Thank you, Madame Chair for the opportunity to testify on HB24-1346. My name is Ruth Hund. I am a resident of Golden, Colorado. I have a bachelor's degree in biochemistry with a minor in chemistry from Colorado State University and a master's degree in environmental science and engineering from the Colorado School of Mines.

I have several concerns regarding HB24-1346. Carbon capture and sequestration is unproven and uneconomical. However, CCS has been shown to be a good method for enhanced oil and gas recovery.

I see no provision for evaluation of the capacity, injectivity, containment and geochemistry of each site in this bill. Geochemistry is a tricky thing. Precipitates from carbon dioxide can form given the correct pH, humidity, and mineral content. These things vary from site to site, within sites, and through time. Precipitates will not form under many conditions. Bench- and pilot-scale studies that show quick kinetics and complete reactions must be completed before any carbon capture at any particular site is attempted full-scale.

Trusting the ECMC to set standards on capacity, injectivity, containment, and geochemistry without a legislative mandate is not supported by that commission's history. Geochemical and geophysical bench and pilot testing must be mandated by law.

I do not support CCS in Colorado as it is unproven, uneconomical, and a great way for oil and gas to continue fracking. However, if there is CCS in Colorado, I recommend setting up a commission separate from the ECMC, which is made up of folks who support oil and gas development. I understand that "carbon management" is part of the ECMC's name, but it is ill-equipped for this task. A commission with geochemists, geophysicists and environmental engineers is needed. If this is not an opportunity for oil and gas, it should not have oil and gas folks overseeing it.

CO2 is toxic and will leak. 100% of owners and residents, including renters, should agree to allow a toxic substance to be pumped below their homes, with full disclosure of the risks. Don't just show folks the money. Finally, I would like to see CO2 removal systems, like radon removal systems, provided by the carbon capture company for all buildings.

I understand the good intentions behind this bill. We all want to find good ways to remove carbon from the air. Let's not use a technology that can be so easily exploited by those who are most responsible for putting CO2 into the air in the first place. I highly recommend photosynthesis. It's cheap and proven to work.

Please vote against HB24-1326.

HB24-1346 | Energy & Carbon Management Regulation

Significant Deficiencies in the Bill include:

1. **Health, Safety and Welfare:** Public health, safety and welfare assurance must be a prerequisite for any CCS/CCUS/DAC programs (Carbon capture, utilization and storage/sequestration, Direct Air Capture), not a “to be determined”. Health risks must be studied, assessed and addressed prior to, and not subsequent to, the green-lighting of any such programs or the awarding of exclusive authority to any state agency,

2. **Costs to Ratepayers and Taxpayers:** Will Xcel and other utilities be passing costs, such as new carbon capture infrastructure and increased coal and other fossil fuel energy input costs affiliated with carbon capture, to ratepayers? Any CCS legislation such as this should include a provision that the cost of capture, including associated costs of the applied fuels in a DAC process, CO2 transport and storage, must be less than the social cost of that carbon or the carbon benefits achieved from deploying solar and wind electricity generation, whichever is less.

3. **Unjust Forced Pooling:** CO2 is not an essential energy source or commodity for Coloradans. Its only significant commercial value is for use in enhanced oil recovery (EOR), a dubious shell-game process that simply exchanges one form of carbon for another, but for which the industry claims carbon sequestration credit. Serious climate change action must involve a rapid transition away from fossil fuels. Therefore, there is no justification for forced pooling at any percentage. There is no such thing as “just and reasonable” forced pooling when removing basic home ownership, property, and mineral rights from Coloradans.

4. **Risking Human Life with “Pore Space” Near Homes and People:** Unlike natural gas, carbon dioxide is heavier than air. Any leakage represents the silent, lethal threat of human suffocation and death. When a carbon pipeline ruptured in Mississippi in 2020, people up to a mile away passed out, cars stalled, and rescuers described conscious victims as "zombies.” (See also the 1986 Lake Nyos leak, in which a CO2 cloud traveled 17 miles and suffocated 1,746 African villagers and 3,500 livestock.) Therefore, under no circumstances should pore space be used for CO2 storage in areas of human population. The CDPHE and independent experts (not the ECMC) should determine a minimum safe distance between underground CO2 storage sites and any human presence.

5. **Alarming ECMC Mission Creep into CDPHE’s legitimate jurisdiction:** We should be reducing and restricting the ECMC’s authority over Colorado’s future energy economy, not expanding it, as this bill does. Moreover, this bill puts the CDPHE in an inferior, advisory position to the ECMC, when health, safety, and welfare should be prioritized per SB-181. The bill provides that oversight of carbon capture occurs only retroactively and then only as determined by the director. The public is excluded from every step of the process. Beyond considerations of health, safety, and welfare, the public’s interest is also excluded from cumulative impacts considerations, especially for DI communities, as well as permitting and oversight.

-Harv Teitelbaum
Board Co-Chair
PSR Colorado (Physicians for Social Responsibility)

Please accept the following as PSR Colorado (Physicians for Social Responsibility) official written submission and testimony on HB24-1346, for the Energy & Environment Committee's hearing on this bill.

HB24-1346 | Energy & Carbon Management Regulation

We believe this bill is substantially deficient:

1. Health, Safety and Welfare: Public health, safety and welfare assurance must be a prerequisite for any CCS/CCUS/DAC programs (Carbon capture, utilization and storage/sequestration, Direct Air Capture), not a "to be determined". Health risks must be studied, assessed and addressed prior to, and not subsequent to, the green-lighting of any such programs or the awarding of exclusive authority to any state agency,

2. Costs to Ratepayers and Taxpayers: Will Xcel and other utilities be passing costs, such as new carbon capture infrastructure and increased coal and other fossil fuel energy input costs affiliated with carbon capture, to ratepayers? Any CCS legislation such as this should include a provision that the cost of capture, including associated costs of the applied fuels in a DAC process, CO2 transport and storage, must be less than the social cost of that carbon or the carbon benefits achieved from deploying solar and wind electricity generation, whichever is less.

3. Unjust Forced Pooling: CO2 is not an essential energy source or commodity for Coloradans. Its only significant commercial value is for use in enhanced oil recovery (EOR), a dubious shell-game process that simply exchanges one form of carbon for another, but for which the industry claims carbon sequestration credit. Serious climate change action must involve a rapid transition away from fossil fuels. Therefore, there is no justification for forced pooling at any percentage. There is no such thing as "just and reasonable" forced pooling when removing basic home ownership, property, and mineral rights from Coloradans.

4. Risking Human Life with "Pore Space" Near Homes and People: Unlike natural gas, carbon dioxide is heavier than air. Any leakage represents the silent, lethal threat of human suffocation and death. When a carbon pipeline ruptured in Mississippi in 2020, people up to a mile away passed out, cars stalled, and rescuers described conscious victims as "zombies." (See also the 1986 Lake Nyos leak, in which a CO2 cloud traveled 17 miles and suffocated 1,746 African villagers and 3,500 livestock.) Therefore, under no circumstances should pore space be used for CO2 storage in areas of human population. The CDPHE and independent experts (not the ECMC) should determine a minimum safe distance between underground CO2 storage sites and any human presence.

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Signed,

Harv Teitelbaum, Board Co-Chair,

PSR Colorado (Physicians for Social Responsibility)

The Colorado Renewable Energy Society
Position on Carbon Management
March 2024

Summary of CRES Position on Carbon Management

CRES opposes the use of state and federal taxpayer dollars and ratepayer funds to deploy unproven carbon management projects in Colorado. This includes the use of direct air capture to remove CO_2 from the atmosphere and the use of carbon capture and storage (CCS) or carbon capture utilization and storage (CCUS) with fossil fuel power plants. CRES believes that climate change impacts have reached a crisis stage and that all current mitigation efforts should be focused on driving carbon emissions to zero or near zero as rapidly as possible. Carbon management does not do this because—unlike renewables—it prolongs the use of fossil fuels.

In particular, funds and policy attention should be invested in the rapid transition of our electric grids to wind and solar energy, in collaboration with the deployment of end-use efficiency, storage, demand response, and transmission. In addition, Colorado should focus on utilizing this carbon-free electricity by electrifying our transportation, buildings, and industry sectors. This means replacing gasoline and diesel cars and trucks with battery electric vehicles, replacing methane gas heating of buildings with ground-coupled and cold-climate heat pumps, and replacing fossil fuels with electricity for the production of industrial process heat.

Introduction and Background

The Intergovernmental Panel on Climate Change (IPCC) has concluded that to achieve "net zero" carbon emissions by 2050, "negative emissions" will be needed to make up for energy uses that are very difficult to abate. The term negative emissions refers to a variety of carbon dioxide removal (CDR) approaches that remove carbon dioxide from the atmosphere. These are generally divided into biological (or "nature-based") methods and non-biological, or mechanical, methods.

Examples of biological solutions include allowing forests to regrow (reforestation), planting new forests (afforestation), restoring coastal wetlands, and switching to regenerative agricultural practices, such as cover crop rotation, that support healthy soils. These biological methods reduce climate change by capturing CO_2 from the air and sequestering it in plants, soils, and sediments. Non-biological means include enhanced rock weatherization and direct air capture. Of all these methods, the one that is receiving the most attention, and is the most expensive, is direct air capture. We address that in the section below on CDR.

CDR methods all attempt to extract carbon dioxide from the atmosphere after it has been added. Of course, it is much easier to not add CO_2 to the atmosphere in the first place, which involves transitioning from fossil fuel energy to renewable energy sources, a transition that is already underway. Because of the enormous extent to which the world relies on fossil fuels, and the large profits of that industry, there is a broad industry effort to explore ways that fossil fuels can

continue to be burned, but with measures taken to capture CO_2 emissions before they enter the atmosphere, then sequester it underground.

Alternatively, CO_2 can be captured before it enters the atmosphere at locations where fossil fuels are used as an energy source (to produce electricity or an industrial product) or as an industrial feedstock. CO_2 can also be captured where it is released as an industrial process emission, such as in the production of Portland cement from limestone.

When CO_2 is captured at a fossil-fueled electric generating plant, it can be captured in three possible ways: 1) pre-combustion (in which the fuel is gasified, and hydrogen and CO_2 are separated), which is only applicable for new fossil fuel power plants, 2) post-combustion (capture of CO_2 in the flue gas), or 3) oxyfuel combustion (burning in pure oxygen, which provides a high-concentration CO_2 exhaust).

Regardless of how CO_2 is captured, be it before or after it enters the atmosphere, a key requirement is that it be stored with some degree of permanence, preferably for time periods much greater than a century. Different methods of carbon capture and storage (CCS or, when utilization is included, CCUS) provide different degrees of permanence. Geologists indicate that the most permanent form of sequestration is via deep geological burial, either in salt caverns or where it is allowed to chemically combine with existing rock when buried.

Regardless of where CO_2 is stored, it will be transported by pipeline. Leaks of CO_2 are extremely hazardous because CO_2 is heavier than air and blankets the ground, leading to the suffocation of animals and human beings. In 1986, CO_2 leakage from Lake Nyos, a volcanic crater lake in Cameroon, West Africa, resulted in the deaths of approximately 1,700 people located 17 miles from the lake.[1] In February 2020, in Satartia, Mississippi, a CO_2 pipeline ruptured. More than 200 people were evacuated and at least 45 people were hospitalized. Automobile engines stalled, hobbling emergency response. People lay on the ground, shaking and unable to breathe.[2] We can only imagine what the human impact of the record Aliso Canyon natural gas leak in California might have been like had this involved a leak of stored CO_2 instead of natural gas.[3]

The Fundamental Issue with Carbon Management (CDR and CCS) Technologies

CRES recognizes that the current climate change underway is not natural, is entirely the result of human emissions (especially from the burning of fossil fuels), and has enormous negative societal, ecological, and economic consequences. To address it, the world must achieve zero or near-zero carbon emissions as rapidly as possible. Once emissions are eliminated, some forms of CDR will be needed to draw down atmospheric CO_2 and lower the global temperature. However, while some amount of R&D aimed at identifying and developing the most cost-effective CDR methods can be justified, there is little justification for deploying DAC today because its high cost would divert funds from the critical need for rapid deployment of carbon-free energy. Also,

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[1] P.J. Baxter, et al., "Lake Nyos disaster, Cameroon, 1986: the medical effects of large-scale emission of carbon dioxide?" *British Medical Journal*, May 27, 1989. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1836556/#:~:text=Carbon%20dioxide%20was%20blamed%20for,exposure%20to%20an%20asphyxiant%20gas.

[2] Julia Simon, "The U.S. is expanding CO2 pipelines. One poisoned town wants you to know its story," NPR, https://www.npr.org/2023/05/21/1172679786/carbon-capture-carbon-dioxide-pipeline

[3] Aliso Canyon, Wikipedia, https://en.wikipedia.org/wiki/Aliso_Canyon_gas_leak#:~:text=Aliso%20Canyon%20SS%2025%20wellhead,were%20released%20into%20the%20atmosphere

spending funds to apply CCS technologies to fossil fuel power plants makes no sense when solar and wind are now the lowest-cost power-generating technologies.

Thus, given the many demands on federal and state budgets, it is critically important that climate change efforts today avoid the distraction of CDR and CCS, and focus on not emitting carbon dioxide in the first place – that is, on transitioning from carbon-emitting energy sources to the most cost-effective non-carbon sources that can be rapidly deployed, namely renewable energy.

The attention being paid to CDR (especially DAC) and CCS technologies today is clearly an effort by the fossil fuel industry to justify the continued use of fossil fuels, as opposed to achieving the necessary transition to carbon-free energy sources. CRES thus opposes the deployment of DAC and CCS, with the exception that CCS can make sense for limited cases where high-concentration CO_2 process emissions are difficult to avoid, such as in cement production.

It is instructive to view the current rush toward carbon management projects in Colorado in the context of our state history. Over the last half-century, Colorado has experienced a series of costly boom-and-bust energy failures. These failures include the Fort St. Vrain nuclear reactor, the oil shale debacle, the Colorado-Ute Electric Association bankruptcy, underground nuclear blasting for natural gas, the often-inoperable and polluting Pueblo 3 coal-fired power plant, and the destruction of large swaths of Colorado land for fracking. The current rush toward carbon management projects is reminiscent of these other failures, and it distracts us from the fundamental need to rapidly transition off of fossil fuels.

The following text provides additional information on CDR and CCS technologies.

Carbon Dioxide Removal (CDR)

We support limited R&D today to investigate CDR methods that can potentially be used to draw down atmospheric CO_2 in a post-fossil fuel energy economy. In particular, we support R&D of biological, nature-based efforts, which reduce climate change by capturing CO_2 from the air and sequestering it in plants, soils, and sediments. We note, however, that the most immediate need today is to halt deforestation around the world.

Unfortunately, fossil fuel industry lobbying efforts are resulting in a great deal of attention being paid to DAC. The key problem with DAC is that, despite CO_2's powerful activity as an absorber of outgoing infrared radiation, it is a trace gas in the atmosphere constituting only 0.04% of the air. Because atmospheric CO_2 is so extremely diluted, directly capturing it requires moving tremendous amounts of air, and that consumes an enormous amount of electric power to operate large fans. Because of the low concentration of CO_2 in the air, a very large surface area of sorbent material is needed to capture the CO_2, which means that materials and capital equipment costs are very high. Finally, an amount of energy on the order of about four times the fan power, with its own greenhouse gas and pollution implications, is needed to extract the CO_2 after it is captured by the sorbent, and more energy is needed to pump the CO_2 into geological storage locations.

As shown in the table below[4], DAC is also extremely expensive compared to other CDR methods. MIT expert Howard Herzog has estimated that it may be years before DAC drops

[4] J. Sekera, et al., "Carbon dioxide removal-What's worth doing? A biophysical and public need perspective, PLOS Climate, February 14, 2023, https://journals.plos.org/climate/article?id=10.1371/journal.pclm.0000124

below a cost of $600 per ton of CO_2,[5] which is about three times EPA's latest estimate of the social cost of CO_2 emissions. Because DAC uses century-old technology (fans, pipes, pumps, heat, and mass transfer equipment) and common sorbents, it is very unlikely to see the cost reductions that we have seen for solar and wind power. The cost of DAC per ton of captured CO_2 may never be lower than the social cost of carbon.

Table 1. Comparison of the financial cost of mechanical and biological methods of CDR.

Method	Cost/tCO2 captured or removed	Source
Direct Air Capture, *gross* capture, and *excluding* costs of compression, transport & storage	$500* - $1,100	[21, 36, 69, 70]
Reforestation/Afforestation	$20 or less	[18]
Improved forest management	$20 or less	[18]
Improved agricultural practices	$100 or less	[18]
Coastal blue carbon	$20 or less	[18]

* Lower cost estimates exist in the literature (including < $100/ton) but generally come from sources close to industry; upper range estimates are generally derived from thermodynamic considerations [e.g., 21, 36, 69].

https://doi.org/10.1371/journal.pclm.0000124.t001

Carbon Capture and Storage (CCS) at Power Plants

New power plants employing pre-combustion capture were considered to have the potential for the lowest cost because they start with the highest concentration of CO_2, and so various efforts around the world have built Integrated Gasification and Combined Cycle (IGCC) power plants. However, the complexity and costs have generally turned out to be higher than expected. The Kemper coal IGCC plant was shut down in 2017 due to high complexity, concerns about start-up risks, and the ascendancy of natural gas in the market.[6] And because solar and wind are now the lowest cost sources for new electricity generation, it makes no sense to build a new fossil fuel power plant employing pre-combustion capture as it would be much more expensive.

In the case of oxy-combustion, there is a considerable amount of energy and cost associated with extracting oxygen from the air. Oxy-combustion has been used by the gas industry. The only attempt to date to use it in a power plant was the White Rose plant in the UK, but construction was halted in 2016 due to lack of funds.[7] Net Power has had plans to build an oxy-combustion plant in Texas that uses carbon dioxide as the working fluid in the power cycle, but the project has been delayed due to global supply chain issues and is not expected to operate until 2028.[8]

[5] "Affordable direct air capture: myth or reality?," MIT Joint Program on the Science and Policy of Global Change, June 8, 2022, https://climate.mit.edu/posts/affordable-direct-air-capture-myth-or-reality

[6] Kristi E. Swartz, "The Kemper project just collapsed. What it signifies for CCS," E&E New, February 26, 2021, https://www.eenews.net/articles/the-kemper-project-just-collapsed-what-it-signifies-for-ccs/#:~:text=The%20project%2C%20which%20was%20half,equipment%20was%20no%20longer%20needed.

[7] "UK government spent £100m on cancelled carbon capture project," BBC News, January 20, 2017, https://www.bbc.com/news/uk-scotland-scotland-business-38687835

[8] Mary B. Powers, Debra K. Rubin, "Developer NET Power Delays $1B Texas Net-Zero Power Plant Start," Engineering News-Record https://www.enr.com/articles/57639-developer-net-power-delays-1b-texas-net-zero-power-plant-start

Net Power also has plans to build a plant on the Southern Ute Indian Reservation.[9] Thus, oxy-combustion for power plants remains in an early development phase.

Much of the discussion lately is about post-combustion capturing of CO_2 from the flue of a coal- or gas-fired power plant. The preferred technology is to use chemical solvents, such as amines. Although used in the chemical and refinery industries, there are no examples of this in full-scale power plants. The concentration of CO_2 in the exhaust varies from as low as 3% in a gas-fired plant to as high as 15% in a pulverized coal plant. Although it is generally assumed that up to 90% of the CO_2 can be captured, rarely has that been achieved on a continual basis. The addition of capture equipment to a plant increases the cost of the plant and reduces the plant efficiency, and so reduces the amount of electricity produced. A report by Professor Mark Jacobson of Stanford[10], which reviewed data from two pilot studies, found that when all carbon impacts are considered, the effective reduction in the plant's emissions would be much less than the 90% claimed and is as low as 30%, although others have pointed out that the results for a new pilot plant are not necessarily reflective of a full-size conventional technology.

Regardless of which of the three technology types is used for CCS at power plants, parasitic energy, or an additional power supply is required to operate them, the costs are significant, and ultimate success is uncertain. The fundamental reason for deploying any of these technologies is to justify the continued extraction and use of fossil fuels. Investing funds in today's very low-cost solar and wind electricity is a much more cost-effective and environmentally responsible way to reduce the carbon emissions associated with electricity production, while avoiding the land disruption, water consumption, and air pollution associated with extracting fossil fuels from the Earth.

The following is a partial list of CRES's concerns about CDR and CCS:

- **CCS has a long history of technical and financial failures**, as described in detail by the Institute for Energy Economics and Financial Analysis.[11] IEEFA has produced comprehensive studies of carbon management and has concluded that "close to 90% of proposed CCS capacity in the power sector has failed at the implementation stage or was suspended early—including Petra Nova and the Kemper coal gasification power plant in the U.S. Further, most projects have failed to operate at their theoretically designed capturing rates. Chevron's Gorgon CCS project in Australia underperformed by 50%.[12] CCS technology has been going on for 50 years, and many projects have failed and continue to fail, with only a handful working. Many international bodies and national governments are relying on carbon capture in the fossil fuel sector to get to net zero, and it simply won't work."

- **CCS is fraught with deception, greenwashing, and a high cost to taxpayers.** According to the Colorado Sun, Bloomberg News has cited reports from Credit Suisse analysts and others estimating carbon capture entrepreneurs will reap up to $52 billion

[9] Coyote Clean Power, https://coyote.energy

[10] M. Jacobson, "The health and climate impacts of carbon capture and direct air capture," *Energy & Environmental Science*, Issue 12, 2019, https://pubs.rsc.org/en/content/articlelanding/2019/ee/c9ee02709b/unauth#!divAbstract

[11] "The carbon capture crux: Lessons learned," Institute for Energy Economics and Financial Analysis, September 1, 2022
https://ieefa.org/resources/carbon-capture-crux-lessons-learned

[12] "If Chevron, Exxon and Shell can't get Gorgon's carbon capture and storage to work, who can?" Institute for Energy Economics and Financial Analysis, April 26, 2022,
https://ieefa.org/articles/if-chevron-exxon-and-shell-cant-get-gorgons-carbon-capture-and-storage-work-who-can

from the uncapped Inflation Reduction Act tax credits in the first 10 years.[13] Of nearly $1 billion in carbon-capture tax credits sought through 2019, $893 million was submitted in ways that didn't meet EPA rules.[14]

- **Parasitic power:** Capture technologies are estimated to cost 25-30% of a plant's power output, driving up the price of electricity by around 80%.[15]

- **The vast majority of captured CO_2 today is used for enhanced oil recovery (EOR).**[16] Occidental Oil and other oil companies are promoting DAC as a CO_2 source for EOR to extend the life of their oil enterprise by decades.[17] Although EOR can allow CO_2 to be sequestered in conjunction with oil drilling operations, DAC is extremely expensive, and the ultimate effect of EOR is to perpetuate the extraction and burning of oil, which contributes to both climate change and air pollution.

- **CDR and CCS are paid for by American taxpayer dollars.** Congress has rewarded the oil and gas industry for their targeted support for the Inflation Reduction Act through the inclusion of a highly lucrative system of tax credits, known as the 45Q. The Bipartisan Infrastructure Law also provides billions of dollars.[18]

- **Adding CCS to power plants would result in a significant increase in the cost of electricity to ratepayers.** According to WyoFile,[19] Wyoming utilities' analyses of the addition of CCS to coal power plants in Wyoming determined that it would increase rates by $22 to $25 per month for the average residential customer and $40 to $104 per month for commercial customers. It would also reduce electrical generation output by more than 30%, exposing ratepayers to additional costs for replacement power.

- **Water requirements for thermal power plants would increase substantially** if CCS is deployed.[20]

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[13] "There Are Fortunes to Be Made in the Carbon Capture Gold Rush," Bloomberg.com, January 11, 2023 https://www.bloomberg.com/news/articles/2023-01-11/there-are-fortunes-to-be-made-in-the-carbon-capture-gold-rush?embedded-checkout=true

[14] Benjamin J. Hulac, "Treasury IG: A decade of carbon-capture tax credits were faulty, Roll Call, April 30, 2020, https://rollcall.com/2020/04/30/treasury-ig-a-decade-of-carbon-capture-tax-credits-were-faulty/

[15] Cory Simon, "Post-Combustion CO2 Capture to Mitigate Climate Change: Separation Costs Energy," *Scientific American*, March 7, 2013, https://www.scientificamerican.com/blog/guest-blog/post-combustion-co2-capture-to-mitigate-climate-change-separation-costs-energy/

[16] David Roberts, "Could squeezing more oil out of the ground help fight climate change?" Vox, Dec. 6, 2019 https://www.vox.com/energy-and-environment/2019/10/2/20838646/climate-change-carbon-capture-enhanced-oil-recovery-eor

[17] Camila Domonske, NPR, December 27, 2023 "This oil company invests in pulling CO2 out of the sky — so it can keep selling crude," https://www.npr.org/2023/12/27/1210928126/oil-climate-change-carbon-capture-removal-direct-air-capture-occidental

[18] "Funding Notice: Bipartisan Infrastructure Law: Carbon Storage Validation and Testing," U.S. Department of Energy, Office of Fossil Energy and Carbon Management, https://www.energy.gov/fecm/funding-notice-bipartisan-infrastructure-law-carbon-storage-validation-and-testing

[19] Dustin Bleizeffer, "Utility: Wyoming's carbon-capture mandate too costly," WyoFile, October 6, 2022, https://wyofile.com/utility-wyomings-carbon-capture-mandate-too-costly/

[20] H. Eldadiry and E. Habib, "Carbon capture and sequestration in power generation: review of impacts and opportunities for water sustainability," *Energy, Sustainability and Society*, February 1, 2018, https://energsustainsoc.biomedcentral.com/articles/10.1186/s13705-018-0146-3

The following are examples of CDR and CCS activity in Colorado that CRES believes should be seriously questioned.

- **The Colorado Oil and Gas Conservation Commission, long a proponent of the fossil fuel industry, had its name changed in 2023, to the Energy and Carbon Management Commission (ECMC)** and is now conducting a study of carbon sequestration.[21] The ECMC anticipates conducting a rulemaking proceeding on carbon topics in the summer of 2024. The agency has released a report on carbon capture and sequestration safety[22] and has signaled its interest in both promoting and regulating carbon management in the state. The ECMC is authorized to seek a replacement of the Environmental Protection Agency regulatory responsibility to review and approve Class VI carbon dioxide injection wells, presumably to speed up the permitting of carbon capture projects in Colorado.[23]

- **Colorado will soon craft regulations that create guardrails to prevent serious safety hazards. These are intended to reduce the serious risks proven to exist for carbon dioxide pipelines.**[24] Sequestration involves risks of leakage and seismic impacts. The Congressional Research Service produced a report that identifies the safety hazards.[25] The State may be considering invoking eminent domain to force pipelines onto private property owners.[26]

- **The Colorado State Land Board has approved a carbon injection exploration lease** in Weld County, potentially to capture CO_2 from a nearby ethanol plant.[27]

- **A utility-sponsored study in Pueblo** has proposed that their community should consider hosting a very expensive combined-cycle methane plant with carbon capture as a way to bring in future tax dollars.[28]

- **A proposed pipeline through Pueblo County** is anticipated to take captured carbon from facilities like a cement plant and deposit them at the Chico Basin Ranch in El Paso County.[29]

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[21] Colorado Senate Bill 23-016, "*Concerning Measures to Promote Reductions in Greenhouse Gas Emissions in Colorado, and, in Connection therewith, making an Appropriation*."
https://leg.colorado.gov/sites/default/files/2023a_016_signed.pdf

[22] *Carbon Capture and Storage: Safety and Impact Considerations from Source to Sequestration*, Colorado Energy and Carbon Management Committee,
https://ecmc.state.co.us/documents/library/GTCCSUNGS/CCS_Safety_Study_Report_20240201.pdf

[23] "Creating Colorado's Carbon Sequestration Framework: A Legislative Proposal," January 2023,
https://ecmc.state.co.us/documents/library/special_projects/CCUS_Framework_Legislative_Proposal.pdf

[24] Julia Simon, "The U.S. is expanding CO2 pipelines. One poisoned town wants you to know its story," NPR, September 23, 2023
https://www.npr.org/2023/05/21/1172679786/carbon-capture-carbon-dioxide-pipeline

[25] Congressional Research Service, "Carbon Dioxide Pipelines: Safety Issues," June 3, 2022
https://crsreports.congress.gov/product/pdf/IN/IN11944

[26] "Creating Colorado's Carbon Sequestration Framework: A Legislative Proposal," January 2023,
https://ecmc.state.co.us/documents/library/special_projects/CCUS_Framework_Legislative_Proposal.pdf

[27] Colorado State Land Board, Carbon Sequestration, https://slb.colorado.gov/Carbon

[28] Pueblo Innovative Energy Solutions Advisory Committee Report, January 2024,
https://www.xcelenergy.com/staticfiles/xe-responsive/Archive/PIESAC%20Written%20Report.pdf

[29] Michael Booth, "Colorado wants to create carbon-capture hubs across the state. But locals aren't sold." The Colorado Sun, November 2, 2023

- **Colorado won a $32 million DOE grant to pay for a carbon capture test well** in the southern part of the state. The grant and the research are managed by the Colorado School of Mines, the Los Alamos National Laboratory, and the private startup, Carbon America.[30]

- **Colorado has won a separate $3 million DOE grant to promote studies and marketing** for a potential direct carbon capture hub centered on Pueblo.[31]

- **A well in Washington County, near Yuma, has already been drilled** as part of a deal that Carbon America worked out with investors to sequester carbon from northeastern Colorado corn ethanol plants.[32]

- **Tri-State Generation and Transmission's December 2023 Electric Resource Plan** envisions adding a 290 MW combined-cycle natural gas unit in 2028, with carbon capture and sequestration added in 2031.[33]

Conclusion

For the reasons stated above, CRES opposes the use of state and federal taxpayer dollars and ratepayer funds to deploy unproven carbon management projects in Colorado. This includes the use of direct air capture (DAC) to remove CO_2 from the atmosphere, and the use of carbon capture and storage (CCS), or carbon capture utilization and storage (CCUS) with fossil fuel power plants.

https://coloradosun.com/2023/09/17/colorado-carbon-capture-future/

[30]Michael Booth, "Colorado gets $32 million to create carbon-stuffing hub underground at Pueblo" The Colorado Sun, May 18, 2023 https://coloradosun.com/2023/05/18/colorado-carbon-sequestration-hub-pueblo-grant/

[31] Michael Booth, "Colorado wants to create carbon-capture hubs across the state. But locals aren't sold." The Colorado Sun, November 2, 2023, https://coloradosun.com/2023/09/17/colorado-carbon-capture-future/

[32]"Tri-State accelerates clean energy transition and bolsters electric system reliability," TRI-STATE, December 1, 2023, https://tristate.coop/tri-state-accelerates-clean-energy-transition

[33] Ibid

March 26, 2024

TO: House Energy and Environment Committee Cathy Kipp, Jenny Willford, Scott Bottoms, Ken DeGraaf, Gabe Evans, Meg Froelich, Junie Joseph, Manny Rutinel, Brianna Titone, Alex Valdez, Elizabeth Velasco, Stephanie Vigil, and Ty Winter

TO: Bill Sponsors: Brianna Titone, Karen McCormick, Chris Hansen, Kevin Priola

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RE: CRES Stance on HB24-1346 | Energy & Carbon Management Regulation

Concerning energy and carbon management regulation in Colorado, and, in connection therewith, broadening the energy and carbon management commission's regulatory authority to include regulation of direct air capture facilities and geologic storage operations

CRES continues to monitor and stay neutral on this bill.

CRES is a nonpartisan, science-based nonprofit with a reach of thousands of Coloradans annually. The CRES Policy Committee brings together a broad range of energy policy and technology experts who review energy bills before the Colorado state legislature to provide our perspective.

The rapid rise of extreme weather events in Colorado and around the world has made it clear that there is an urgent need to address the climate crisis, which is caused primarily by the burning of coal, oil, and methane gas, the emissions of which also result in a wide range of illnesses and enormous healthcare costs. Funds and policy attention should be invested in the rapid transition of our electric grid to Colorado's excellent wind and solar energy resources, in collaboration with the deployment of end-use efficiency, storage, demand response, and transmission. Colorado needs to focus attention on utilizing carbon-free, truly renewable, energy sources to electrify our transportation, buildings, and industry sectors.

Colorado citizens and policymakers are urged to focus on **real solutions, and reject misdirected state agency attention on false solutions**, including the various carbon management technologies such as direct air capture (DAC) and carbon capture, utilization, and storage (CCUS). These technologies are fundamentally aimed at continuing reliance on burning fossil fuels, not on addressing the issues of climate change and air pollution.

We support the potential for nature-based solutions, which involve conserving, restoring, or better managing ecosystems to remove some amount of CO2 from the atmosphere. Examples include allowing forests to regrow, restoring coastal wetlands, and switching to restorative agricultural practices, such as cover crop rotation, that support healthy soils.

Unlike these nature-based methods, however, the fossil fuel industry is promoting the immediate deployment of dangerous and extremely expensive technologies that despite billions of (mainly

taxpayer) dollars have not been proven to work, that are largely geared toward recovering more oil, or justifying the continued burning of coal and methane gas. CRES is concerned that **HB24-1346,** while set up to regulate CCUS, might act to distract policymakers and agency personnel from concentrating on proven solutions. Colorado should not be distracted by false so-called "climate solutions," that won't come close to approaching the scale of the climate emergency.

The following is a partial list of our concerns about carbon management. Sources for each of these bullets are contained in CRES's detailed policy statement, and summary (attached).

- Since the start of the Industrial Revolution, the burning of fossil fuels has increased the amount of heat-trapping CO_2 in the atmosphere by over 50%—from 280 ppm to 422 ppm, and it is now growing at 3 ppm per year.
- Once CO_2 enters the atmosphere, it is highly diluted, constituting only 0.04% of the air. It is thus much easier and much less expensive to prevent CO_2 from entering the atmosphere in the first place than to try to remove it afterward. Of the various methods proposed to remove CO_2, DAC is especially high in dollar and energy costs because of the amount of air that must be moved by fans and the energy needed to remove CO_2 from sorbents once it is captured. Energy expert Amory Lovins has described the challenge of removing CO_2 from the atmosphere as akin to removing urine from a swimming pool.
- CCUS has a long history of technical and financial failures, as described in detail by many sources, including the Institute for Energy Economics and Financial Analysis, and Taxpayers for Common Sense.
- CCUS and DAC require massive inputs of materials, energy, chemicals, and water to operate.
- The vast majority of the captured carbon is used to recover oil that would otherwise remain in the ground – a process known as enhanced oil recovery. Thus, the dominant utilization of captured carbon perpetuates one of the major causes of the climate crisis.
- CO_2 pipelines are far more dangerous than oil and gas pipelines, and indeed, they can be deadly. Unlike methane gas, CO_2 is heavier than air, and leaks result in a ground-level blanket that can result in the silent suffocation of humans and livestock alike.
- Congress has given the oil and gas industry massive, multi-billion dollar, carbon capture subsidies in the Bipartisan Infrastructure Law. The gold rush now underway to raid the US Treasury has been valued by Bloomberg as eventually reaching as high as $52 billion, via the Inflation Reduction Act's system of tax credits, known as 45Q. Carbon capture comes with an extreme price tag, as noted so forcefully by Taxpayers for Common Sense.
- Adding carbon capture to power plants would result in a significant increase in the cost of electricity to ratepayers. According to WyoFile, Wyoming utilities' analyses of the addition of CCS to coal power plants in Wyoming determined that it would increase rates by $22 to $25 per month for the average residential customer, and $40 to $104 per month for commercial customers. It would also reduce electrical generation output by more than 30%, exposing ratepayers to additional costs for replacement power.

The following are examples of CO_2 removal and carbon capture and sequestration activities in Colorado that CRES believes should be seriously questioned - not facilitated or encouraged - by the Energy and Carbon Management Commission (ECMC):

- In 2023, the legislature changed the name of the Colorado Oil and Gas Conservation Commission to the ECMC. The new name is applauded by the fossil fuel industry, as it eliminates the words oil and gas, and facilitates their campaign to promote carbon management as an alternative to the need for a rapid phaseout of fossil fuels, that is widely supported by the scientific community.

- To meet the interest in generating future local tax dollars, a utility-sponsored study in Pueblo has recommended that the community consider hosting non-renewable, costly energy sources (paid by Xcel ratepayers, if ever approved by the PUC), including a combined-cycle natural gas plant with carbon capture.
- A proposed 27-mile pipeline through Pueblo County is being considered to take captured carbon from a cement plant to deposit the carbon at the Chico Basin Ranch in El Paso County.
- Colorado won a $32 million DOE grant to pay for a carbon capture test well in the southern part of the state.
- Expecting federal dollars to come their way - money that ought to be clawed back - Tri-State Generation and Transmission's December 2023 Electric Resource Plan envisions adding a 290 MW combined-cycle natural gas unit in 2028, with carbon capture and sequestration added in 2031.

Given that this bill regards the regulation of CCUS, CRES is neutral on HB24-1346. However, for the reasons given above, CRES opposes the use of Colorado tax dollars, and the attention by the ECMC, to facilitate costly, unproven carbon management projects. Instead, tax dollars and policy attention should be invested in the far more affordable, and effective harnessing of Colorado's vast solar and wind resources. In addition, Colorado policy-makers need to focus on end-use efficiency, storage, demand response, and transmission to assist the electrification of our buildings, transportation, and industrial sectors.

We urge the Committee caution with administrative attention on the false solutions encouraged in this bill. Instead, we urge you to turn Colorado's focus to proven, economic approaches that truly address the climate crisis.

Thank you for considering these concerns.

Sincerely,

Vincent Calvano
Chair, CRES Policy Committee

To: Members of the House Committee on Energy and Environment

From: Morey Wolfson, resident of Lakewood, Colorado moreywolfson@aol.com

Date: March 27, 2024

This communication is sent in a personal capacity only– it does not represent the position of an organization.

I appreciate your interest in carbon management, and thank you in advance for your willingness to expand your present understanding of this complex and controversial topic.

HB24-1346 concerns energy and carbon management regulation in Colorado, and broadens the ECMC's authority to regulate direct air capture facilities and geologic storage operations.

As you know, many environmental and public health-minded citizens and organizations are increasingly concerned about the underlying purpose of the bill. On the positive side, regulations of industries are vital. However, you are encouraged to be clear-eyed that Colorado state policy should not be perceived as an "all of the above" signal that this industry, particularly the supercritical carbon dioxide pipelines, are welcome to come to Colorado.

By directing the ECMC's attention on a distraction that falsely poses as a "climate solution," I am concerned that the sponsors may, either advertently or inadvertently, be sending an uninformed position that they wish to be framed as positive.

You have it in your power to place restrictions on this industry, rather than setting up a distracting attention at the ECMC. Time is better spent studying the topic.

Take direct air capture for example. Did you want to know that 1ppm of CO2 in the atmosphere weighs 8 billion tons? When you multiply 8 billion tons times the lowest DOE aspirational cost in 2032 of $100/ton results in a cost of $800 billion to move the needle from 422 to 421ppm? Don't trust me. Do the math. It's simple. So why is DAC even a topic? Well, find out from Taxpayers for Common Sense how the US Treasury is on a trajectory to disgorge billions of dollars, mainly to the oil and gas industry, through the 45Q direct pay tax provision. It takes very little to arrive at the conclusion that CCS is an incredible waste of public money, and the drain on Colorado's energy and water resources by technologies that don't pencil out should be prevented.

Why should Colorado follow the lead of petro-states Wyoming, North Dakota, Texas, and Louisiana in their push to expedite building pipelines, and the injection of CO2?

It would be far better if Colorado would follow the lead of New York, where lawmakers, just last week, passed a bill to expand their existing fracking ban by blocking natural gas drilling companies from injecting liquid carbon dioxide into the ground.

What is the underlying purpose of this bill? Is it to have Colorado help the carbon capture and storage industry head to the US Treasury to claim their 45Q direct pay tax credits? Taxpayers for Common Sense has denominated exposing the 45Q system as one of their top priorities. Bloomberg Energy has characterized the federal taxpayer exposure to reach as high as $52 billion. This could be a bigger scandal than Teapot Dome. Why should Colorado public policy be party to this?

The declaration characterizes Direct Air Capture and Geologic Storage as important tools that will reduce carbon emissions, retain workers, and provide for permanent storage of carbon dioxide. Please explore whether these assertions actually pencil out.

Is it an important tool? I encourage committee members to ask the proponents to quantify the expected outcomes from this "important tool." Ask if carbon capture, dangerous supercritical CO2 pipelines, and sequestration developments in Colorado would result in carbon reductions that would even register above noise level. Explore whether this bill serves as a way for Colorado public policy to help greenwash an industry, just furthering the chase after federal dollars that should not have been put there in the first place.

Will it reduce carbon emissions? I encourage committee members to ask for a quantification. For example, Colorado's only (and perhaps the last) direct air capture plant releases whatever tiny amount of carbon dioxide they manage to collect, right back to the atmosphere. Catch and release. And the developers won't reveal the amount of carbon energy they consume to operate the machine.

Will carbon capture schemes retain workers? That sounds fine. But committee members should ask for an estimate of the number of workers. For example, there are more people working at Arby's nationwide than employed by the coal industry.

Please explore whether these carbon capture schemes will result in the permanent storage of carbon dioxide. Dangerous asphyxiating supercritical CO2 pipelines are required to deliver the carbon to sequestration sites. CO2 injection is such a questionable enterprise that the USEPA has only approved two Class VI wells in the country. So why has the legislature directed the ECMC to pursue primacy, other than an effort to speed up a permitting process? Mission creep. The development and operation of geologic storage facilities presents technical risks, such as potential leakage and induced seismicity.

Colorado has had more than its share of misguided and costly promotions of "energy solutions" that resulted in failures- the Ft. St. Vrain high-temperature gas-cooled nuclear reactor, plans under the banner of "energy independence" for up to ten thousand nuclear bomb fracking on the Western Slope, oil shale, the Colorado Ute Electric Association bankruptcy, and the list goes on.

Carbon capture and storage has all of the markings of another failure to add to the list. The legislature should exercise out this topic. Public policy should exercise the precautionary principle, and discourage this industry early on, thereby avoiding a lot of wasted time and energy.

Thank you for your consideration of these concerns.

Atmospheric concentration of CO2 is measured in parts per million.

There are 424ppm up there.

And it's growing at 2.5ppm/year.

We've got a climate crisis.
Everything must be on the table!
Just 7 years left. So I'll wish away
any questions of scale,
money, and parasitic power.
Let's pull carbon out of thin air!

But wait - just out of curiosity-
what does 1 ppm of CO2
weigh?
Hmmmm..I never thought of it that way.

Now that's interesting.
1ppm of CO2 weighs 8 billion tons.

That sounds like a lot.
But what does 8 billion tons mean?

Okay, if you insist.
I'll go ahead and multiply
8 billion tons x
the lowest conceivable future
cost of pulling CO2
out of thin air, i.e. **$100/ton.**

Hmmm. That's **$800 billion**!
That can't be right! That's about the size of the annual Defense Department budget!

$800B to drop the 424ppm to 423ppm

Never mind all of this arithmetic. I've never been good at math, and we've got a climate crisis! So I'm okay to remain agnostic about throwing good (public) money after bad year after year to pull carbon out of the atmosphere.

moreywolfson@aol.com