology uses excess energy to compress air to high pressures and stores it in a geologic formation. Once needed, the compressed air is brought to the surface where the pressured air runs a turbine and generates electricity. Similar to sequestration, hydrogen, and other industries, this technology may target depleted oil and gas reservoirs and deep saline reservoirs, among other formations. At this time it is not known how prevalent this technology may become in Colorado.

1 C.R.S. § 34-60-102(1)(a)(I).

2 SHASTA/DOE/NETL, Subsurface Hydrogen and Natural Gas Storage: State of Knowledge and Research Recommendations Report, April, 2022. https://www.netl.doe.gov/projects/files/SubsurfaceHydrogenandNaturalGasStorageStateofKnowledgeandResearchRecommendationsReport_041122.pdf

3 Energy and Environmental Science, Enabling large-scale hydrogen storage in porous media - the scientific challenges, pg 853-854, Figure 1, January 2021, https://pubs.rsc.org/en/content/articlepdf/2021/ee/d0ee03536j

Hydrogen

Hydrogen Hydrogen is viewed as an important low-carbon energy carrier and a potential key component in decarbonizing various industries, including transportation, power and heating, and energy intensive processing industries.[4] While not directly related to carbon sequestration, hydrogen activities may interact with or be a potential source of CO_2 for Class VI projects. Additionally, large-scale hydrogen production in the future will likely require underground storage in geologic formations with similar characteristics to sequestration targets.

Hydrogen can be produced from conventional, renewable, and natural sources. There are different categories of hydrogen based on the source of the gas and associated emissions. Currently, the majority of hydrogen production is generated from natural gas through the steam methane reforming (SMR) process.[5] Through this process, hydrogen and CO_2 are derived from methane, the CO_2 typically is released to the atmosphere, and the hydrogen is utilized. This is categorized as gray hydrogen and is by far the most prevalent hydrogen currently produced. Blue hydrogen incorporates carbon capture and storage into the SMR process resulting in hydrogen production with significantly lower carbon emissions. Other categories of hydrogen production are emerging but are presently more expensive to produce or not as readily available. This includes green hydrogen that is produced through electrolysis of water and by utilizing renewable energy sources such as solar, wind, and geothermal. In the near-term, blue hydrogen will likely be the most cost-competitive source of clean hydrogen (as defined by IIJA) in the region.[6] However, the IRA includes additional financial incentives primarily for green hydrogen, which will improve associated project economics. Over time, blue hydrogen production will likely decrease as emission-free hydrogen processes such as green hydrogen become more prevalent and affordable.

With all this in mind, hydrogen will likely be associated with not only multiple renewable energy sources, but also with numerous subsurface operations in Colorado, including Class VI wells, pipelines, natural gas production, and underground gas storage. Further, CCUS will likely be a vital tool for decarbonizing hydrogen production in the near future. While the state of Colorado has a preference for green hydrogen production, it is expected that private entities will pursue blue hydrogen projects as well. As the hydrogen industry emerges, CCUS, underground storage, and pipeline transport may serve as critical supports to the industry.

Underground Gas Storage Regulation

Underground gas storage related to hydrocarbons, including mixtures of natural gas and hydrogen, is regulated by PHMSA. PHMSA has regulatory authority over gas pipeline facilities that includes underground natural gas storage in depleted hydrocarbon reservoirs, aquifers, and salt caverns,[7] while EPA likely regulates underground injection and storage of other types of gasses such as pure hydrogen or air through its UIC program. However, EPA's authority specifically excludes "Injection wells used for injection of hydrocarbons which are of pipeline quality and are gasses at standard temperature and pressure for the purpose of storage."[8] It is thus clear that PHMSA holds jurisdiction over natural gas storage projects, while injection wells and underground storage of hydrogen and other gasses at higher pressures would likely fall under the authority of the EPA's UIC program.

EPA and other federal agencies are completing initial work related to hydrogen injection for storage, which may give further clarification on what could be required in the future. Further, the IIJA includes provisions to identify the appropriate federal regulatory agencies and clarify responsibilities to support the deployment of clean hydrogen.[9] As clarity is provided by federal agencies, regulatory authority related to the injection and storage of hydrogen and other gasses should become more clear.

PHMSA is the regulatory authority over underground natural gas storage facilities in Colorado. Regulations for underground gas storage are within the federal pipeline regulations at 49 C.F.R. §§ 191 and 192. PHMSA has exclusive jurisdiction over *interstate* gas storage facilities, but state agencies can obtain delegated authority over *intrastate* facilities through a section 60105 agreement with PHMSA. No Colorado agency has pursued a 60105 agreement for gas storage facilities, though COPUC regulates intrastate gas pipelines through a similar agreement. COPUC has jurisdiction over related intrastate pipelines transporting gas within or near a storage facility, but does not regulate all portions of underground gas storage facilities since that would require a separate 60105 agreement with PHMSA in addition to the agreement for gas pipelines. Further, Colorado state statute does not clearly grant any state agency jurisdiction over all portions of an underground gas storage facility.

4 *Id. at 853.* Energyoffice.colorado.gov, GHG Pollution Reduction Roadmap, January 14, 2021, https://energyoffice.colorado.gov/climate-energy/ghg-pollution-reduction-roadmap

5 Energy.gov, Hydrogen Production: Natural Gas Reforming, https://www.energy.gov/eere/fuelcells/hydrogen-production-natural-gas-reforming

6 American Petroleum Institute, The Potential Role of Blue Hydrogen in Low-Carbon Energy Markets in the US, October 12, 2022, https://www.api.org/~/media/Files/News/2022/10/12/API-ICF-Hydrogen-Report

7 49 U.S.C. § 60101(a)(26).

8 40 C.F.R. § 144.1(g)(2)(iv).

9 Congress.gov, Infrastructure Investment and Jobs Act, H.R. 3684, 117th Cong. Sec. 40314, 814(a)(2)(H), https://www.congress.gov/bill/117th-congress/house-bill/3684/text.

The COGCC has been granted state jurisdiction over gas storage wells[10] and the closure of underground natural gas storage caverns.[11] PHMSA is encouraging state agencies with safety authority over the downhole portion of intrastate underground gas storage facilities to participate in the underground storage safety program.[12] They have reached out to the COGCC to ascertain the interest and feasibility of COGCC regulating intrastate underground gas storage facilities. There would be a number of advantages to COGCC regulation of intrastate gas storage facilities including having a more robust database for projects and the ability to regulate the facilities in a manner consistent with the priorities of the State. While the COGCC does have state jurisdiction over the wellbore, the COGCC is not currently able to gather information on the wells since they are associated with gas storage facilities regulated by PHMSA. Additionally, PHMSA does not have a record keeping database for underground gas storage and the majority of records are maintained by the operator. The COGCC is currently more stringent with certain regulations for oil and gas wells compared to the federal regulations for gas storage wells, including wellbore testing requirements to prevent leaks and record keeping.

There are 10 existing underground gas storage projects in Colorado including 6 interstate projects and 4 intrastate projects.[13] The 4 intrastate projects include 54 gas storage wells according to PHMSA. Similar to pipelines, delegated regulatory authority over intrastate underground gas storage facilities can be pursued through a 60105 or 60106 agreement. In order to pursue delegated authority through a 60105 agreement, the General Assembly would need to grant a state agency explicit jurisdiction over all underground gas storage activities. The agency would then need to promulgate rules at least as stringent as the federal regulations. With a 60105 agreement, a state agency could impose more stringent regulations and require submission of well information. If this agreement with PHMSA is desired, additional discussion and analyses pertaining to existing state jurisdiction over underground gas storage will need to occur and likely collaboration will be required between COGCC and COPUC.

Recommendations

- The General Assembly should clarify jurisdiction over intrastate underground natural gas storage facilities as between COGCC and COPUC.
- Grant COGCC authority to promulgate rules and regulate intrastate underground gas storage facilities through a 60105 agreement with PHMSA.

Deep Geothermal Resources

Deep sedimentary geothermal is an emerging industry in Colorado that will utilize hot water in deep formations within sedimentary basins that are typically associated with oil and gas production. When compared to conventional geothermal settings, sedimentary geothermal can have some advantages such as utilizing existing infrastructure, access to abundant subsurface data from oil and gas development, and usually have a larger extent. Furthermore, sedimentary geothermal projects may utilize existing oil-and-gas technologies for drilling, testing, wellbore construction, injection, and more.

Many of the oil and gas producing sedimentary basins in Colorado, including the DJ Basin, Piceance Basin, and Raton Basin, are associated with higher-than-average geothermal gradients and subsurface temperatures.[14] Since many of Colorado's sedimentary basins include oil and gas operations, there is extensive subsurface data, infrastructure, and potential for repurposing existing wells. Due to these factors, multiple sedimentary basins in Colorado may become a robust resource for geothermal energy production in the near future.[15]

In the state of Colorado, any water used to extract heat is administered by the Colorado State Engineer through the DWR. All drilling associated with geothermal exploration and development requires a permit from the DWR.[16] Depending on the geothermal project, the DWR may collaborate with a variety of agencies including the COGCC. The COGCC is involved in the permitting of deeper wells (greater than 2500') or wells that have fluids hotter than 212 degrees, which are defined within DWR rules as Type B geothermal wells.[17] The DWR is required by statute to notify the COGCC of any Type B geothermal well and to consider and/or incorporate the COGCC's input into permitting decisions.[18] Additionally, existing oil and gas wells may be utilized or repurposed for geothermal projects, which will further involve the COGCC. UIC Class V injection wells may also be part of geothermal projects due to the reinjection of formation fluids after the heat has been utilized to produce energy. Currently, the EPA is the regulatory authority for Class V wells in Colorado.[19]

10 § 34-60-106(2.5)(a), C.R.S. and § 34-60-103(6.5), C.R.S.

11 § 34-60-106(17), C.R.S.

12 PHMSA.dot.gov, State Participation. https://www.phmsa.dot.gov/pipeline/underground-natural-gas-storage/state-participation

13 PHMSA.dot.gov, LNG Plant and UNGS Safety Programs, July 2021, https://www.npms.phmsa.dot.gov/Documents/LNG_UGSF_CoopAgreementsMap.pdf

14 NREL.gov, Sedimentary Geothermal Resources in Nevada, Utah, Colorado, and Texas, pg 14, August 2020, https://www.nrel.gov/docs/fy20osti/76513.pdf.

15 Deep Earth Energy is developing a geothermal power plant in the northern Williston Basin in Canada that will utilize 250°F fluid produced from several horizontal wellbores at around 11,000' depth. Colorado has several basins with temperatures at or above what is being utilized for this power plant. https://deepcorp.ca/about-deep/

16 § 37-90.5-106(1)(b), C.R.S.

17 2 C.C.R. § 402-10:4.2.29;

18 § 37-90.5-106(4), C.R.S. and 2 C.C.R. § 402-10:6.6.

19 EPA, Class V UIC Study, Electric Power Geothermal Injection Wells, September 1999, https://www.epa.gov/sites/default/files/2015-08/documents/classvstudy_volume17-geothermalelectricpower.pdf

One type of sedimentary geothermal project would utilize hot, produced fluid from existing oil and gas wells or from repurposed wellbores. This strategy would incorporate geothermal power units into existing oil and gas operations that produce hot formation fluid or operations that produce hot brine from a repurposed wellbore.[20] The heat would be utilized for energy generation and the resultant colder fluid would be transported for utilization, disposal, or reinjection. This emerging technology may directly impact existing oil and gas and injection operations regulated by the COGCC. This approach could provide renewable energy while reducing cumulative impacts, surface disturbance, and the need for additional infrastructure. These operations are likely more appropriate for energy applications in proximity to the wellbore.

Another emerging approach to deep geothermal development includes drilling larger diameter water production wells and reinjection wells that are permitted separately from oil and gas wells. The production wells produce hot water from deep subsurface reservoirs, and reinjection wells are used to return colder water into the same reservoir after the heat has been utilized for energy generation.[21] Flowlines or pipelines at the surface will be utilized for transporting the fluids through project areas. Potential target formations for these operations include deep saline reservoirs that may also be utilized for CO_2 sequestration or disposal projects. The Lyons Formation, which is already included in disposal projects in Colorado and is a potential target for Class VI projects, has been identified to have potential for geothermal energy production depending on the permeability of the formation.[22] These operations, which typically require producing and injecting large fluid volumes, could generate significant energy.

Beyond the potential use of similar formations and technologies as oil and gas and sequestration, there is some initial commentary looking at the potential of incorporating sedimentary geothermal energy generation and CO_2 sequestration in the same project.[23] Interconnected operations could benefit both industries as the geothermal project could use CO_2 to generate energy and the CCUS operations could be powered by local renewable energy. Further, a turbine that utilizes supercritical CO2 is in development and may allow for additional integration of sequestration and geothermal power generation projects.[24] This local power generation would reduce CCUS impacts and could potentially provide a tangible benefit to the impacted community.

Another geothermal technology in development is the utilization of the subsurface for energy storage, which is generally referred to by several different terms including geothermal battery, synthetic geothermal reservoir, Geo-TES, in-reservoir energy storage, etc. This technology can be implemented with different strategies. One strategy builds pressure in the reservoir by continuing injection and ceasing production during periods of low energy demand. During periods of high energy demand, the pressure is released through higher production rates (higher energy production).[25] Another strategy utilizes the insulating properties of the earth to store energy by using any excess energy source to heat fluids and then injects the hot fluids into the subsurface to utilize the heat later.[26] Initial research shows that the majority of energy is recoverable regardless of strategy. This type of operation has the potential to be co-located with variable renewable energy sources (i.e., solar, wind) to allow for fully dispatchable renewable energy to the grid.

Deep geothermal resources have a variety of emerging applications and potential to be interconnected with multiple industries including CCUS, oil and gas, variable renewable energy sources, and the industrial sector. They also have commercial and residential applications. Other states have instigated in-depth studies to identify the extent of the geothermal resources, explore potential opportunities, and understand the scale of geothermal energy generation and its applications within the state.[27] These studies help inform policymakers, provide perspective on how geothermal may help states reduce GHG emissions, give context to how existing infrastructure and expertise may be leveraged, and provide an understanding of how geothermal resources may be utilized in the near future. Further, there is an influx of federal funds for plugging orphaned wells, and existing oil and gas operators are also abandoning more and more wells. With this in mind, a technical study that incorporates the requirements for repurposing infrastructure could help identify assets that should be considered for deep geothermal operations prior to plugging wellbores and site reclamation. For these reasons, we recommend Colorado pursue a geothermal study to ensure the State's subsurface resources are utilized in the most safe, effective, and efficient manner for Colorado to encourage emerging and existing energy industries to reduce cumulative impacts and associated emissions.

20 This approach is being investigated as a possibility in Colorado by Transitional Energy. https://transitionalenergy.us/sedimentary-geothermal

21 This approach is being investigated as a possibility in Colorado by Geothermal Technologies. https://geothermal.tech/our-approach-sustainable-energy/

22 NREL.gov, Sedimentary Geothermal Feasibility Study, pg 40, October 2016, https://www.nrel.gov/docs/fy17osti/66552.pdf.

23 Littlefield A., Stautberg E., Synergies Between Carbon Capture, Utilization and Sequestration and Geothermal Power in Sedimentary Basins, Payne Institute for Public Policy Commentary, June 7, 2022, https://payneinstitute.mines.edu/wp-content/uploads/sites/149/2022/06/Payne-Institute-Commentary-Synergies.pdf.

24 Sage Geosystems, Technology, Surface (Power Plant), https://www.sagegeosystems.com/technology/

25 Ricks,W., Norbeck, J., Jenkins, J., The value of in-reservoir energy storage for flexible dispatch of geothermal power, Applied Energy, May 2022, https://doi.org/10.1016/j.apenergy.2022.118807

26 INL, Flexible Geothermal Power Generation utilizing Geologic Thermal Energy Storage, May 2019, https://inldigitallibrary.inl.gov/sites/sti/sti/Sort_14945.pdf

27 Petrolern LLC, Final Report of Geothermal Resource and Applicable Technology for Wyoming, July 2022, https://wyoenergy.org/wp-content/uploads/2022/11/Petrolern_FinalReportWYGeothermalPotentialAndApplicableTechnology_FINAL1Aug2022.pdf
Beard et al., The Future of Geothermal in Texas, to be released soon, https://cgmf.org/blog-entry/460/Report-The-Future-of-Geothermal-in-Texas.html

With significant potential for repurposing oil and gas infrastructure, leveraging industry expertise, and even interacting with oil and gas minerals, Colorado should consider how to best administer these geothermal resources and specifically, the COGCC and DWR must work together to create legal and regulatory strategies that enable operators to utilize existing infrastructure, expertise, and geothermal resources through several emerging technologies. As indicated in Wyoming's geothermal study,[28] the oil and gas commission is likely best suited to regulate deep geothermal resources due to similarities in technology and resource development. While a technical report, as indicated above, will help provide context for resource administration, a parallel effort focused on legal and regulatory clarity within the DNR may also be prudent including considering if deep geothermal wells are better regulated by the COGCC, if an interagency agreement is necessary, and considering strategies to expedite conversion of infrastructure and the development of deep geothermal resources.

There should also be consideration of the interactions between the recommendations in this proposal and property rights related to geothermal resource development. Geothermal resource development may interact with subsurface pore space when fluids are removed and utilized for energy generation and then reinjected back into the same geologic formation (geothermal operations generally do not add additional fluid to the formation and only reinject fluid previously removed from the formation). Generally, in Colorado, geothermal resources are deemed part of the surface estate unless specifically conveyed,[29] similar to our pore space recommendation. Additionally, state statute provides reasonable accommodation for geothermal resource development,[30] which allows for reasonable access to the surface estate for geothermal development. If, as recommended, Colorado vests ownership of pore space in the surface owner, presumably the reasonable accommodation doctrine would also allow reasonable access to pore space for geothermal resource development. With that said, further review of the interaction of any enacted pore space law and geothermal projects may be warranted to better understand any potential impacts.

Similar to sequestration, the geothermal industry has legal and regulatory challenges that can delay projects. With the potential for interconnected operations that could reduce the overall impact of CCUS and geothermal, legal and regulatory barriers should not prevent cooperative innovation in emerging technologies that help reduce GHG emissions. Further outreach and research would be beneficial in determining if interconnected projects are both technically and legally feasible.

Recommendations

- To evaluate the potential applications of emerging geothermal technologies, the state of Colorado should pursue a technical study of the state's geothermal resources, including a resource evaluation, technology assessment, an evaluation of potential impacts, an economic analysis, and evaluating the potential to repurpose existing infrastructure.
- The DNR, COGCC, and DWR should identify legal and regulatory changes necessary to enable protective and efficient pathways for geothermal resource development.

28 Id. Petrolern at v

29 § 38-35-121, C.R.S.; Where a geothermal resource is found in association with geothermal fluid which is tributary groundwater (any groundwater hydrologically connected to surface waters), such geothermal resources are declared to be a public resource and are administered by the DWR (a situation only applicable to shallower geothermal projects). § 37-90.5-104(1), C.R.S.; Colorado Geological Survey, Geothermal Regulations in Colorado-Land Ownership is the Key, GRC Transactions, Vol. 36, 2012, https://publications.mygeoenergynow.org/grc/1030389.pdf

30 § 37-90.5-105, C.R.S.

Full UIC Program

While the majority of states have primacy for UIC Classes I-V, Colorado only has primacy over UIC Class II wells through a SDWA section 1425 primacy program,[31] which is implemented by the COGCC. The state of Colorado and the COGCC are also pursuing options for a state UIC Class VI program as outlined in this proposal. Applications for individual UIC classes are only allowed by the EPA for Class II and VI. If primacy is sought for any additional UIC classes, including I, III, IV, and V, a SDWA 1422 application for all classes must be submitted. The different UIC classes are outlined below in Table A-1.

Adding all UIC classes at once, including VI, would require significantly more time for program development, as well as state and federal rulemakings. Due to the potential impact of Class VI operations on reducing GHG emissions in the state, primacy for Class VI wells should be prioritized, and therefore a full UIC program should not be considered until after Class VI primacy is obtained. Additionally, this will allow time for the EPA and other federal agencies to provide more clarification on federal jurisdiction and classification of certain emerging industries, including deep geothermal and hydrogen storage. Similar to Class VI, there is potential for additional emerging industries to become a new injection class once the technology is no longer experimental (Class V includes experimental wells).

Obtaining state primacy for all UIC classes of injection wells provides certain benefits to the state. A full program would allow for evaluation of potential project interactions in a broader context, more comprehensive induced seismicity prevention, permitting flexibility and efficiency, and the ability to prioritize the needs of Colorado in the context of subsurface injection and storage, importantly including requirements that are more stringent than the EPA's where applicable.

Multiple classes of injection wells in Colorado currently inject into or may target deep saline aquifers or depleted oil and gas formations. Class I and II injection disposal wells within the DJ Basin are currently injecting into deep saline aquifers. Additionally, these same formations are potential targets for sequestration and Class V wells (including deep geothermal reinjection wells, hydrogen storage, etc.). With this in mind, it may be important to evaluate future injection permits in the context of potential interactions with other nearby injection or storage projects. Without consolidating regulatory responsibility at the state level, it may be difficult to incorporate all available injection data and information into permitting and process decisions. A more unified state approach to subsurface injection may provide better protection of Colorado's subsurface resources, as well as Colorado's public health, safety, and welfare, the environment, and wildlife resources.

In some situations, wells from different injection classes could be involved in the same development project, or injection wells may be transitioned from one class to another. For example, CO_2 may potentially be transported for use and sequestration in a stacked development project including Class II enhanced recovery wells and a Class VI well for injecting the remaining CO_2 that is not utilized for the EOR project. Further, Class V well permits are utilized for a large variety of situations and the permit may be utilized as a stratigraphic wellbore for data acquisition and transitioned to another UIC Class after completing the associated analyses. Also, the COGCC

31 EPA.gov, UIC, Primary Enforcement Authority for the UIC Program, https://www.epa.gov/uic/primary-enforcement-authority-underground-injection-control-program-0

Table A-1. UIC Classes

Class	Description
Class I	Industrial and Municipal Waste Disposal.
Class II	Oil and Gas related injection wells including EOR and disposal wells.
Class III	Solution Mining.
Class IV	BANNED—Shallow hazardous and radioactive injection.
Class V	Class V injection wells are used to inject non-hazardous fluids underground. This encompasses a variety of operations including deep injection wells such as geothermal wells, aquifer storage and recovery wells, wells for salinity control, and experimental wells used to test new or unproven technologies. The injection class also comprises shallow operations including advanced wastewater disposal systems used by industry, stormwater drainage wells, septic system leach fields, and agricultural drainage wells. Further, this class will likely include underground storage of hydrogen and compressed air as experimental wells unless new classes are formed.
Class VI	CO_2 sequestration.

has experience working with the EPA to transition a well from Class I to Class II waste disposal, and vice versa. With many potential project interactions and well transitions between different UIC injection classes, a full 1422 UIC Primacy program may provide a more clear, supportive, and informed regulatory process for all interconnected injection and storage activities, while providing additional flexibility for permitting and testing new technologies.

Collaboration between numerous state agencies would be required for the successful implementation of a full UIC program. Throughout the nation, states with a complete UIC program typically designate their water or environmental quality department or division as the primary, or coordinating, state agency. However, it is also common for a state to have multiple implementing divisions, including oil and gas divisions. In Colorado, the Water Quality Control Division within the CDPHE is the most likely coordinating division based on how other states are set up, as well as its own developed expertise, but Colorado can customize the approach to fit the state's current and future needs. Further outreach and discussion would be required to determine the best administrative structure for a complete UIC program, but several state agencies would likely be involved. Beyond the COGCC, the WQCD would likely play an important role and potentially administer portions of the program. Other agencies that would need to be involved or included in the program are the DWR, the Division of Reclamation, Mining, and Safety, and potentially others. Additional discussion with the EPA would also be required.

As new projects and technologies emerge in the subsurface and regulatory jurisdiction is clarified at the federal level, Colorado may want to consider pursuing regulatory authority for a full state UIC program in order to create a unified state approach to subsurface storage and injection. Further, a full UIC primacy application should be considered to ensure Colorado's communities, wildlife, environment, and subsurface resources are protected in a manner that aligns with the state's priorities, and encourages emerging clean energy industries. After or during the Class VI primacy application process, the requirements and potential administrative structure of a full program should be evaluated.

Recommendation

- Consider if Colorado should pursue a full UIC program for all injection classes including determining the best administrative structure for these regulatory operations and the necessary state resources for a safe and effective program.

Direct Air Capture

Direct air capture (DAC) is another emerging industry related to CCUS. It involves the removal of CO_2 directly from the atmosphere. Generally, DAC facilities utilize large fans that direct air through a capture media that removes CO_2 and other pollutants. These pollutants are transported for sequestration or usage and the cleaner air is released back into the atmosphere. While carbon capture at point sources is important for reducing active emissions, carbon removal technologies, including DAC, may be important tools for addressing legacy pollution.[32] Further, carbon removal technologies will be required to meet global climate goals, and can complement other strategies that reduce GHG emissions.[33]

There are significant federal incentives for DAC. The IIJA included $3.5 billion to establish regional DAC hubs[34] and the recently passed IRA includes significantly increased 45Q tax credits for any stored carbon from a DAC facility. With these funding opportunities in mind, DAC projects may begin to move forward throughout the nation.

For a DAC project to be viable, it must utilize or be co-located with renewable energy so that the facility itself is not a carbon producer, and there must also be access to viable carbon sequestration and/or usage options. One major benefit to DAC is that the location is flexible in that it is not tied to a particular emission source. For this reason, it can be strategically located where renewable energy, such as solar or geothermal, is available and near a Class VI sequestration well or EOR opportunities. In Colorado, deep sedimentary basins, in particular the DJ Basin due to its available options for sequestration, EOR, and geothermal potential, may present an opportunity to co-locate a DAC facility with Class VI and/or Class II EOR wells along with deep sedimentary geothermal operations or solar power. Generally, for CCUS activity, this co-location presents an opportunity to reduce the impact of related operations while actively improving the air quality of the impacted community.

While DAC facilities can provide benefits and help reduce GHG emissions, there are also associated concerns and impacts.[35] DAC facilities require a significant amount of energy and likely need a renewable power source to be viable. This can limit where facilities can be located. A million-tonne-per-year DAC facility may require 100

32 National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration, 2019, https://www.nationalacademies.org/our-work/developing-a-research-agenda-for-carbon-dioxide-removal-and-reliable-sequestration.

33 IPCC, Climate Change 2022: Mitigation of Climate Change, Chapter 3, Mitigation pathways compatible with long-term goals, https://www.ipcc.ch/report/ar6/wg3/.

34 Energy.gov, DOE Announces Bipartisan Infrastructure Law Effort to Establish Regional Direct Air Capture Hubs for Large-Scale CO2 Removal, May 19, 2022, https://www.energy.gov/articles/biden-administration-launches-35-billion-program-capture-carbon-pollution-air-0.

35 World Resources Institute, Direct Air Capture: Assessing Impacts to Enable Responsible Scaling, May, 2022, https://www.wri.org/research/direct-air-capture-impacts.

or more acres of land.[36] If coupled with solar power, additional land use will be required. Additionally, these facilities may make a minor amount of noise and are not visually appealing. Despite these impacts, if DAC facilities are co-located with renewable energy and geologic storage, impacts can be minimized and some benefits can be provided to the local community. With these factors in mind, siting DAC facilities in the context of protecting public health, safety, and welfare, the environment, and wildlife resources may be a strategy to consider to reduce cumulative impacts.

Colorado should seek to enable emerging industries and interconnected operations that provide benefits to impacted communities and reduce GHG emissions by evaluating and addressing legal and regulatory barriers. As sequestration projects progress in Colorado, interconnected and supportive technologies should also be evaluated and encouraged to help reduce overall impact of CCUS operations.

Recommendation

- Consider the siting of direct air capture facilities in the context of protecting public health, safety, and welfare, the environment, and wildlife resources.

36 Carbon Engineering, News & Updates, Pale Blue Dot Energy and Carbon Engineering create partnership to deploy Direct Air Capture in the UK, September, 16, 2020, https://carbonengineering.com/news-updates/pale-blue-dot-energy-and-carbon-engineering-partnership/.

Interconnected Operations and Regulatory Evaluations

By consolidating regulatory responsibility and providing a unified approach to new and existing subsurface industries, Colorado can encourage innovation, investment in state projects, reuse of existing infrastructure, and integrated operations. Additionally, consolidating project information will better help protect Colorado's resources by preventing gaps in regulatory oversight, reducing the number of regulatory agencies involved, encouraging a sustainable and protective approach to development, and enabling a more comprehensive approach to induced seismicity prevention. Multiple existing and emerging industries may utilize similar subsurface reservoirs and project interaction may become an important topic. Development of subsurface resources in Colorado may be impeded and even less protective without proper regulation of and clarification on potential subsurface conflicts. Table A-2 below outlines how certain operations are interconnected with existing COGCC activities and emerging industries.

Table A-2. Interconnected Operations and Regulatory Evaluations

Related and Connected Operations	CCUS Operations (Class II and VI Wells)	Deep or other Geothermal Operations	Underground Gas Storage	Hydrogen Related Operations	Other Subsurface Injection Operations	Pipelines and Flowlines	Property Rights Considerations
Oil and Gas Operations including Class II Injection Wells	Captured carbon may be utilized in Class II enhanced recovery operations to increase production in depleted reservoirs.	Many oil and gas basins in Colorado are also prospective for geothermal resource development. The industries utilize similar technologies including drilling, wellbore construction, completion types, and more. Coproduction of oil and gas and geothermal resources may occur. Oil and gas infrastructure may be repurposed for geothermal development.	Underground storage of produced natural gas and utilization of similar reservoirs including depleted oil and gas formations and deep saline aquifers.	Through the steam methane reforming process, natural gas can be utilized to produce gray or blue hydrogen.	Class I and V wells may target similar formations (deep saline reservoirs) as Class II disposal wells. Class II wells may be converted to Class I depending on type of fluid injected and vice versa. Similar technologies across several injection well types.	Transport of oil and gas within project flowlines and pipelines.	Existing pooling and spacing mechanisms for oil and gas minerals. Unitization process for Class II EOR operations. Consideration for the impact of pore space law on Class II disposal wells.
CCUS Operations (Class II and VI Wells)	Carbon capture, utilization, and storage involves capturing CO_2 from point source emitters, such as industrial facilities, or directly capturing CO_2 from the air (DAC) and the transportation of the fluid for use or sequestration in a Class VI well.	CO_2 may be utilized as a geothermal working fluid. A CO_2 turbine for geothermal projects is in development. Co-locating these operations can provide benefits to both industries and the impacted community.	Target similar reservoirs including depleted oil and gas reservoirs and deep saline reservoirs. Drilling and wellbore construction technologies are similar.	In the production of low-carbon, blue hydrogen, CO_2 is captured and may be utilized in various processes and/or sequestered in a Class VI well.	Class I and V wells may target similar formations (deep saline reservoirs) as Class VI wells. Similar technologies across several injection well types.	Transport of CO_2 in both gaseous and supercritical phase within pipelines and project flowlines.	Recommendation for a property right aggregation process, such as unitization, for pore space in Class VI projects.

Table A-2. Interconnected Operations and Regulatory Evaluations (cont.)

Related and Connected Operations	CCUS Operations (Class II and VI Wells)	Deep or other Geothermal Operations	Underground Gas Storage	Hydrogen Related Operations	Other Subsurface Injection Operations	Pipelines and Flowlines	Property Rights Considerations
Deep Geothermal Operations	CO_2 may be utilized as a geothermal working fluid. A CO_2 turbine for geothermal projects is in development. Co-locating these operations can provide benefits to both industries and the impacted community.	Deep geothermal operations include production and injection wells and flowlines, and may be interconnected with other activities. These projects may target deep saline aquifers and utilize existing oil and gas infrastructure and technologies.	Target similar reservoirs including depleted oil and gas formations and deep saline aquifers.	Geothermal energy may be utilized to produce green hydrogen. Geothermal operations may target similar formations as underground gas storage facilities including hydrogen storage.	Class V injection wells are commonly a part of geothermal operations (reinjection well). Class I wells and other types of Class V wells target similar formations (deep saline reservoirs).	Transport of formation fluid for reinjection. Transport of any additional working fluids to be utilized in the project.	Consideration for a property right aggregation process, such as spacing and pooling, for future, larger-scale development of deep geothermal resources.
Underground Gas Storage	Target similar reservoirs including depleted oil and gas reservoirs and deep saline reservoirs. Drilling and wellbore construction technologies are similar.	Target similar reservoirs including depleted oil and gas formations and deep saline aquifers.	Underground gas storage can provide a dispatchable energy source that can be accessed as needed to meet fluctuating energy demands. Natural Gas and hydrogen may be stored in depleted oil and gas reservoirs, deep saline aquifers, and salt formations. Projects involve injection and production wells, monitoring wells, pipelines, and flowlines.	Underground storage of natural gas mixed with hydrogen.	Target similar reservoirs including depleted oil and gas formations and deep saline aquifers. Underground gas storage of pure hydrogen or other gases that do not include hydrocarbons will likely be a part of the UIC program (Class V).	Transport of gas to and from the underground storage facility.	Consideration for the impact of pore space law on underground gas storage facilities. A property right aggregation process similar to Class VI may be appropriate.
Other Subsurface Injection Operations	Class I and V wells may target similar formations (deep saline reservoirs) as Class VI wells. Similar technologies across several injection well types.	Class V injection wells are commonly a part of geothermal operations (reinjection well). Class I wells and other types of Class V wells target similar formations (deep saline reservoirs).	Target similar reservoirs including depleted oil and gas formations and deep saline aquifers. Underground gas storage of pure hydrogen or other gases that do not include hydrocarbons will likely be a part of the UIC program (Class V).	Class V wells may be utilized for injection and storage of pure hydrogen in the subsurface.	Subsurface injection through the EPA's UIC program encompasses 6 different classes that include a large variety of injection wells. The primary goal of the program is to protect underground sources of drinking water through the administration of the Safe Drinking Water Act.	Transport of fluids to be injected into the subsurface.	Consideration for the impact of pore space law on other injection classes. Subsurface injection may utilize pore space.
Pipelines and Flowlines	Transport of CO_2 in both gaseous and supercritical phase within pipelines and project flowlines.	Transport of formation fluid for reinjection. Transport of any additional working fluids to be utilized in the project.	Transport of gas to and from the underground storage facility.	Transport of natural gas, hydrogen, and CO_2 for different types of hydrogen projects. This includes mixtures of natural gas and hydrogen as well as pure hydrogen. CO_2 transport related to blue hydrogen production.	Transport of fluids to be injected into the subsurface.	Pipelines and flowlines are crucial to several industries, including oil and gas, CCUS, underground gas storage, geothermal projects, and more.	Not applicable

Development Planning and Siting

With consolidated regulatory responsibility, the project planning and development process will more easily be able to incorporate the needs of multiple industries and stakeholders and encourage innovation. This could include integrating operations such as oil and gas, CO_2 sequestration, and geothermal operations into a single project area to reduce cumulative impacts to the public and environment while encouraging safe development of state resources. Some industries may be able to utilize the same infrastructure for concurrent operations. For instance, Class II EOR and Class VI sequestration activities could operate from the same well pad and utilize the same pipeline and flowline infrastructure. Further, oil and gas operations may potentially be combined with geothermal operations to reduce energy usage in oil fields and even produce oil and gas and generate geothermal energy from a single wellbore. As technologies mature, additional interrelated operations may become possible, and regulatory barriers should not inhibit collaborative innovation.

Environmental justice and the effect of subsurface resource development on disproportionately impacted communities is an evolving and growing consideration in decision-making and planning processes. Incorporating a wider range of activities into the development planning process will allow for more comprehensive analyses of impacts and benefits and provide a broader understanding of interrelated activities. For instance, deep geothermal resource development may be able to repurpose existing infrastructure, which minimizes impacts, while reducing energy expenditures of nearby activities, such as oil and gas and CCUS. These types of considerations could be included in an integrated development planning process to help reduce negative cumulative impacts to the public and environment while potentially benefiting local communities that may have been disproportionately impacted by previous industrial and/or energy development.

Flexibility in regulatory process and permitting can encourage innovation and allow for more efficient well conversions and reuse of existing infrastructure. Centralized regulation will allow for an adaptive process to address unique situations involving new technologies and interconnected development plans. Additionally, the process of reusing or repurposing existing infrastructure in a new project will be more efficient and informed under a single regulatory agency.

The COGCC's existing Oil and Gas Development Plan (OGDP) provides a comprehensive and protective development planning process that includes outreach to disproportionately impacted communities, requires consultation with relevant sister agencies, allows for an alternative location analysis as needed, requires outreach to all affected parties including local governments, incorporates strategies to reduce impacts on the public and wildlife, and accounts for spacing, unitization, and well planning. This process could be adapted and utilized for the siting and planning of additional and/or integrated operations including CCUS, underground gas storage, deep geothermal projects, and other similar operations.

Property Rights

The utilization of pore space, extraction of minerals, development of geothermal resources, and potential associated conflicts between surface, mineral, resource, and pore space owners are important considerations that may impact several industries. Consideration should be given to how existing and emerging industries will address potential conflicts with separate owners in split estates. Mechanisms for aggregating property interests for subsurface projects will be essential to project development and the protection of correlative rights. Once these issues have been addressed, it will be important to incorporate this information into project planning and permitting decisions. In making these determinations, an adjudicatory body with the relevant expertise, such as a commission, is crucial and necessary to provide fair and thoughtful decisions. By consolidating regulatory authority, the decisions pertaining to subsurface resource utilization will be more comprehensive and potentially more protective.

The COGCC has extensive experience in protecting correlative rights and aggregating subsurface property rights. Through both conventional and unconventional oil and gas development and enhanced recovery, existing processes are in place for spacing, pooling, and unitization. Similar strategies and legal mechanisms are likely also applicable to numerous emerging industries. As outlined above, property right aggregation, such as unitization, will likely play a role in allowing for large-scale CCUS deployment in Colorado. Beyond CCUS, property right aggregation is a consideration for underground gas storage and deep geothermal resource development. Further, any enacted pore space law may be a consideration for other subsurface injection operations that utilize pore space (such as other UIC classes). More research and outreach is required to fully determine the best path forward for all interconnected or related subsurface operations.

Induced Seismicity Prevention

As potential subsurface injection projects increase, it will be important to manage any potential hazards of induced seismicity. The COGCC has contemplated induced seismicity in regards to Class II injection wells and has established rules to prevent induced seismicity. Rules 801.d, 803.f.(1), 803.g.(6), and 810.b[37] are intended to prevent induced seismicity, which could otherwise create safety risks, by prohibiting injection in proximity to the Precambrian basement, limiting injection volumes, and requiring seismicity evaluations as a component of injection well permitting. While the EPA does have some requirements for preventing induced seismicity, their regulations are centered around protecting USDWs.

37 COGCC.state.co.us, 800-Series Rules, Underground Injection for Disposal and Enhanced Recovery Projects, https://cogcc.state.co.us/documents/reg/Rules/LATEST/800%20Series%20-%20Underground%20Injection%20for%20Disposal%20and%20Enhanced%20Recovery%20Projects.pdf

Consolidating regulatory responsibility to the state for all known subsurface activities that have the potential to cause induced seismicity will allow for a more unified approach to address the specific needs of the State.

With all oil and gas and injection operations within Colorado consolidated within the State, the primary activities known to have the potential to cause induced seismicity would be regulated at the state level. If needed, the implementation of any additional induced seismicity prevention requirements could be pursued by the state. This could become much more difficult if some of these activities remain regulated by a federal agency. Therefore, consolidating regulation of all subsurface injection activities would create the opportunity for a unified state approach to induced seismicity prevention. This could include cooperation with agencies such as the USGS, CGS, or induced seismicity partnerships focusing on monitoring seismic activity.[38]

Database and Information

Consolidating information from multiple related industries will provide a unique resource for not only operators and regulatory agencies, but also for the public and any interested stakeholders. Integrating detailed project information for several subsurface operations into a single database will allow for a more comprehensive evaluation process and provide project transparency to all stakeholders including the public.

The COGCC currently requires operators to electronically submit permit applications, completion reports, reports of subsequent operations, monitoring tests, production reports, and various other types of data related to oil and gas operations. All of this information is stored in the Colorado Oil and Gas Information System (COGIS) and the Colorado Environmental (COENV) database. The COGCC uses an online electronic form system that allows for the efficient submission, review, and approval of information including attachments. COGIS also contains inspection reports, violation data, hearings orders, and other important legacy data. While significant investment in expanding the database would be required, the current database content and structure are well suited for implementing and administering an expanded portfolio.

The COGCC also maintains an online Geographic Information System for use by COGCC staff, operators, the public, local governments, and more. The system displays several types of information including data within the COGIS and COENV databases, spatial information critical to permit approval, and various types of data such as topography, roads, water resources, federal and state lands, and aerial photography. The existing mapping system would be an excellent resource for implementing new regulatory programs.

Conclusion

For emerging industries such as carbon sequestration, deep geothermal resource development, and hydrogen, lack of clarity in the regulatory and permitting process has been identified as a significant barrier. It is necessary and prudent to not only encourage innovation and investment in emerging technologies that reduce greenhouse gas emissions, but also to facilitate parallel growth in regulation in order to provide a framework for safe and effective development of state resources. This can increase efficiency in permitting and regulatory processes, provide additional pathways to reduce greenhouse gas emissions, and help Colorado meet future climate goals.

By consolidating regulatory responsibility, the State could encourage efficiency, innovation, integrated operations, and safe development of energy resources. Adapting the existing oil and gas development planning process to address other subsurface operations will allow the agency to incorporate the needs of multiple industries and stakeholders and address environmental justice considerations in a broader context. It will also allow for a more flexible regulatory approach to emerging industries. Additionally, a comprehensive database would serve as a robust resource for regulatory evaluations, operators, stakeholders, the public, and more.

As Colorado transitions to new and emerging energy technologies, an expanded COGCC could play a crucial role in providing legal and regulatory pathways for emerging and existing energy operations as well as protecting our communities and subsurface resources. The COGCC looks forward to further discussions and collaboration on these important topics and working together to make a better future for all Coloradans.

38 USGS.gov, Earthquake Hazards, https://www.usgs.gov/programs/earthquake-hazards
Coloradogeologicalsurvey.org, Earthquakes, https://coloradogeologicalsurvey.org/hazards/eq/
Utexas.edu, Regional Induced Seismicity Collaborative, https://www.beg.utexas.edu/risc

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