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ADVANCING CARBON CAPTURE, UTILIZATION, AND SEQUESTRATION TECHNOLOGIES AND ENSURING EFFECTIVE IMPLEMENTATION OF THE USE IT ACT

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

UNITED STATES SENATE

ONE HUNDRED NINETEENTH CONGRESS

FIRST SESSION

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COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ONE HUNDRED NINETEENTH CONGRESS

FIRST SESSION

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C O N T E N T S

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WEDNESDAY, FEBRUARY 12, 2025

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The committee met, pursuant to notice, at 10:02 a.m. in room 406, Dirksen Senate Office Building, Hon. Shelley Moore Capito (chairman of the committee) presiding.

Present: Senators Capito, Whitehouse, Cramer, Curtis, Ricketts, Husted, Alsobrooks.

OPENING STATEMENT OF HON. SHELLEY MOORE CAPITO, U.S. SENATOR FROM THE STATE OF WEST VIRGINIA

Senator CAPITO. I would like to call this hearing to order. I thank everybody for coming. I think this morning's hearing about advancing carbon capture utilization, sequestration, or CCUS, we will be referring to it as such.

I am excited to start the year with a hearing on a bipartisan topic that Ranking Member Whitehouse and I have worked together over the years to address, and I look forward to continuing bipartisan efforts to champion meaningful legislation on this issue with Ranking Member Whitehouse and the rest of the committee. Certainly, the gentleman to my right knows a lot about this, at the same time, in the great State of North Dakota.

Innovative CCUS technologies will play a critical role in reducing emissions, particularly for facilities that face unique challenges because of their size, location, or industrial application.

In my State of West Virginia, several CCUS efforts are underway. West Virginia University is currently exploring direct air capture technologies, and the Department of Energy's National Energy Technology Laboratory, which is located in Morgantown, is supporting a suite of CCUS research.

West Virginia is also a partner in the Appalachian Regional Clean Hydrogen Hub, known as ARCH2, that includes project partners who are working to deploy CCUS technologies. Collectively, these projects position West Virginia to continue as a national energy leader, while also reducing our air emissions. We cannot realize the full benefits of these projects and emerging technologies like CCUS if there is not a permitting framework that will allow for the rapid and safe deployment of these projects.

That is why Ranking Member Whitehouse and I, working with Senator Barrasso and former Senator Carper, moved forward to get the Utilizing Significant Emissions with Innovative Technologies Act, or the USE IT Act, signed into law in December 2020.

This legislation was intended to ensure that carbon capture projects at all types of facilities can be permitted in a timely and efficient manner. Despite the progress made by the USE IT Act, there have been significant problems with its implementation that have held back the deployment and the development of CCUS.

First, while the Council on Environmental Quality, or CEQ, released a report in 2021 and subsequent interagency guidance for the deployment of CCUS in 2022 as the USE IT Act required, the guidance failed to present a clear pathway to expedite permitting for these projects.

Second, the law required at least two Federal task forces be established to help identify challenges to and solutions for permitting these projects. The Department of Energy and CEQ missed the required 18-month deadline to establish these task forces. They were not chartered until April 2024, more than twice as long as the Congress mandated in the USE IT Act. The delay in standing up these task forces has hindered our progress in supporting CCUS, but at least they are finally working on recommendations to improve the permitting process.

After the USE IT Act, Congress and the EPW Committee worked in a bipartisan way to expedite carbon capture projects by including $25 million dollars in the IIJA for the EPA to review and approve Class VI well applications. The IIJA also included $50 million to help our States obtain primacy for permitting such Class VI wells. This funding gave the EPA needed resources to clear its backlog of individual Class VI applications and reduce the total number of applications that the EPA must review by granting States primacy.

Despite receiving additional help and funding with the process, the Biden Administration only approved two Class VI projects, and only granted primacy to two States, Louisiana, after more than three and half years, and your State already had your primacy. You are No. 1, you are No. 1. have not, I was getting there, and my home State, just really the last day of the Biden Administration, received their permit for primacy on Class VI wells.

I am very excited that we got our primacy over that permitting process. I hope EPA Administrator Zeldin will prioritize reducing the current backlog of pending applications and support additional States that are seeking to obtain primacy.

The North American Electric Reliability Corporation has found that over the next 10 years, due to a rise in energy consumption and the early retirement of our existing fossil fuel generation, our Country could face major electric reliability concerns.

The deployment of CCUS can be a tool to not only maintain but expand reliable electric generation capacity and ensure the reliability of our electric grid, while improving the environment and growing our economy. I believe that is a win-win situation.

I look forward to our discussion today on this important topic, so we can figure out how we can continue to work in a bipartisan manner to advance CCUS deployment.

I now recognize our Ranking Member Whitehouse for his opening statement.

OPENING STATEMENT OF HON. SHELDON WHITEHOUSE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator WHITEHOUSE. Thank you, Chairman. I want to thank you for calling today's hearing on carbon capture and utilization. I want to recognize Senator Cramer for his work on the PROVE IT Act. As I have said before, I want to get things done to solve the climate change problem.

Chair Capito and I have worked well together to encourage and expand carbon capture. There is a solid foundation of bipartisanship here.

I want to start by establishing the context for our hearing and why carbon capture is so important. We have just come off of Earth's two hottest years on record. For years, scientists warned of the perils of exceeding 1.5 degrees Celsius above the preindustrial norm. Well, it happened last year; 2024 crossed above what science tells us is the safety threshold. This does not necessarily mean that we have reached the point of no return, but it serves as yet another big red warning sign that we are dangerously close.

In this 11th hour, what does the path forward look like? The Potsdam Institute reviewed 1,200 forward-looking, peer-reviewed scenarios used by the IPCC to predict our future with climate change. Of these 1,200 scenarios, all the ones that led to safety depended on limiting warming to 1.5 degrees Celsius by the end of the century. Now, only 11 of those 1,200 are still achievable. This review was done 3 years ago, so, likely, we have actually fewer than 11 pathways to climate safety.

Those remaining 11 scenarios that give us a pathway to climate safety have two things in common. One, they overshoot the 1.5-degrees safety limit, so carbon removal, particularly direct air capture, is necessary to claw our way back. Two, it just can not be free to pollute. There must be a cost to fossil fuel emissions. These all require a price on carbon emissions.

It is simple. Direct air capture, price on carbon emissions, or we fail.

Here is the IPCC, "Reaching net zero GHG emissions primarily requires deep reductions in CO_2, methane, and other GHG emissions, and implies net negative CO_2 emissions. Carbon dioxide removal will be necessary to achieve net negative CO_2 emissions."

To reach climate safety, we must deploy carbon capture, and we are doing it, but way too slowly.

In 2015, I visited Saskatchewan with Senator Graham to see the Boundary Dam Power Station, the first electricity generating facility to successfully deploy carbon capture technology. We know this works. It was working there and then, but there are only 45 facilities operating worldwide with a total capture capacity of only 50 million tons annually, when we need to be operating at a gigaton scale. That is, we need to be capturing 1,000 times more carbon annually to find that pathway to climate safety.

I have consistently led efforts to promote carbon capture. I co-led the USE IT Act, a focal point of today's hearing, with our current Chair and with then Chair Barrasso. I led repeated, successful ef-

forts to improve 45Q, the tax credit for carbon capture with our Chair and Senators Barrasso, Cramer, and Hoeven. My Federal CDR Leadership Act is being piloted now by the Department of Energy. I have advocated for funding for offices and programs that support carbon capture deployment, including for EPA's Class VI wells program that the Chairman mentioned.

Bipartisan steps to support carbon capture included DOE's Regional Direct Air Capture Hubs and DOE's Carbon Dioxide Transportation Infrastructure Finance and Innovation Program, God, we know how to name things, both part of the Bipartisan Infrastructure Law, but we cannot dawdle. We have entered the era of climate economic consequences.

Families are paying higher prices in grocery store aisles because climate change is disrupting supply chains and diminishing crop yields. Worse, families are facing a homeowner's insurance affordability and availability crisis. This threatens to cascade from insurance markets to mortgage markets to home property values and then, like 2008, into the general economy.

The more we overshoot 1.5 degrees, the more of this looming economic pain and dislocation. Plus, the added risk of far graver, irreversible changes: the collapse of ice sheets in Greenland or Antarctica, mass coral reef die-off, the collapse of the Amazon rainforest. It will take direct air capture as well as a price on pollution to pull us back from this danger.

The happiest estimates peg the cost of widespread, commercial CO_2 removal at about 100 dollars per metric ton. This is a negligible cost compared to the costs of ignoring the problem. The Economist says a $25 trillion hit to global real eState markets. Deloitte says a $220 trillion global GDP swing between getting climate right and continuing to fail.

The Financial Stability Board has issued a warning to the global banking system of this climate risk. First Street Foundation has found that the climate-driven insurance crisis will erase $1.5 trillion in U.S. real eState value over the next 30 years, i.e. the period of a mortgage that is issued today.

Ramping up carbon capture is a step we need to take with urgency, and I am delighted to join our Chairman in this hearing.

Senator CAPITO. Thank you.

Next, I will turn to Senator Cramer for his introductory remarks.

OPENING STATEMENT OF HON. KEVIN CRAMER, U.S. SENATOR FROM THE STATE OF NORTH DAKOTA

Senator CRAMER. Thank you, Chair Capito, Ranking Member Whitehouse. It seems like such an appropriate early hearing on a topic that we really have worked closely together on, successfully, frankly, in this committee. It is really fun to be part of it, so thanks for digging in on this topic that we are so familiar with.

Thanks for the shoutout as No. 1. I mean, when you referred to me as a gentleman at that beginning, I was impressed, but No. 1 was really something. I am sorry, I love the opportunity, of course, to highlight North Dakota's place in the area of carbon capture, utilization, and storage. There is a lot that goes into why North Dakota has been at the forefront.

One of the central reasons is the Energy and Environmental Research Center at the University of North Dakota, who sends us a wonderful witness today. In fact, the last EPW hearing on this topic, then-Ranking Member Capito invited John Harju from EERC, who is to be our star witness, and John is with us today, as well as the CEO, Charles Gorecki. Thank you all for being here today.

I would just say this about the EERC. If you are from a State that is looking at primacy or carbon capture, if you think that is a potential, they are not confined to North Dakota. Their expertise is used everywhere. In fact, there is a good chance, if you are pursuing a project, that they are already working with you, so thank you, EERC.

Today, we are joined by Kevin Connors, who serves as the Assistant Director for Regulatory Compliance and Energy Policy at EERC. Kevin has been an invaluable asset to me and to my staff. In fact, we look to EERC as a bit of an extension of our staff in all matters relating to carbon capture, utilization, and storage.

From permitting to engineering to safe geological storage and the use of carbon, Kevin's expertise is invaluable to this committee's work. The successful sequestration of CO_2 is a matter of national concern, as it obvious today, and I am glad Kevin can tout the good work of North Dakota in this space and how other States can benefit from our State's success in permitting Class VI wells.

Prior to his time at EERC, Kevin served on the North Dakota Industrial Commission in several capacities, including Carbon Capture and Storage Supervisor, Underground Injection Control Supervisor, and Petroleum Engineer. His expertise is not limited to the theoretical, however. He began his career as a well site geologist in the oil fields of Western North Dakota. If you are familiar with the nature of the work day in the Bakken, it is safe to say he has earned his stripes.

In addition to his well-deserved professional accolades, his most important duties are, of course, as a husband and a father. Kevin and Julie are the proud parents of seven wonderful children. That will keep you busy.

We want to thank you and your wife and your children for sharing you with us today. Thank you, Madam Chair, for allowing me to introduce Mr. Connors to our committee. I look forward to a productive discussion.

Senator CAPITO. Perfect introduction, and we will lead, Mr. Connors, you are welcome to give your opening statement. Thank you.

STATEMENT OF KEVIN CONNORS, ASSISTANT DIRECTOR FOR REGULATORY COMPLIANCE AND ENERGY POLICY AT THE ENERGY AND ENVIRONMENTAL RESEARCH CENTER

Mr. CONNORS. Good morning, Chairman Capito, Ranking Member Whitehouse, and members of the committee. I must say, praise the Lord, it is an honor to be here. Thank you so much for the introduction, Senator Cramer.

My name is Kevin Connors. As was mentioned, I am the Assistant Director for Regulatory Compliance and Energy Policy at the e University of North Dakota's Energy and Environmental Research Center, or the EERC. Thank you for the invitation to pro-

vide testimony concerning the implementation of the USE IT Act, the Class VI well permitting, and related efforts to accelerate CCUS deployment.

For the purpose of my testimony, prior to coming to work for the EERC, I led North Dakota's efforts to become the first State in the Nation to receive Class VI primacy. In 2019, I began working at the EERC where today, I manage the Plains CO_2 Reduction Partnership, or the PCOR Partnership, and work closely with EERC clients to support CCUS project development. It is important for the committee to note the EERC has been the technical lead tasked with the development of all nine Class VI projects that have been approved in North Dakota.

The history of the EERC dates back to 1951 as part of the U.S. Bureau of Mines. Later, in 1977, the U.S. Department of Energy, and in 1983, the EERC became a business unit of the University of North Dakota. The EERC is focused on practical solutions to our world's energy and environmental challenges.

As a leading developer of technologies, the EERC has spent decades performing applied research in CCUS. The EERC leads the PCOR Partnership, one of DOE's Regional Carbon Sequestration Partnership Programs. PCOR is an industry-government partnership with more than 250 member organizations across a 10-State, four Canadian province region in the upper great plains in Northwestern-North America.

What has become apparent over the course of now over 20 years of PCOR Partnership activities is that while our region has astounding potential for geologic CO_2 storage, our region's emissions are interwoven with the economy. The local, State, and regional economies and the industrial tax base that supports these communities represent the primary emission source of CO_2. This is consistent nationwide.

This is where we encounter the dual challenge, the dual challenge of reducing carbon intensity of our major industrial sectors while simultaneously ensuring continued economic growth and prosperity for our local economies tied to these industries. The deployment of CCUS technologies offers a unique solution to meet this dual challenge.

Today, the 45Q tax credit and low carbon fuel markets have created a business case for CCUS. However, carbon capture technology has not been economically deployed across the full spectrum of emissions sources.

There are three main barriers preventing accelerated CCUS deployment. First, the cost of retrofitting our largest electricity generation facilities with capture technologies continues to be a major hurdle. Second, CO_2 pipeline permitting and public opposition concerned with pipeline safety and eminent domain laws have created transportation challenges. Third, long lead times and delays in permitting Class VI storage projects as the Federal level persists.

The solutions to these barriers are all actively underway. The industry continues to advocate for increases to the 45Q tax credit to strengthen the incentive and offset record inflation on materials and increased labor costs. PHMSA has proposed new regulation to enhance CO_2 pipeline safety, and there are policy solutions being

proposed at the Federal level to improve CO_2 pipeline permitting and Class VI permitting.

The solution to alleviate the significant backlog in Class VI permit applications at the EPA regional offices begins with Class VI primacy. The Class VI primacy process can take between four and 7 years for States to receive this authority from the EPA. I hope we all can agree that this process is inefficient and must be improved.

States are best positioned to regulate these activities. States have a broader framework to consider, in addition to the environmental protections offered by the Class VI rules, such as promoting the development of geologic CO_2 storage, and maximizing the use of pore space of storage reservoirs.

As soon as a State has demonstrated equivalent Class VI program protections, EPA should move expeditiously to approve their Class VI application and hand that authority over to the States. The State has already demonstrated that the program meets the criteria.

An important technical challenge facing the CCUS industry has to do with the prohibition of new aquifer exemptions for Class VI. There are many examples of deep geologic formations that meet Federal definitions for an underground source of drinking water, but there are extenuating circumstances, such as depth or economics, that make these particular formations unsuitable as a drinking water source. The result of this prohibition removes billions of tons of CO_2 storage potential in States like North Dakota, Montana, Wyoming, Colorado, Utah, Oregon, and Alaska, to name a few Western States.

Thank you again, Chairman Capito, Ranking Member Whitehouse, and members of the committee for your invitation to provide these remarks. I would be happy to answer any questions you might have regarding my testimony and views on carbon management.

[The prepared statement of Mr. Connors follows:]

Testimony of Kevin Connors, Assistant Director for Regulatory Compliance and Energy Policy
University of North Dakota Energy & Environmental Research Center
Before the Senate Committee on Environment and Public Works
February 12, 2025

Good morning, Chairman Capito, Ranking Member Whitehouse, and members of the committee. My name is Kevin Connors, and I am the Assistant Director for Regulatory Compliance and Energy Policy at the University of North Dakota's (UND's) Energy & Environmental Research Center (EERC). Thank you for the invitation to provide testimony concerning the implementation of the Utilizing Significant Emissions with Innovative Technologies (USE IT) Act, the Class VI well-permitting process, and related efforts to advance carbon capture, utilization, and storage (CCUS).

For the purpose of my testimony, I started my career in the oil and gas industry in western North Dakota as a wellsite geologist. I worked for the North Dakota Department of Mineral Resources from 2010 to 2018, during which I was given the opportunity to lead North Dakota efforts to become the first state to receive Class VI primacy. In 2019, I began working at the EERC, where I manage the Plains CO_2 Reduction (PCOR) Partnership and work closely with EERC clients to support CCUS project development. The EERC has been the technical lead tasked with the development of all nine Class VI projects approved in North Dakota.

The EERC is a business unit of UND focused on practical solutions to our world's energy and environmental challenges. The EERC was initially founded in 1951 as the Robertson Lignite Research Laboratory under the U.S. Bureau of Mines. With the creation of the U.S. Department of Energy (DOE) in 1977, we became one of the nation's five energy technology centers and have been part of

UND since 1983. The EERC's mission has evolved considerably since that time, from a mission focused exclusively on the utilization of low-rank lignite coals to a mission that focuses on all fossil, renewable, and alternative fuels and addressing environmental challenges associated with energy development.

As a leading developer of technologies that improve production efficiency and optimization of our energy resources and address critical environmental challenges, the EERC has spent decades performing applied research on CCUS. The EERC leads the PCOR Partnership, an industry–government partnership with more than 250 member organizations across a ten-state and four-Canadian province region in the upper Great Plains and northwestern North America. Beginning in 2003, DOE released a solicitation to establish Regional Carbon Sequestration Partnerships (RCSPs) intended to develop an inventory of our nation's major stationary CO_2 emission sources as well as strengthen the technical understanding of regional geology by characterizing subsurface reservoirs with CO_2 storage potential. The EERC was selected as one of the original seven regional partnerships under the first phase (Phase I), performing regional characterization. Three subsequent RCSP funding phases include Phase II field validation, Phase III commercial demonstration, and most recently the initiative phase (Phase IV). Phase IV funding was awarded by DOE in 2019 to continue the work of the PCOR Partnership, with the goal of using the knowledge and experience gained over the previous phases to address current challenges and accelerate commercial CCUS deployment.

The PCOR Partnership region is home to multiple deep sedimentary basins with favorable geology conducive to large-scale CO_2 storage. The major industrial CO_2 emissions sources across the region are interwoven with the regional

economy, acting as economic pillars for the states or local regions, for example, the mining, manufacturing, and industrial centers around the Great Lakes and Mississippi River Valley; the agriculture processing and biofuels businesses of Iowa, Minnesota, Nebraska, and the Dakotas; and the oil-, gas-, and coal-producing regions of North Dakota, Wyoming, Montana, Alaska, and the Canadian provinces. The local, state, and regional economies, and the industrial tax base that supports these communities, represent the primary emissions sources of CO_2. This is where we encounter the dual challenge of reducing the carbon intensity of our major industrial sectors while simultaneously ensuring continued economic growth and prosperity for the local economies tied to these industries. The deployment of CCUS technologies offers a unique solution to meet this dual challenge.

Today, the 45Q tax credit and low-carbon fuels markets have created a business case for CCUS, with ethanol, biofuels, fertilizer manufacturing, and hydrogen production being the first movers to deploy these technologies. Carbon capture technology has been commercially demonstrated but not economically deployed across the full spectrum of major industrial emissions sources. The opportunity to advance this technology and produce low-carbon energy, fuels, or other marketable products has proven to create a competitive advantage in the marketplace. In addition, wide-scale carbon capture deployment across the full spectrum of these industries will make readily available and abundant CO_2, creating new economic opportunities for technology innovation and CO_2 utilization.

However, with the opportunity to advance these technologies there are complex challenges that require practical solutions. There are three main barriers

preventing accelerated CCUS deployment. First, the cost of retrofitting an existing coal-fired electricity generation facility with postcombustion capture technology continues to be a major hurdle. Second, CO_2 pipeline permitting and public opposition concerned with pipeline safety and eminent domain laws have created challenges for deploying carbon capture technology on industrial facilities that are not in close proximity to favorable geology and require long distance, multistate pipeline infrastructure. Third, long lead times and delays in permitting Class VI storage projects at the federal level persist.

The solutions to these barriers are all actively underway. Industry continues to advocate for increases to the 45Q tax credit to strengthen the incentive to pursue carbon capture deployment while attempting to offset record inflation on materials (e.g., steel) and increased labor costs. The Pipeline and Hazardous Materials Safety Administration (PHMSA) has proposed new regulations to enhance CO_2 pipeline safety, and there are policy solutions being proposed at the federal level to improve CO_2 pipeline permitting and Class VI permitting.

In 2023, the White House Council on Environmental Quality (CEQ) finalized appointments for two task forces charged with providing input for the deployment of CCUS. The task forces are established under the USE IT Act and are focused on CCUS with regard to permitting on private and federal lands. On October 31, 2023, CEQ and DOE finalized a memorandum of understanding (MOU) to promote cooperative efforts between CEQ and DOE to establish, maintain, and manage the two proposed regional permitting task forces and clarify the agencies' respective roles. Upon signing the MOU, DOE began the process of formally chartering the two task forces. The task forces are tasked with preparing guidance for this Senate Committee, the Senate Energy and Commerce

Committee, and the House of Representatives Committees on Natural Resources and Transportation and Infrastructure. The guidance being prepared by the task forces will identify permitting and other challenges that regulatory authorities and project developers face in permitting. In addition, the task forces will be making recommendations to improve the permitting process and regional coordination for the purpose of promoting the efficient, orderly, and responsible development of CCUS projects and CO_2 pipelines.

The solution to alleviating the significant backlog in Class VI permit applications at the U.S. Environmental Protection Agency (EPA) regional offices begins with improvements to the Class VI primacy process. Currently, four states have received Class VI primacy: North Dakota (2018), Wyoming (2020), Louisiana (2023), and most recently West Virginia (2025). The primacy process is a 2–5-year process that begins when EPA determines the state application to be complete. For a state to apply for primacy, it also has an approximately 2-year preapplication phase that includes working with EPA to demonstrate that the state's Class VI underground injection control (UIC) program is "at least as stringent as" the EPA Class VI UIC program in protecting underground sources of drinking water (USDWs). That said, the Class VI primacy process can take states between 4 and 7 years. I hope we can agree that this process is inefficient and must be improved. Once the state and EPA agree that the "as stringent as" standard has been achieved, the state begins the rulemaking process to codify Class VI regulations in the state administrative code. Once state regulations are codified, the state can move forward and apply for Class VI primacy. Based on my experience, the preapplication phase and the demonstration of equivalent program protections should be the most time-consuming part of the Class VI

primacy process. As soon as a state applies for primacy, EPA should move expeditiously to approve the already demonstrated state program.

States are best positioned to regulate and permit Class VI injection well activities. States have a broader framework to consider in addition to the technical criteria and environmental protections of the Class VI regulations, such as promoting the development of geologic CO_2 storage and maximizing the use of the pore space of storage reservoirs. For this reason, in the 2010 preamble to the Class VI rules, EPA recognized the added value, flexibility, and better positioning of states to regulate CO_2 storage at the time the Class VI regulations were being contemplated:

> *EPA believes that States are in the best position to implement UIC–GS (geologic sequestration) programs, and by allowing for independent Class VI primacy, EPA encourages States to take responsibility for implementation of Class VI regulations. The Agency's UIC program believes that this may, in turn, help provide for a more comprehensive approach to managing GS projects by promoting the integration of GS activities under the SDWA (Safe Drinking Water Act) into a broader framework for States managing issues related to CCS (carbon capture and storage) that may lie outside the scope of the UIC program or other EPA programs. This would harness the unique efficiencies States can offer to promote adoption of GS technology that incorporates issues in the broader scope of CCS while ensuring that USDWs are protected through the UIC regulatory framework. Allowing States to apply only for Class VI primacy will also shorten the primacy approval process. EPA's willingness to accept independent [primacy] applications for Class VI wells applies only to Class VI well primacy and does not apply to any other well class under SDWA Section 1422 (i.e., I, III, IV, and V)* (U.S. Environmental Protection Agency, 2010).

EPA recognizes the limitations of its regulatory program implementation under the Safe Drinking Water Act and the Class VI UIC program and

acknowledges the ability of the states to broaden the scope of a well-centric regulatory program (i.e., the federal Class VI UIC program) to create a regulatory framework that spans all aspects, from cradle-to-grave, of a dedicated CO_2 storage project. Several states, including North Dakota, have adopted a resource management framework for regulating all aspects of CO_2 storage, including project permitting and pore space amalgamation.

The current regulatory landscape clearly demonstrates the difference in state Class VI UIC program implementation, including permitting, compared to that of EPA. States that have adopted a resource management framework combined with Class VI primacy are able to efficiently permit Class VI projects. EPA implements the Class VI UIC program under a waste disposal framework and has experienced significant backlog of Class VI permit applications with long lead times and permitting delays. As of January 2025, there are 161 Class VI well applications that have been submitted to seven different EPA regional offices; the 161 well applications make up 54 projects across 13 states. To date, EPA has issued two Class VI permits for the currently operating Archer Daniels Midland (ADM) project in Illinois (permits issued April 15, 2014), two Class VI permits to construct for the Wabash Carbon Services project in Indiana (permits issued on January 24, 2024), and four Class VI permits to construct for the Carbon TarraVault project in California (permits issued on December 31, 2024). When factoring in agency review time and subtracting out the time the agency was waiting on the applicant to address permit deficiencies, each of these EPA Class VI permit approvals took between 2 and 4 years for a final permit decision. It is important to note the Wabash Carbon Services and Carbon TarraVault projects received “permits to construct”; under the EPA permitting process, these

applicants are required to resubmit their Class VI permits with updated data and information from the drilling, testing, sampling, and construction of these wells for EPA to make a final determination for "authorization to inject," the timing of which is unknown. In contrast, North Dakota and Wyoming both have issued multiple Class VI project approvals. North Dakota has permitted nine storage projects, with an average of 8 months for the final permit decision, and Wyoming has permitted three projects, with an average of 12 months to final permit decision. The distribution of Class VI well and project applications at the EPA regional offices includes several states that are pursuing Class VI primacy or have announced their intent to apply for Class VI primacy. Of the 13 states with Class VI well and project applications submitted to EPA regional offices, ten of those states have either announced or begun the preapplication phase for Class VI primacy.

When Louisiana received Class VI primacy in 2023, 31% of the well applications that were submitted at the EPA regional office transferred to Louisianna, significantly reducing the EPA backlog. If EPA granted primacy to the ten states that are either pursuing primacy or have announced their intent to pursue primacy, the Class VI well-permitting backlog at EPA would be reduced by 39%.

An important technical challenge facing the CCUS industry has to do with the prohibition of new aquifer exemptions for Class VI injection. There are many examples of geologic formations that meet federal regulatory criteria of a USDW, but there are extenuating circumstances that make these particular formations unsuitable as a source of drinking water for human consumption or other freshwater supply. EPA has a process for exempting these types of geologic

formations and allowing for underground injection other than for Class VI. Currently, federal regulations do not allow new aquifer exemptions to be issued for Class VI injection and are unclear regarding the use of existing aquifer exemptions for Class VI injection. The inability of project operators to receive aquifer exemptions for Class VI wells unnecessarily condemns billions of tons of CO_2 storage potential within the state of North Dakota and throughout the United States. The use of aquifer exemptions for Class VI projects is necessary for continued progress in deploying CCUS across the United States.

None of the outstanding research and development work performed by the EERC would have been possible without the foresight of this key committee, your counterparts on the Energy and Natural Resources and Appropriations Committees, and DOE. With your direction and leadership, I believe that we are poised to continue our nation's progress toward broad, economically viable carbon management.

Thank you, again, Chairman Capito, Ranking Member Whitehouse, and members of the committee for your invitation to provide these remarks. I would be happy to answer any questions you might have regarding my testimony and my views on carbon management.

Senate QFR – Senator Cramer, Q1

Senator Cramer:

1. Mr. Connors, my understanding is all other Underground Injection Control (UIC) program injection well classifications can and regularly receive new aquifer exemptions. Can you provide the Committee with supporting documents which demonstrate the importance of providing Class VI wells with existing aquifer exemptions or the creation of new aquifer exemptions for these wells?

Answer:

Yes, UIC injection well Classes I, II, III, and V have and do receive new aquifer exemptions under the Safe Drinking Water Act (SDWA) if the aquifer has "no real potential to be used as drinking water sources."[1] Class VI wells cannot be granted a *new* aquifer exemption,[2] and the use of currently exempted aquifers was not extended to Class VI except in a limited scenario involving Class II enhanced oil recovery (EOR) wells.[3]

"EPA is aware that confining Class VI CO_2 injection to below the lowermost USDW [underground source of drinking water] may restrict the use of sequestration in areas of the country with deep USDWs where well construction would be technically impractical or infeasible."[4] This acknowledged restriction leads to increased cost and risk for industries looking to move forward with CO_2 storage in deep saline reservoirs. These costs and risks manifest themselves through the need to build many more miles (thousands) of CO_2 pipeline to transport the captured CO_2 to other areas.

Commenters of the proposed U.S. Environmental Protection Agency (EPA) rules for geologic sequestration (GS) wells in 2009 indicated that such injection should be allowed under the following conditions and based on the following arguments:

- *Because many parts of the country will be excluded from GS activities and as a result CCS [carbon capture and storage] deployment may be restricted (if this requirement is maintained as written);*
- *Because Class II, Class III, and Class V operations are already injecting above the lowermost USDW without any potential for threats to underlying (or overlying) USDWs; and,*

"Furthermore, some specific research on CO_2 injection for GS into various formations including shallow, volcanic rocks such as flood basalts (McGrail, *et al.,* 2006)[5] and coal seam injection

[1] 40 CFR §144.1(g).
[2] 40 CFR § 144.7(a).
[3] 40 CFR § 146.4.
[4] 40 CFR Part 146 [EPA–HQ–OW–2008–0390; FRL–8951–3] (www.federalregister.gov/documents/2009/08/31/E9-20920/federal-requirements-under-the-underground-injection-control-uic-program-for-carbon-dioxide-co2).
[5] McGrail, P.B., Schaef, H.T., Ho, A.M., Chien, Y., Dooley, J.J., and Davidson, C.L. 2006. Potential for carbon dioxide sequestration in flood basalts. Journal of Geophysical Research: Solid Earth, v. 111, issue B12 (https://doi.org/10.1029/2005JB004169).

(Dooley, *et al.,* 2006; IPCC, 2005; MIT 2007; White *et al.,* 2005)[6] illustrates the potential for GS in these formations, but only if there is depth requirement flexibility. Certain States have indicated that where USDWs are very deep (*e.g.,* 15,000 ft/4,572 meters and deeper) and layered (stratified) these regions would become unavailable for large-scale GS projects because injectors would not be able to comply with the current injection depth (and well construction) requirements. These States suggest that GS should be allowed in certain areas if a site-specific demonstration can be made that USDWs will be protected."[7]

With respect to supporting documents, please consider the following:

- Meeting the dual challenge—a roadmap to at-scale deployment of carbon capture, use, and storage – Chapter Three: Policy, regulatory, and legal barriers (https://dualchallenge.npc.org/files/CCUS-Chap_3-030521.pdf).

- Water quality and regional considerations for Class VI permitting (https://netl.doe.gov/sites/default/files/netl-file/24CM/24CM_Posters_DiRaddo.pdf).

  Surprises from site characterization data create a permitting impasse for the Kevin Dome project (https://netl.doe.gov/sites/default/files/event-proceedings/2016/fy16%20cs%20rd/Posters/Tollefson-Water-Poster.pdf).

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[6] Dooley J. J., Davidson C. L., Dahowski R. T., Wise M. A., Gupta N., Kim S. H., Malone E. L. 2006. Carbon Dioxide Capture and Geologic Storage: A Key Component of a Global Energy Technology Strategy to Address Climate Change, Joint Global Change Research Institute, Battelle Pacific Northwest Division. May 2006. PNWD-3602. College Park, MD; IPCC. 2005; IPCC Special Report on Carbon Dioxide Capture and Storage. Prepared by Working Group III of the Intergovernmental Panel on Climate Change. Cambridge University Press; MIT. 2007. Massachusetts Institute of Technology. The Future of Coal—Options for a Carbon Constrained World; and White, C.M., Smith, D.H., Jones, K.L., Goodman, A.L., Jikich, S.A., LaCount, R.B., DuBose, S.B., Ozdemir, E., Morsi, B.I., and Schroeder, K.T. 2005. Sequestration of Carbon Dioxide in Coal with Enhanced Coalbed Methane Recovery A Review. Energy & Fuels 2005 19 (3), 659-724. DOI: 10.1021/ef040047w.

[7] 40 CFR Part 146 [EPA–HQ–OW–2008–0390; FRL–8951–3] (www.federalregister.gov/documents/2009/08/31/E9-20920/federal-requirements-under-the-underground-injection-control-uic-program-for-carbon-dioxide-co2).

Senator Cramer:

2. Mr. Connors, I believe North Dakota's success in the permitting and operation of these wells can serve as an instructive template for not only other states engaged in receiving primacy, but for EPA as well. Can you share with my office and the Committee examples where EPA can improve the efficiency and processing time of the Class VI primacy process?

Answer:

Improving the efficiency and processing time of State Class VI primacy applications will benefit both the state and federal governments. Most states that are pursuing Class VI primacy are doing so as 1422 UIC program revisions (i.e., the state has primacy for other UIC well classes under the 1422 UIC program). This means that the state has established UIC program expertise and technical staff, and they are applying to EPA to revise the existing state UIC program to add Class VI. In instances where the state has an established UIC program and is applying to EPA for a program revision to add Class VI, EPA should expediate the primacy application process. Class VI primacy applications that are submitted to EPA as a UIC program revision should be approved by EPA within 1 year of receipt of the state application.

The states that have already received Class VI primacy are best positioned to provide insight into recommendations for efficiency and processing time improvements for Class VI primacy applications. Accordingly, input was obtained from the North Dakota Department of Mineral Resources, Wyoming Department of Environmental Quality, Louisiana Department of Energy and Natural Resources, and West Virginia Department of Environmental Protection—the four states with Class VI primacy.

Several recommendations are presented below.

- Promote primacy application as a collaborative process.

  The Class VI primacy application should be viewed as a collaborative process between EPA and the state. A collaborative relationship fosters efficiency, enhances communication, promotes innovation, and improves overall project outcomes, leading to better quality and faster completion. Upon receipt of a primacy application, EPA should develop and communicate an application review schedule. In addition, EPA and the state should establish recurring meetings amongst key personnel to promote an understanding of expectations and schedule progress.

  Further, better collaboration would help EPA to understand the state's required rulemaking process and notification requirements. Several states experienced requests for or receipt of comments outside of the state's regulatory public comment periods. This causes issues in regulatory transparency and an incomplete administrative record. Several states also experienced multiple rounds of requests for revisions to the state regulations, causing redundant rulemaking proceedings.

- Provide clarity in requests for additional information.

  EPA reviewers should provide clear and concise comments and indicate precisely what response is requested. Vague comments can increase processing time because once the commenter's response is received, the state is unclear on what is sought and is unable to respond without further clarification. An example of this occurred for one state during review of the lengthy crosswalk document prepared comparing the state regulations against federal regulations. Several comments provided were "similar" or "not verbatim," and it was not clear what action, if any, was requested. This necessitated additional contact with EPA to clarify and time needed for EPA's reply, adding unnecessary delay. In this example, no additional information was needed from the state, but that was not clear. Comments should be of a substantive nature and provide clear guidance on what information is still needed.

- Streamline the process between EPA Regions and EPA Headquarters.

  Several states experienced misalignment of expectations between the regional office and headquarters, resulting in redundancies. One state commented that communication from the Region was overruled by Headquarters, resulting in confusion, delay, and redundant work product. At one point, Headquarters conducted reviews by multiple offices serially rather than simultaneously, resulting in an unnecessarily extended process. Reviews should be conducted simultaneously within a set timeframe, with feedback provided collectively to expedite the approval and preferably with a single person responsible for timely shepherding of the application through the process.

- Follow and/or update Groundwater Protection Branch (GWPB) Guidance #34: Guidance for Review and Approval of State Underground Injection Control (UIC) Programs and Revisions to Approved State Programs.[8]

  We recommend that EPA follow the July 5, 1984, GWPB Guidance #34. Most states already have UIC primacy for other well classes, and the addition of Class VI to a state's UIC program is conducted as a revision. This document is extremely beneficial in that it provides a time frame for when a state can expect review of primacy applications as well as the process for substantial program revisions. Because the guidance was effective July 5, 1984, revisions may be needed, but in the interim, this guidance should be followed.

- Improve the injection well application handover when primacy is received.

  We recommend that EPA prepare a handover report to the state to help ensure a smooth transition. This report would include a list and timetable of key actions and a status briefing on the reviews conducted. In addition, working documents should be shared, e.g., if EPA did a completeness review and found there were several deficiencies, these should be shared with the state to avoid unnecessary duplication of effort. The same is

[8] www.epa.gov/sites/default/files/2020-02/documents/guidance_for_review_and_approval_of_state_uic_programs_and_revisions_to_approved_state_programs.pdf (accessed March 2025).

true for the technical review. If the technical review has begun, the results and progress should be shared with the state. Making the transition collaborative will help ensure a reasonable permitting time frame, even when a new agency takes over responsibility.

a. More specifically, can you provide the Committee with specific actions North Dakota took to ensure success ahead of receiving primacy officially?

Answer:

North Dakota has been a leader among the states in developing a regulatory framework for the geologic storage of CO_2. In 2008, North Dakota formed an ad hoc CO_2 storage workgroup, with representatives from the state government, the Oil and Gas Division of North Dakota Industrial Commission (NDIC), the Department of Environmental Quality (DEQ), the Attorney General's office, the Lignite Energy Council, the North Dakota Petroleum Council, the Energy & Environmental Research Center (EERC), and other energy industry and legal experts. The North Dakota CO_2 Storage Workgroup drafted legislation, based on the 2007 Interstate Oil and Gas Conservation Commission (IOGCC) model statute,[9] that was ultimately introduced and signed into law during the 2009 legislative session. In 2010, the Oil and Gas Division of NDIC promulgated administrative rules following the template of the IOGCC model regulations.[10] At the time, North Dakota became the first state with a complete and comprehensive regulatory framework in place for geologic storage of CO_2. The EPA Class VI rule was published in late 2010, and the Oil and Gas Division was directed by the 2011 Legislature to apply for and obtain Class VI primacy.

The current North Dakota regulations represent a resource management framework and meet the "as stringent as" standard by incorporating the Class VI UIC program requirements. The timeline of these North Dakota regulatory developments is summarized as follows:

- Effective April 2009: Senate Bill 2139 created North Dakota Century Code (NDCC) Chapter 47-31, Subsurface Pore Space Policy, which granted the title of pore space ownership to the overlying surface estate and prohibited severing the title to the pore space from surface ownership, although leasing is allowed. The relationship between pore space and mineral estates identified the mineral estate as dominant.

- Effective July 2009: Senate Bill 2095 created NDCC Chapter 38-22, Carbon Dioxide Underground Storage, a new statutory chapter that granted regulatory authority to NDIC, established permit requirements that included pore space amalgamation, created an administrative fund and a long-term trust fund, and addressed responsibility for long-term liability through a certificate of project completion (to be issued no sooner than 10 years postinjection following demonstration of a stable CO_2 plume in the subsurface) and transfer of title of the stored CO_2.

[9] Interstate Oil and Gas Compact Commission, 2007, CO_2 Storage: A Legal and Regulatory Guide for States, December 2007.
[10] Interstate Oil and Gas Compact Commission, 2010, Biennial review of the legal and regulatory environment for the storage of carbon dioxide in geologic structures, September 2010.

- Effective April 2010: North Dakota Administrative Code (NDAC) Chapter 43-05-01, Geologic Storage of Carbon Dioxide, provided a first-of-a-kind state regulatory framework that incorporates permitting, well construction, and detailed engineering and geological data analyses, along with a CO_2 injection plan that includes a description of the mechanisms of geologic confinement to ensure the prevention of horizontal or vertical migration of CO_2 beyond the proposed storage reservoir. The operator is also required to submit for state approval an emergency response plan, worker safety plan, corrosion monitoring and prevention plan, and facility and storage reservoir leak detection and monitoring plan.

- 2011: House Bill 1014 provided an appropriation of $532,000 from the general fund to the CO_2 storage facility administrative fund, which was established in 2009, creating one full-time position to prepare a Class VI primacy application and secure approval of Class VI primacy for the state of North Dakota.

- Effective April 2013: NDAC Chapter 43-05-01, Geologic Storage of Carbon Dioxide, was amended (effective April 2013) to meet the "as stringent as" standard of the federal Class VI UIC program. EPA required rules to be codified as part of North Dakota's Class VI primacy application.

Following these legislative and administrative actions, North Dakota's legal and regulatory frameworks address permitting, pore space amalgamation (i.e., pore space ownership for the subsurface), responsibility for the long-term liability of a closed storage site, and Class VI UIC program requirements. On June 21, 2013, the official North Dakota Class VI primacy application was submitted to EPA. On April 24, 2018, nearly 5 years later, the state of North Dakota was granted Class VI primacy.

Senator Cramer:

3. For the purpose of clarification: in your testimony, you mentioned, "all other UIC well classes allow aquifer exemptions" for injection of fluids or wastes. Can you expand on your statement, and perhaps explain the characteristics and or nature of those cases and how drinking water resources remain protected?

Answer:

The UIC regulations allow EPA to exempt aquifers that do not currently serve as a source of drinking water and will not serve as a source of drinking water in the future based on certain criteria. The criteria provided at 40 Code of Federal Regulations (CFR) § 146.4 include the provisions listed below:

a. It is mineral, hydrocarbon, or geothermal energy producing or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible.
b. It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical;
c. It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or
d. It is located over a Class III well mining area subject to subsidence or catastrophic collapse; or
e. The total dissolved solids (TDS) content of the groundwater is more than 3000 and less than 10,000 mg/L and it is not reasonably expected to supply a public water system.

To demonstrate how drinking water resources remain protected, the Record of Decision includes information about the aquifer to be exempted (e.g., depth, lithology), the total surface area of the aquifer to be exempted (e.g., feet from the wellbore), a demonstration that the injectate will remain in the exempted portion of the aquifer (e.g., formation thickness and porosity, verification of upper/lower confining zones, limitation on volume of injected fluid), and the water quality of the aquifer to be exempted (e.g., TDS). In addition, the principal sources of drinking water in the area of the proposed aquifer for exemption are identified along with other USDWs in the region and the distance of the proposed aquifer for exemption from public water supplies. There is also a cost estimate to develop the proposed aquifer for exemption as a water supply demonstrating such an endeavor's economic or technological impracticality.

For the *expansion* of a Class II EOR well for the exclusive purpose of Class VI injection for geologic storage, the areal extent must meet the criteria below which are similar in part to the criteria for other aquifer exemptions:

a. It does not currently serve as a source of drinking water; and

b. The TDS content of the groundwater is more than 3000 mg/L and less than 10,000 mg/L; and

c. It is not reasonably expected to supply a public water system.

A Class II EOR project has the potential to store as much CO_2 as a storage project into a saline formation, so this raises the question why aquifer exemptions are available only for *expansion* of existing Class II EOR projects but not for *new* Class VI projects. As long as the foregoing criteria are satisfied, Class VI aquifer exemptions should be possible.

Senator Cramer:

4. Mr. Connors, you would agree States enjoy certain permitting advantages when considering the primacy of the UIC Class VI program?

Answer:

Yes, I agree. State Class VI primacy provides for a comprehensive approach to managing geologic CO_2 storage projects by promoting the integration of activities into a broader framework, including managing issues that lie outside the scope of the federal UIC program, e.g., pore space unitization. States offer unique efficiencies to help promote geologic CO_2 storage projects while ensuring environmental protection. States are best positioned to administer a "cradle-to-grave" regulatory system that accounts for the entire life cycle of a CO_2 storage project, from permitting to site closure to long-term monitoring. States have experience and expertise in regional geology; injection well design, construction, and operation; and an understanding of areas in the state that need special consideration and protection, along with established relationships with the regulated community.

a. In addition to Class VI injection well permit, what additional permitting and approval is needed to operate a CO_2 injection and storage project?

CO_2 injection and storage projects require a complex and thorough permitting process. This process typically starts early and involves several layers of regulatory approvals. These can vary depending on the location, scale of the project, and specific geologic formations being considered for CO_2 storage. Using North Dakota, a state with Class VI primacy, as an example, a listing of permits and approvals needed is provided below.

Local Level
Conditional use permit
Road access

State Level
Geophysical exploration permits (seismic survey)
Stratigraphic test well-drilling permit
State Water Commission (USDW monitoring well)
DEQ review (North Dakota law mandates NDIC's Oil and Gas Division to consult with the DEQ before issuing CO_2 storage permits)
State Historical Protection Office (SHPO) review
Storage facility permit
- Geologic storage of CO_2
- Pore space leasing and amalgamation (i.e., pore space unitization)
- Financial assurance requirements

Fees required for CO_2 storage (North Dakota has two fees, an administrative fee and a long-term stewardship fee)
Permit to convert or reenter well
CO_2 Class VI injection permit

CO_2 flowlines (typically smaller-diameter pipelines that are not regulated under Pipeline and Hazardous Materials Safety Administration [PHMSA])
Training and supporting emergency responders (injection wellsite and pipeline)
Transfer of long-term responsibility at closed site

Federal Level
Monitoring, reporting, and verification (MRV) plan – EPA Greenhouse Gas Reporting Program (GHGRP)

If federal funding is involved or federal lands, then the project would fall under National Environmental Policy Act (NEPA) requirements and approvals may be needed from the Bureau of Land Management and the U.S. Forest Service as well as under the Historical Preservation Act and the Endangered Species Act.

In addition, there are quarterly and annual reporting requirements as well as reporting mechanical integrity tests, well workovers, and other injection well tests. There is also the requirement to report within 24 hours any endangerment to a USDW.

Ranking Member Whitehouse:

1. How can U.S. federal agencies improve coordination with state and local governments on CCUS and CO2 transportation permitting?

Answer:

- Improve the Class VI primacy process.

States are best positioned to effectively and efficiently permit Class VI CO_2 storage projects. For the states to be positioned as the lead regulatory and permitting authority, there needs to be improvements in EPA's coordination of the Class VI primacy process. The UIC program is designed under the cooperative federalism construct that authorizes the federal government to create minimum nationwide standards and offers the states the opportunity to apply for and receive the authority to implement the federal program within state jurisdiction. The UIC program includes a cooperative process for states to apply for and receive primacy from EPA. State primacy positions the state agency as the lead regulatory authority for implementing the federal program, with EPA as the oversight authority.

The Class VI UIC program primacy process is well-defined and in alignment with cooperative federalism, in that states are required to demonstrate that the state UIC program is "as stringent as" the federal program in the protection of USDWs. However, the Class VI primacy process has been subject to significant delays and extended periods of time with no EPA action. These delays by EPA have led to uncertainty in the timing of the primacy application process, increased the state cost in pursuing primacy, and created delays in commercial deployment of Class VI storage projects. By delaying approval of state Class VI primacy applications after the state has demonstrated the "as stringent as" standard has been met, states are experiencing challenges ensuring appropriate staffing levels can be maintained from primacy application to program implementation. The multiyear EPA process is forcing states to temporarily reallocate those staff and resources until primacy is granted. EPA needs to approve Class VI primacy applications in a timely manner, e.g., 1 year or less, to facilitate the primacy approval process and the commercial deployment of Class VI storage projects across the United States. A more rapid and consistent primacy review and approval process would also be consistent with the 2010 Class VI rule preamble[11] that recognizes the states as being "best positioned" to regulate CO_2 storage. The National Petroleum Council in its report recommended that Congress, through its agency oversight process, also emphasize the importance of accelerating the EPA review of state applications seeking primacy to implement the Class VI UIC program.[12]

- Funding for Class VI primacy program implementation.

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[11] U.S. Environmental Protection Agency, Federal Register, 2010, Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells: v. 75, p. 77230: https://www.govinfo.gov/content/pkg/FR-2010-12-10/pdf/2010-29954.pdf (accessed March 2025).

[12] National Petroleum Council, 2019, Meeting the dual challenge—a roadmap [*sic*] to at-scale deployment of carbon capture, use, and storage: https://dualchallenge.npc.org/downloads.php (accessed March 2025).

Funding for the administrative agency implementation of the Class VI UIC program will ensure adequate resources are available for regulatory oversight. It is almost certain that EPA will maintain Class VI primacy and directly implement the Class VI UIC program for some states, such as Illinois and California, where approximately 50% percent of the Class VI permit applications are located. Several states have either announced their intent to pursue Class VI primacy or have initiated the preapplication process with EPA. Federal funding that can be allocated to the Class VI primacy agency (i.e., EPA or the states) is essential to ensure adequate resources are available for efficient permit processing and regulatory program implementation.

- Improve the injection well application handover when primacy is received (As stated above in response to Senator Cramer's QFR regarding examples where EPA can improve the efficiency and processing time of the Class VI primacy process).

We recommend that EPA prepare a handover report to the state to help ensure a smooth transition. This report would include a list and timetable of key actions and a status briefing on the reviews conducted. In addition, working documents should be shared, e.g., if EPA did a completeness review and found there were several deficiencies, these should be shared with the state to avoid unnecessary duplication of effort. The same is true for the technical review. If the technical review has begun, the results and progress should be shared with the state. Making the transition collaborative will help ensure a reasonable permitting time frame, even when a new agency takes over responsibility.

- PHMSA proposed rulemaking.

One challenge facing CCUS deployment is public concerns related to pipeline safety. It is my understanding that the PHMSA proposed rulemaking has been withheld from the Federal Register. In order to address these specific public concerns related to CO_2 pipeline safety, it is important that federal pipeline regulations are up to date to foster public support and bolster transportation safety.

- Proposed Federal Energy Regulatory Commission (FERC) siting and regulation of CO_2 pipelines.

We are aware of draft legislation that would allow CO_2 pipeline operators to opt in to FERC siting and regulation. Such a provision, if passed into law, could facilitate and expedite build-out of new CO_2 pipelines.

Senate QFR – Senator Markey, Q1

Senator Markey:

1. CCUS has historically been developed for Enhanced Oil Recovery (EOR), not climate mitigation. According to the Global CCS Institute, 82% of CO2 captured worldwide is used to extract more oil, a process that ultimately results in more net CO2 emissions than if the CO2 were never captured in the first place. Critics argue that CCUS serves as a social license for continued fossil fuel expansion, rather than a genuine decarbonization tool. Given the long-standing reliance of CCUS on EOR, what guarantees exist that government subsidies for CCUS will not primarily benefit oil and gas expansion rather than permanent storage?

   Answer:

   The reason EOR has been a "long-standing" driver for CCUS is simply because there is a business case for selling the captured CO_2 as a commodity with long-term contracts to purchase the CO_2 from the capturer. While the Global CCS Institute reports that CO_2 captured worldwide is often used to extract more oil, it should be noted that with CO_2 EOR projects, CO_2 is stored, resulting in carbon emission reductions. CO_2 EOR produces oil with a lower emission factor than conventional oil.[13] In addition, nearly all (over 95%) of the purchased CO_2 delivered to the oil field remains securely trapped within the deep geologic formation.[14] Therefore, CO_2 EOR results in permanent storage. It is important to note that the National Petroleum Council states in its 2019 report that U.S. CO_2 EOR development has the potential to store 274 billion tonnes of CO_2.[15] Correspondingly, published expectations for U.S. emissions reduction due to CCS range from 50 to 150 billion tonnes by 2100. Expansion of CO_2 EOR to new fields offers a significant opportunity for emissions reduction relative to these stated emissions reduction goals (Peck and Connors, 2023).[16]

   CO_2 EOR does not necessary "benefit oil and gas expansion" as stated in the question above, rather CO_2 EOR involves the redevelopment of existing mature oil fields where the surface footprint has already been disturbed. Therefore, additional extractive activities (and injection) will occur with minimal land and habitat disturbance while efficiently using existing infrastructure. However, redevelopment of oil fields for CO_2 EOR operations will require reinvestment in and revitalization of existing infrastructure (e.g., wells and production facilities) to ensure continued environmental protection and permanence of CO_2

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[13] Azzolina, N.A., Peck, W.D., Hamling, J.A., Gorecki, C.D., Ayash, S.C., Doll, T.E., Nakles, D.V., and Melzer, S.L., 2016, How green is my oil? A detailed look at greenhouse gas accounting for CO2-enhanced oil recovery (CO2-EOR) sites: International Journal of Greenhouse Gas Control, v. 51, p. 369–379. DOI: /10.1016/j.ijggc.2016.06.008.

[14] Azzolina, N.A., Peck, W.D., Hamling, J.A., Gorecki, C.D., Ayash, S.C., Doll, T.E., Nakles, D.V., and Melzer, S.L., 2016, How green is my oil? A detailed look at greenhouse gas accounting for CO2-enhanced oil recovery (CO2-EOR) sites: International Journal of Greenhouse Gas Control, v. 51, p. 369–379. DOI: /10.1016/j.ijggc.2016.06.008.

[15] National Petroleum Council, 2019, Meeting the dual challenge—a roadmap [*sic*] to at-scale deployment of carbon capture, use, and storage: https://dualchallenge.npc.org/downloads.php (accessed March 2025).

[16] Peck, W.D. and Connors, K.C., 2023, Regional business model assessment—Part II: Plains CO2 Reduction (PCOR) Partnership Deliverable 13 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FE0031838; EERC Publication 2024-EERC-01-06, Grand Forks, North Dakota, Energy & Environmental Research Center, December.

stored in association with EOR operations. It is important to note that the mature existing CO_2 EOR industry possesses the operational practices and expertise to manage large volumes of CO_2 safely and effectively. (Peck and Connors, 2023)[17]

A full life cycle analysis shows that oil produced by injecting CO_2 captured from coal-fired power plants has a 20% lower carbon footprint than typical oil production (Azzolina and others, 2016).[18] This makes CO_2 EOR an effective carbon mitigation strategy without further enhancement. However, EOR projects have traditionally operated in a manner designed to minimize CO_2 utilization and its associated cost. If maximizing storage becomes an expressed goal of an EOR project, the produced oil would be carbon neutral or negative. While a typical EOR project uses (stores) 0.45 tonnes of CO_2 to recover one barrel of incremental oil, the International Energy Agency (IEA) projects in its "Maximum Storage EOR+" scenario that EOR projects operated to maximize storage could store 0.9 tonnes of CO_2 per barrel of oil recovered (International Energy Agency, 2015).[19] This means that potentially, EOR oil would be carbon neutral even under the assumption that the EOR production translates directly to additional oil consumption and does not merely displace oil production from other sources.

Because all the CO_2 used in the EOR process is stored, CO_2 EOR should be considered a critical component of a carbon mitigation strategy. Geopolitical realities underscore the value of new, stable domestic oil supplies, such as that provided by CO_2 EOR, in increasing energy security. Increased energy security and carbon mitigation can be realized using CO_2 EOR.

For additional information on CO_2 EOR, please access the fact sheet titled "CO_2 Enhanced Oil Recovery: Greener Oil" available here:
https://pcor.undeerc.org/assets/PDFs/CO2%20EOR%20Greener%20Oil.pdf

a. Can you provide examples of large-scale CCUS projects that do not use EOR and have demonstrated successful long-term sequestration at the scale required for meaningful climate mitigation?

Answer:

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[17] Peck, W.D. and Connors, K.C., 2023, Regional business model assessment—Part II: Plains CO2 Reduction (PCOR) Partnership Deliverable 13 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FE0031838; EERC Publication 2024-EERC-01-06, Grand Forks, North Dakota, Energy & Environmental Research Center, December.

[18] Azzolina, N.A., Peck, W.D., Hamling, J.A., Gorecki, C.D., Ayash, S.C., Doll, T.E., Nakles, D.V., and Melzer, S.L., 2016, How green is my oil? A detailed look at greenhouse gas accounting for CO2-enhanced oil recovery (CO2-EOR) sites: International Journal of Greenhouse Gas Control, v. 51, p. 369–379. DOI: /10.1016/j.ijggc.2016.06.008.

[19] International Energy Agency, 2015, Storing CO_2 through enhanced oil recovery—combining EOR with CO_2 storage (EOR+) for profit: Paris, International Energy Agency, November, 46 p., https://iea.blob.core.windows.net/assets/bf99f0f1-f4e2-43d8-b123-309c1af66555/Storing_CO2_through_Enhanced_Oil_Recovery.pdf (accessed March 2025).

CCS is a growing area of focus and investment. While there are still challenges, e.g., cost, scalability, and the need for infrastructure, advancements in technology and increased investment in recent years are paving the way for wider adoption. All told, nearly 70 MMt of CO_2 has been stored for CCS projects that do not use EOR, translating into over 15,000,000 cars off the road for a year.[20]

In the United States, the Archer Daniels Midland (ADM) CCS project in Decatur, Illinois, has been actively injecting CO_2 deep underground. The ADM project was the first American company to be granted a Class VI CCS well permit by EPA and has been operating for more than a decade. The project has sequestered approximately 4.5 MMt of CO_2, or the equivalent of more than 1,000,000 cars off the road for an entire year.[21]

In North Dakota, nine CCS projects have received storage facility permits and three of the projects are actively injecting CO_2 into a deep saline formation. Since beginning injection in June of 2022, the Red Trail CCS project has injected over 435,000 metric tons of CO_2 deep underground. The Blue Flint project began injection operations in October 2023 and has injected nearly 222,000 metric tons of CO_2, and the Dakota Gasification project began operations in February 2024 and has injected over 1.5 MMt of CO_2. These three projects combined have the capability to store 40 MMt of CO_2. The remaining six permitted CCS projects have the capability to inject nearly 30 MMt of CO_2 annually for 20 years for a total of approximately 600 MMt of CO_2.

Operational CCS facilities actively injecting CO_2 deep underground into saline formations for permanent storage are listed in the table below (Table 1).

Table 1. Operational Facilities Injecting into Deep Saline Formations*

Facility	Country	Operational Year	Industry	Capture Capacity (MMt/year)	CO_2 Stored (MMt)
Sleipner CCS project	Norway	1996	Natural gas/liquefied natural gas (LNG)	1	23[22]
Equinor Snohvit	Norway	2008	Natural gas/LNG	0.7	11.9[23]

[20] A typical passenger vehicle emits about 4.6 metric tons of CO_2 per year (www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle#:~:text=2%20per%20mile.-,What%20is%20the%20average%20annual%20carbon%20dioxide%20(CO2)%20emissions,around%2011%2C500%20miles%20per%20year).

[21] www.adm.com/en-us/standalone-pages/adm-and-carbon-capture-and-storage/ (accessed March 2025).

[22] https://ccreservoirs.com/the-sleipner-ccs-project-an-active-case-history-for-co2-storage-in-a-saline-aquifer/ (accessed March 2025).

[23] https://industrydecarbonization.com/news/is-carbon-capture-and-storage-more-expensive-than-we-thought.html#:~:text=As%20far%20as%20one%20can,dioxide%20per%20year%20since%202008.

Aquistore	Canada	2015	Coal	0.7	0.5[24]
Shell Quest	Canada	2015	Hydrogen/ammonia /fertilizer	1.3	9[25]
ADM Illinois Industrial	United States	2017	Bioenergy/Ethanol	1	4.5
QatarEnergy LNG	Qatar	2019	Natural gas/LNG	2.2	6.3[26]
Chevron Gorgon	Australia	2019	Natural gas/LNG	4	10[27]
Entropy Glacier Gas Plant (Phase 1A,1B)	Canada	2022	Natural gas/LNG	0.32	~0.64
Red Trail CCS Project	United States	2022	Bioenergy/Ethanol	0.18	0.435[28]
Blue Flint Sequester Project	United States	2023	Bioenergy/Ethanol	0.2	0.222[29]
CNOOC Enping	China	2023	Natural gas/LNG	0.3	~0.60
Barnett Zero CCS	United States	2023	Natural gas/LNG	0.185	~0.185
Great Plains CO_2 Sequestration Project (Dakota Gasification Co.)	United States	2024	Coal gasification	2.7	1.5[30]
				Total	68.782

*Global CCS Institute: Global Status of CCS 2024 (https://www.globalccsinstitute.com/wp-content/uploads/2024/11/Global-Status-Report-6-November.pdf), as modified.

Globally, there are 18 CCS projects currently in construction proposing an annual CO_2 storage capacity of 24.44 MMt and there are 66 global projects in advanced development that have the additional CO_2 storage capacity of nearly 70 MMt/year.[31] Currently, in the United States, the

[24] www.sasktoday.ca/southeast/local-news/ptrcs-aquistore-reaches-milestone-of-500000-tonnes-of-stored-co2-6471300#:~:text=Aquistore%20has%20stored%20500%2C000%20tonnes%20of%20CO2%20since%20opening%20%2D%20SaskToday.ca (accessed March 2025).
[25] www.catf.us/resource/carbon-capture-storage-what-can-learn-from-project-track-record/#:~:text=As%20of%20May%202024%2C%20Quest,million%20tonnes%20of%20CO2.&text=Key%20takeaways:%20Quest%20has%20implemented,the%20purposes%20of%20emissions%20reduction, citing Tucker O (2024) *The Quest CCS project. Presentation to: Zero Emissions Platform Technology Committee.*
[26] 2023, www.qatarenergy.qa/en/MediaCenter/Publications/QatarEnergy%20Annual%20Review%202023.pdf.
[27] 2024, https://australia.chevron.com/what-we-do/gorgon-project/carbon-capture-and-storage#:~:text=More%20than%2010%20million%20tonnes,40%2Dplus%20years%20of%20operation.
[28] www.dmr.nd.gov/dmr/sites/www/files/documents/Oil%20and%20Gas/Class%20VI/CO2%20Reporting/Website%20CO2%20Volume%20Reporting_Red%20Trail.pdf (accessed March 2025).
[29] www.dmr.nd.gov/dmr/sites/www/files/documents/Oil%20and%20Gas/Class%20VI/CO2%20Reporting/Website%20CO2%20Volume%20Reporting_Blue%20Flint.pdf (accessed March 2025).
[30] www.dmr.nd.gov/dmr/sites/www/files/documents/Oil%20and%20Gas/Class%20VI/CO2%20Reporting/Website%20CO2%20Volume%20Reporting_DGC.pdf (accessed March 2025).
[31] www.globalccsinstitute.com/wp-content/uploads/2024/11/Global-Status-Report-6-November.pdf (accessed March 2025).

growth of CCS projects can be evidenced by the number of projects undergoing EPA review—57 projects with 165 well applications. Policies like the 45Q federal tax credit in the United States and similar initiatives in Europe have created a more commercially viable landscape for CCS projects in recent years.

However, lengthy EPA permitting times in the United States have created uncertainty for industry, resulting in project deployment delays while putting into question industries' ability to monetize the 45Q tax credit and attract and maintain investment in dedicated Class VI storage (i.e., non-EOR storage). On the contrary, the business case for CO_2 EOR projects benefits from CO_2 offtake agreements in lieu of incentive programs, resulting in larger numbers of projects in the United States. "Revenue from the sale of CO_2 for EOR alone may be sufficient to cover the costs of capturing and transporting CO_2 in sectors where the cost of capturing CO_2 is relatively low, such as natural gas processing, fertilizer and bioethanol production."[32] Non-EOR projects have the near-term opportunity to surpass CO_2 EOR projects with increasing government support and regulatory certainty with Class VI permit timelines. Both forms of storage, CO_2 EOR and non-EOR storage, are necessary for the United States to achieve wide-scale CCUS deployment. The benefits of CO_2 EOR, such as low-carbon-intensity oil production, efficient use of the depleted reservoir for CO_2 storage, and the sustainable business case to utilize CO_2 as a valuable commodity make it a long-term, viable solution to manage CO_2 emissions.

[32] www.globalccsinstitute.com/wp-content/uploads/2019/04/TL-Report-Policy-prorities-to-incentivise-the-large-scale-deployment-of-CCS-digital-final-2019.pdf (accessed March 2025).

Senate QFR – Senator Blunt Rochester, Q1

Senator Blunt Rochester:

1. Mr. Connors, I would like to discuss impact assessments with you. What kind of health impact assessments are required for Class VI well projects?

Answer:

At the Class VI rulemaking stage, EPA determined the risk to human health from airborne exposure resulting from CO_2 injection activities (even in the case of leakage or accidental exposure) is minimal based on decades of CO_2 injection in the oil and gas industry, international CO_2 geologic storage projects and evaluation of large-scale releases of naturally occurring CO_2.[33] EPA determined the main risk of Class VI well projects to human health is the potential leakage of CO_2 to underground sources of drinking water (USDWs). Under the Safe Drinking Water Act (SDWA), EPA has developed comprehensive regulations through the UIC program to address the potential risk of leakage and endangerment of USDWs. Regulations and the permitting process for Class VI wells are the most rigorous of the UIC program. Specific health impact assessments beyond the stringent Class VI regulations are not required for permitting a CO_2 storage project.

   a. How do we ensure these assessments are thorough and transparent?

Answer:

The UIC Class VI regulations and permitting process provide the groundwork for ensuring thorough assessment of the potential of a Class VI well project to impact human health and the environment. The UIC Class VI permitting process is a rigorous process. As part of the permit application, a project developer must demonstrate the site is suitable for safe and permanent storage of CO_2, all potential leakage risks have been evaluated, the project is designed to prevent leakage, and appropriate monitoring plans are in place to ensure that no leaks are occurring. Regulators perform a thorough review of the permit application including evaluation of all the data that project developers used to evaluate the suitability of the project site and design the project.

As more projects look to seek UIC Class VI permits, one way to ensure these reviews continue to be thorough is for states to have primacy over Class VI wells. States have the best knowledge of regional geology and areas in need of special protection, along with established relationships with the regulated community. Additionally, states have staff that specialize in field inspection to ensure regular and timely site inspections, review of monthly and annual reporting, and compliance reviews to certify that well owners/operators comply with the regulations.

Transparency of the UIC Class VI permitting process is addressed via public participation. Communities have the ability to attend public hearings or provide comments on the submitted

[33] U.S. Environmental Protection Agency. Federal Register, 2008, Federal requirements under the Underground Injection Control (UIC) program for carbon dioxide (CO_2) geologic sequestration (GS) wells: v. 73, p. 43492: www.govinfo.gov/content/pkg/FR-2008-07-25/pdf/E8-16626.pdf (accessed 2025).

Class VI permits. Additionally, the Class VI rule adopts the existing public participation requirements under the SDWA. These requirements include 1) providing public notice to interested parties of pending actions via newspaper advertisements, radio, mailings, or emails; 2) holding public hearings and soliciting and responding to public comment; and 3) involving a broad range of stakeholders.[34]

b. Can you speak to the specific environmental impact assessments required for Class VI wells, and how communities' voices and concerns are incorporated into these assessments?

Specific environmental assessments beyond the stringent Class VI regulations are not required for permitting a CO_2 storage project. The UIC Class VI regulations require operators to evaluate potential environmental risks associated with the CO_2 injection and storage process including leakage of CO_2 to USDWs or the atmosphere and induced seismicity; design the project to prevent leakage and induced seismicity; and regularly monitor for potential leakage and induced seismicity during the life of the project. At the Class VI rulemaking stage, EPA determined that the risk of adverse impacts to ecosystems from a release of CO_2 to the atmosphere and risk of induced seismicity are low.[35] EPA determined the main risk of Class VI well projects to the environment is the potential leakage of CO_2 to USDWs. Under the SDWA, EPA has developed comprehensive regulations through the UIC program to address the potential risk of leakage and endangerment of USDWs.

Community voices and concerns are solicited and incorporated into projects throughout the development process. Project developers generally engage the local community early and often as they develop a project through public open houses, one-on-one meetings with stakeholders, and participation in city and county commission meetings. For example, site characterization activities performed at the early stages of project development tend to require access to and have short-term impacts on proposed project site(s), necessitating direct engagement with landowners and/or mineral owners for land access permission. This results in these baseline data acquisition activities such as seismic survey(s) or drilling of stratigraphic test well(s) becoming very public-facing activities that often draw widespread interest and concern from local and regional communities. In many cases, these site characterization activities also require county or state permits, which usually include requirements for public notices. In states with pore space laws, project developers may also have to engage pore space owners to obtain all or a certain percentage of the necessary leases to store CO_2 in order to obtain regulatory approval to proceed with the project. These types of requirements mean operators must work with pore space owners to address their concerns and reach an agreement. In North Dakota, all nine projects permitted to date have had 79%–96% of the required pore space voluntarily lease, far exceeding the minimum requirement of 60%, a success operators attribute to early and active engagement with their

[34] www.epa.gov/system/files/documents/2022-06/Public%20Participation%20Considerations%20for%20GS%20Projects%20Fact%20Sheet_508v3.pdf (accessed March 2025).

[35] U.S. Environmental Protection Agency. Federal Register, 2008, Federal requirements under the Underground Injection Control (UIC) program for carbon dioxide (CO_2) geologic sequestration (GS) wells: v. 73, p. 43492: https://www.govinfo.gov/content/pkg/FR-2008-07-25/pdf/E8-16626.pdf (accessed 2025).

communities. The UIC Class VI permitting process itself also has requirements related to public participation. Regulators must provide public notice to interested parties, hold public hearings, and solicit and respond to public comments. Community members have the right to attend public hearings and provide comments on submitted Class VI permits. When engagement is done early, project developers can address community concerns up front and incorporate changes into their project plans ahead of the permitting process. Communities that have their feedback solicited and acted upon may also experience greater levels of ownership and support for developing projects, leading to positive outcomes for project developers.

Senator Blunt Rochester:

2. Can you explain how the US government can continue to support the development and deployment of new technologies that enable the decarbonization of traditional, critical industries, and access to testing and CO2 delivery infrastructure to scale?

Answer:

The Regional Carbon Sequestration Partnership (RCSP) Program funded by the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) built regional expertise and established industry–government partnerships over three project phases from 2003 to 2019. DOE NETL extended the work of the RCSP Program under a fourth phase (2019–9/30/2025), known as the Regional Initiatives to Accelerate Carbon Capture, Utilization, and Storage (CCUS) Deployment. Continuation of this industry, government, and research collaboration is vital to transferring valuable lessons learned and best practices for sustained commercialization and deployment of CCUS regionally, nationally, and worldwide. The RCSP Program has played a vital role in addressing technical challenges and providing scientific support for the development of legal and regulatory frameworks. With the expanded commercialization of operating CCUS projects, there will be growing opportunities for technical improvements and efficiency gains, as well as new technical challenges. Through continued funding of the RCSP Program, DOE can maintain regional leadership and help support the technical expertise needed to address future challenges.

As an example of the success of private, state, and federal partnerships, the Plains CO_2 Reduction (PCOR) Partnership (2003 to present), led by the Energy & Environmental Research Center (EERC), has over 20 years of expertise through applied research in CCUS across a region (ten states and four Canadian provinces) that encompasses the northern Great Plains and northwestern regions of North America. The PCOR Partnership has experienced unprecedented growth, surpassing 260 industry, government, and research member organizations since the program's inception in 2003. This growth in partners coincides with increased commercial activity across the PCOR Partnership region, with an increasing number of projects under development, including the expansion of existing CCUS infrastructure. Planned projects in the region would capture CO_2 from a variety of industrial sources, build or repurpose multistate transport pipeline networks, and permanently store CO_2 either through utilization in enhanced oil recovery or geologically in non-oil and gas reservoirs. The PCOR Partnership continues to lead the world in research and development and commercialization of CCUS.

Senator CAPITO. Thank you, Mr. Connors.

Our next witness is Dan Yates, and he is the Executive Director of the Groundwater Protection Council, or GWCP. He has been with GWCP for over 20 years and has worked with his members on the challenges that have been experienced with the Class VI primacy process.

I would note, he has two children, so we are up to nine. We are getting up to a high average here. Thank you, Mr. Yates, for coming.

STATEMENT OF DAN YATES, EXECUTIVE DIRECTOR OF THE GROUND WATER PROTECTION COUNCIL, INC.

Mr. YATES. Thank you, Madam Chairman Capito, Ranking Member Whitehouse, and all the members of the committee for inviting me to speak today. It is an honor to be here to discuss the work the Groundwater Protection Council has been doing with our State members for the past 40 years.

We were created in 1983 to bring together the technical regulatory experts to address underground injection control and groundwater protection issues. Our national organization represents both energy and water agencies, including such programs as Water Quality, Underground Injection, Drinking Water Source Protection, Groundwater Protection, and Oil and Gas.

My experience spans 25 years helping aid State programs in tool development, regulatory considerations, and capacity development. We have been at the forefront of CCUS, including work on CO_2 injection for enhanced oil recovery, the creation of the Class VI UIC program, and promulgation of State regulations in order to get primacy.

Class VI well regulations, like all UIC programs, are designed to protect public health and underground sources of drinking water. They cover injectionsite evaluation, construction specifications, operational constraints, well testing, monitoring, emergency response, and closure requirements, among others.

As part of primacy applications, States develop their own rules and regulations that meet or exceed Federal rules. The UIC program is a novel and complex program that relies heavily onsite-specific determinations. As previously mentioned, four States have primacy currently, and several of this committee's States have submitted primacy applications, while even more are in the process of completing primacy applications.

As Kevin mentioned, North Dakota waited several years for their primacy, and now States are waiting many years once they have submitted their applications to obtain primacy. State agencies have a vested interest in the communities where they live, work, and raise their families. They understand environmental protection, economic development, water use, and public health needs of their State. They have the expertise in local geology, water sources, geography, and they are the most efficient and can provide faster responses.

Some challenges remain toward obtaining primacy. State regulators have expressed to us that EPA has been helpful in providing information about the Class VI application process. They have made themselves available to meet and discuss the process, pro-

vided guidance documents, and interfaced with States, both individually and through work groups through the Groundwater Protection Council.

However, the current application process is extremely rigorous. Though EPA has done some work to improve this process, States that already have regulatory programs in place, including other components of the UIC program, are well suited to manage the Class VI program and should have a more streamlined process to obtain primacy.

Regulations for Class VI should be based primarily on geologic siting, operation, and secure project closure. States are best equipped to administer the complexities of this Class VI program, but more resources are needed for permitting and regulatory capacity, including staffing, training, and technology.

Some funding has been provided by Congress, either directly to State programs or to EPA, but not all of those funds have been released by EPA, including $1.2 million for the Fiscal Year 2024 budget for State training.

GWPC has initiated a Class VI training program, including developing a Class VI curriculum in conjunction with States for their needs, but additional funding from Congress could speed the development.

Data management focused on full well life cycle is critical for this program. States and GWPC have previously developed similar programs and have begun work on a Class VI data management program, but funding is needed to complete a robust, State-managed system for Class VI.

How can Congress help? Federal funding enacted as part of an annual appropriations could provide essential support for geologic storage deployment by expanding capacity of States to permit geologic storage. From industry partners that have the technology to construct these projects, to States ready to develop safe and effective regulations, all the ingredients are there to implement safe and secure carbon sequestration.

GWPC stands ready with its State agency members to work with Federal partners and stakeholders to attain geologic storage on a needed scale.

Thank you again for your time on this important topic today. I am happy to answer any questions.

[The prepared statement of Mr. Yates follows:]

Written Testimony of
Dan Yates
Executive Director
Ground Water Protection Council
Before the U. S. Senate Committee on Environment and Public Works

Advancing Carbon Capture, Utilization and Sequestration Technologies and Ensuring Effective Implementation of the USE IT Act

Wednesday, February 12, 2025

Thank you, Madame Chairman Capito, Ranking Member Whitehouse and to all committee members for the invitation to testify today. It is an honor and a privilege to be able to discuss the work the Ground Water Protection Council (GWPC) has been doing for the past 40 years with its state agency members, and specifically on Class VI primacy for the states and carbon capture and storage.

The Ground Water Protection Council was created in 1983 to bring together technical and regulatory experts to specifically address underground injection control issues and overall groundwater protection. Since its creation, GWPC has grown into a national organization who represents both energy and water agencies including oil and gas programs, water quality programs, underground injection control programs, drinking water source protection, and groundwater protection.

My experience and knowledge spans 25 years at GWPC helping aid state regulatory programs with tool development and regulatory considerations for multiple topics including Underground Injection Control (UIC). We have been at the forefront of carbon capture and storage discussions including work on CO_2 injection for enhanced oil recovery, the creation of a new Class VI UIC program, state promulgation of carbon capture and underground storage (CCUS) rules and regulations, and state primacy attainment including interfacing with USEPA, state regulators, industry, and NGOs.

GWPC maintains a repository of current and relevant information on Class VI and CCUS that is widely used by our state regulators, federal agencies and other stakeholders, which can be easily accessed on the GWPC website.

Storing CO_2 in oil and gas fields has been occurring for more than fifty years. This work demonstrates that geologic storage of CO_2 can be done safely with little to no risk of CO_2 migration outside a formation when properly sited and regulated.

Class VI well regulations, like all UIC programs, are designed to protect public health and underground sources of drinking water. They cover injection site evaluation, construction specifications, operational constraints, well-testing parameters, monitoring approaches, emergency response procedures, financial responsibility, and site closure requirements. In addition to the Class VI regulations, USEPA requires reporting of CO_2 injected along with approved monitoring, reporting, and verification procedures with additional required reporting to its air quality program.

As part of the state primacy application, states develop their own rules and regulations that meet or exceed the federal rules. The UIC Class VI program is a novel and complex regulatory

program that relies heavily on site-specific determinations for long-term geologic storage. Currently three (3) states have primacy for the UIC Class VI program: North Dakota, Wyoming, and Louisiana, with West Virginia primacy expected in the coming month. Several of this committee's states have submitted primacy applications while even more are in the process of putting together their primacy applications. As the first state that applied for Class VI primacy, North Dakota took several years to attain primacy. Other states, such as Texas and Alaska, have been working for a few years through the complex application process. Some states do not show up on the USEPA chart as applying for Class VI primacy as the cumbersome process places it on the states to prove the state program has support and capacity. For example, Arkansas, who does not show up on the EPA website as applying but has a bill in their state legislature this session, has been diligently working to apply.

CURRENT UIC PRIMACY

EPA manages all well classes for 8 states and DC including:

1. Arizona*
2. Minnesota
3. Iowa
4. New York
5. Pennsylvania
6. Virginia
7. Hawaii
8. Vermont

*Arizona has submitted an application to obtain primacy for all well classes.

Only three states have primacy for all well classes (Classes I, II, III, IV, V and VI)

1. North Dakota
2. Louisiana
3. Wyoming

Most states have primacy for all wells except Class VI including:

1. Washington
2. Oregon
3. Idaho
4. Utah
5. Nevada
6. New Mexico
7. Texas
8. Oklahoma
9. Nebraska
10. Kansas
11. Arkansas
12. Missouri
13. Illinois
14. Wisconsin
15. Ohio
16. Tennessee
17. Alabama
18. Mississippi
19. Georgia
20. Florida
21. North Carolina
22. South Carolina
23. West Virginia
24. Maine
25. Rhode Island
26. New Jersey
27. Maryland
28. Delaware
29. Massachusetts
30. New Hampshire
31. Connecticut

States with Class II primacy only.

1. Alaska
2. California
3. Montana
4. Colorado
5. South Dakota
6. Michigan
7. Indiana
8. Kentucky

States currently in some phase of obtaining Class VI primacy:

1. According to EPA website, West Virginia is in final phase.
2. Alaska, Arizona, Colorado, Oklahoma, Mississippi, Texas, Utah, Alabama

According to the USEPA Class VI permit tracker,

1. There are 161 well applications currently under review with 37 % of those received in the last 12 months. 56 of these applications are in Texas and 55 in California.
2. The permit tracker says that "EPA aims to review complete Class VI applications and issue permits, when appropriate, within approximately 24 months."
3. Only eight (8) permits have been issued nationally, including in Illinois, Indiana, Texas, and California, since USEPA began managing in 2011. Four of these permits were issued in December 2024.

Since receiving primacy in 2018, North Dakota has approved eight Class VI injection well permits. USEPA approved Wyoming for primacy in 2020, and Wyoming Department of Environmental Quality has issued nine Class VI permits.

Federal regulations are supposed to be the foundation for states to create programs that best fit their states' needs, as there cannot be a one-size-fits-all Class VI program. State regulators have a more vested interest in the communities where they live, raise their families, and call home. When a state asks for primacy, it is because they want what is best for their home in environmental protection, economic development, public health, etc. The state agency employs the staff that has the depth of knowledge and experience in geology, climate, water sources and aquifers, geography, and geopolitics. It is the state regulators that understand the needs of their state and can manage their own resources better. Like most state regulatory programs that have been given primacy, it is the state that can regulate more efficiently, with faster response, and engage their cities and towns.

CHALLENGES TOWARDS OBTAINING PRIMACY

State regulators have expressed to GWPC that they believe USEPA staff want to help them gain primacy as the USEPA has been helpful in providing information about Class VI application process. USEPA staff have made themselves available to meet and discuss the process and provide valuable guidance documents. They have interfaced with states individually and collectively through GWPC led workgroups.

The current application process is extremely rigorous, specifically the Crosswalk template that states must compare to federal regulations. It is almost like having a language barrier as working

through the Crosswalk is not comparing apples to apples. Though EPA has done some work to improve this process, states that already have regulatory programs in place, including other components of the UIC program (Classes I-V), are well suited to manage the Class VI program and should have a more streamlined process to attain primacy. Priority has been placed on activities that are not part of programmatic, science-based regulations in this rigorous application process that has hindered primacy approval. Regulations for Class VI should be based primarily on geologic siting, operation, and secure project closure after operation ends.

STATE CAPACITY

States are the best equipped to administer the complexities of the Class VI programs, but additional knowledgeable staff is greatly needed. Capacity development, with more easily accessible resources, is needed to help states increase permitting and regulatory oversight including staffing, training, and technology.

Some funding has been provided by Congress either directly to state programs (Class VI state grant) or through the USEPA budget (Class VI training) but not all of those funds have been yet released by USEPA, including $1.2 Million from the FY24 budget for state training. Training must be provided for any new program, especially as robust and complex as a Class VI program.

GWPC has initiated a state Class VI training program by developing a Class VI curriculum and interfacing with states on specific needs, additional training budget for states from Congress would speed the development of state programs

Data management focused on the full well lifecycle, history of permits, inspections, regulatory actions, compliance, and reporting is critical. States and GWPC have previously developed similar systems for other UIC well classes. Class VI wells are significantly more complicated, and funding is needed to create a sound and effective state-managed Class VI well data management reporting system.

According to the USDOE report *Carbon Storage Atlas,* the United States' geology offers vast potential to permanently and securely store captured carbon deep underground in appropriate geologic formations safely. The report shows that the country's geologic storage capacity is anywhere from 2.2 trillion to 21.2 trillion metric tons of CO_2. For greater context, US emissions totaled approximately 6,340 million metric tons of CO_2 in 2021. In essence, we won't run out of available geologic storage.

HOW CONGRESS CAN HELP

Robust and thoughtful federal funding enacted as part of annual appropriations could provide essential support for geologic storage deployment, including by expanding the capacity of federal and state authorities to permit geologic storage in saline formations and providing funds for further geologic storage site characterization. From industry partners that have the technology to construct these projects to states ready to develop safe and effective regulations, all the ingredients are there to remove CO_2 from the air and implement safe and secure carbon sequestration.

Through cooperative federalism, GWPC stands ready with its state agency members to work with its federal counterparts to advance the implementation of responsible management of effective and efficient Class VI rules and regulations at the state level. To attain geologic storage on the needed scale, state regulators, with federal assistance, will be able to provide the resources, staffing, and training necessary for regulatory program deployment and ensure that proper regulations are in place to allow storage at the scale necessary to ensure water resources are protected and to mitigate impacts to the environment.

Senate Committee on Environment and Public Works
Hearing Entitled, *"Advancing Carbon Capture, Utilization and Sequestration Technologies and Ensuring Effective Implementation of the USE IT Act."*
February 12, 2025
Questions for the Record for Mr. Dan Yates

Ranking Member Whitehouse:

1. *How can the current approach to Class VI well permitting be streamlined or improved to expedite project deployment while maintaining safeguards for drinking water?*

Answer:

Streamlining the UIC Class VI well permitting process to expedite project deployment in a manner protective of drinking water, including groundwater sources, can be accomplished by:

1. **State/Tribal UIC Class VI Primacy Actions:**

- Simplify the state/tribal UIC primacy application process, particularly for states/tribes that have gained experience through implementing their delegated UIC primacy programs for other UIC well classes.
- Provide new performance measures for EPA staff related to processing state/tribal primacy applications. Measures should include timelines for timely and constructive collaboration during state/tribal application-building process and comparison of state/tribal regulations with federal UIC Class VI regulations to ensure sufficiency.
- Provide training to EPA regional UIC staff and OGWDW UIC staff members on essential state/tribal processes that must occur as they develop their primacy applications and regulatory structure. This is important to avoid late or ill-timed requests for changes that can significantly delay primacy. These state/tribal processes include rulemaking followed by appropriation of funding and approval of adequate staffing, program implementation and policy development, etc.
- Make the UIC Class VI grant application/implementation process more straight-forward. EPA has added many requirements for the Class VI grant funding appropriated by Congress, such as duties and requiring the development of new agency-wide Quality Management Plans. The UIC Class VI grants to states/tribes could be structured similar to EPA's Multi-Purpose Grants, which are less rigorous

for grantees. (https://www.epa.gov/sites/default/files/2020-07/documents/mpg_guidance_for_tribes.pdf)

2. UIC Class VI Application Process:

- To date, EPA and states have co-evaluated the submitted UIC Class VI applications in a collaborative manner while the state's primacy application was being processed. As part of this collaboration, the application evaluations and review documents developed by EPA/contractors should be provided to the state. It will also be helpful for EPA and its contractors to provide review assistance post primacy attainment, as requested by the state/tribe.
- Many of the planned CCUS/UIC Class VI projects are sited in the Rocky Mountain states. A major issue facing states/tribes in this region is the ability of a state/tribe to determine usage of deep aquifers for either drinking water, agricultural, industrial, or disposal purposes. States/tribes in all EPA regions should have the authority to designate groundwater uses rather than being negated by EPA, often after considerable investment in project development has occurred (UIC program and permit overreach).

The following bullets address aquifer exemptions (AEs), a regulatory mechanism in the UIC rules that could be changed to allow states/tribes greater control of their own groundwater and subsurface environment, including deep subsurface storage reservoirs that meet the challenging geologic requirements for secure Class VI well siting. Unlike surface water, groundwater ownership does not belong to the federal government/EPA. It either is owned by the state/tribe, owned by the property (surface estate) owner, or it has been adjudicated by the state.

- In the UIC Program, the designation of exempted aquifers is essential to the identification of Underground Sources of Drinking Water (USDWs), to exclude aquifers presumed to be possible USDWs but that are incapable of supplying drinking water, as defined in UIC federal regulations at 40 CFR 146.4. The designation of an exempted aquifer constitutes a decision that the aquifer does not qualify as a USDW within the UIC Program. EPA has retained for itself the final approval authority for aquifer exemptions requested by states/tribes (as UIC program revisions) – this authority should rest with the states/tribes and not EPA.

- Developed in the early 1980s, EPA rules allow for AEs for injection well operations in UIC Classes I, II, III, IV, and V. EPA changed its tact in developing the federal UIC Class VI rules in 2010, and the rules essentially disallow the designation of AEs for Class VI projects while inserting an untested process called a depth waiver (DW). While EPA did a thorough job of developing other UIC Class VI guidance documents, EPA has not yet provided a UIC Class VI DW guidance document.
- This combination of AE/DW actions by EPA essentially highjacks the states/tribes ability to implement their UIC Class VI program by denying states/tribes the ability to use deep brackish water aquifers for CO_2 sequestration or storage. These deep brackish water aquifers are economically or otherwise infeasible to use as drinking water sources and could be put to gainful use by the state/tribe for CO_2 sequestration or storage. CCUS operations are typically sited at a minimum depth of at least 3,500 feet below ground surface in order to achieve optimal storage of CO_2 while it is in a supercritical fluid phase that has properties of both a liquid and a gas. Most of the proposed CCUS operations will use secure CO_2 storage reservoirs that are several thousands of feet deeper than the minimum operational depth of 3,500 feet.
- The federal UIC regulations should be changed to allow AE utilization for UIC Class VI projects, and EPA should provide detailed guidance on the DW process, which may be a useful regulatory tool used in combination with AEs. This could be accomplished through either an EPA-initiated, expedited rulemaking to make these changes or it could be actuated by Congressional legislation to require EPA make these changes, followed by an expedited federal UIC rulemaking action to implement the new federal legislation.

Senator Markey:

1. *Mr. Yates, the projected large-scale deployment of CCUS requires an extensive network of CO2 pipelines to transport captured carbon to storage sites. Yet CO2 pipeline ruptures—such as the 2020 Satartia, Mississippi incident—have demonstrated serious risks, including asphyxiation hazards and emergency response challenges. Moreover, eminent domain conflicts over pipeline construction have led to widespread opposition from landowners. Given that CCUS requires significant CO2 pipeline expansion to function at scale, how do you address the risks of pipeline leaks, pressure build-up, and*

potential for CO2 plumes in the event of a rupture? Can you cite specific case studies where these risks have been effectively mitigated?

Answer:

GWPC's areas of focus related to CCUS are on the underground injection operations as regulated under the UIC Program focused primarily on the wells used for sequestration. While we do not have expertise nor provide services to our state agency members in this area, we do offer the following observations and suggestions.

The safety track record for operation of CO_2 pipelines has been excellent for more than 50 years of operation in the nation, aside from the Satartia, Mississippi incident. The US Department of Transportation (DOT) currently regulates CO_2 pipelines under the Hazardous Liquid Pipeline Act of 1979, and its Pipeline and Hazardous Materials Safety Administration (PHMSA) was established in 2004 within DOT to oversee CO_2 pipeline safety.

US DOT developed a proposed rulemaking regarding safety of CO_2 pipelines and issued notice in January 2025, following the multi-year investigation of the CO_2 pipeline Satartia, Mississippi incident. Several new standards were developed for transporting carbon dioxide via pipeline. Key provisions of the proposed rule included requirements for training emergency responders and for communications during an emergency. This proposed rulemaking appears to have been paused.

Considering the estimated ten-fold expansion of CO_2 pipelines needed to fully implement CCUS from the current 5,000 miles of CO_2 pipelines, Congress may wish to consider the existing national CO_2 pipeline safety requirements and determine the need for new standards and requirements, such as emergency response and communications during an emergency.

Also given this expansion of CCUS, continued and additional funding will be required for PHMSA and state pipeline safety agencies in order for these agencies to effectively inspect and regulate pipeline operations, requiring changes as needed to protect public safety. Adequate regulation is an important component of a well-functioning and safe national CO_2 pipeline system. Ongoing communication between PHMSA and the state agencies that have, or will attain, Class VI Primacy is crucial.

Senator Blunt Rochester:

1. *Mr. Yates, Class VI wells are used for injecting CO_2 deep underground for long-term storage. What measures are in place to ensure that these wells do not contaminate local groundwater supplies, especially in areas where groundwater is a primary source of drinking water?*

Answer:

The UIC program was developed with the primary regulatory focus of protecting groundwater supplies used for drinking water from degradation related to injection well operations. UIC Class VI regulatory requirements for siting, construction, operation, closure, and post-closure care are comprehensive and stringent:

- Class VI wells must be sited in geologically secure subsurface formations (reservoirs), demonstrated to contain the CO_2, without leakage. UIC Class VI rules on geologic siting include a concept called the Area of Review (AoR), where careful evaluation of geologic faults or large fractures for their potential to be an excursion route is conducted. The AoR also entails an evaluation of artificial penetrations (APs) (i.e., existing deep wells such as oil and gas wells or industrial disposal wells) that may exist within the predicted pressurized area of the proposed injection zone that, if not constructed or closed (plugged and abandoned) might transmit CO_2 out of the reservoir. If potentially transmissive APs are identified, corrective action is required to retrofit or properly plug and abandon these APs, and/or the Class VI project applicant must modify the proposed operations or find a different, sufficiently secure site to locate the CCUS/Class VI injection project.
- Multiple telescoping well casings supported by and bonded to the borehole by cement are required in the well design to create an impermeable barrier that the CO_2 will be safely transported through to the deep geologic storage reservoirs or injection zones, protecting the shallow freshwater, or USDWs, from any possible influence of the Class VI well operations. Injection and reservoir pressures must be continuously monitored during operations and if pressures cannot be maintained as dictated in the permit, the Class VI well must be shut-in and

remedial actions, such as workovers, must be conducted before injection operations can continue.

- CCUS/Class VI projects are monitored in several ways during and after operations to ensure CO_2 plumes remain in the deep geologic repository as designed and corrective actions are required if monitoring shows deviation from the permitted operation. Financial responsibility requirements for CCUS/Class VI permitted operators are designed to provide the permitting agency with assurance that all facets of CCUS/Class VI operations are financially covered and, if necessary, that the state/tribal permitting agency has the resources to implement any corrective action that may be necessary. The post-injection site closure period and requirements of the UIC Class VI rules dictate CCUS operators provide sufficient monitoring and corrective action for up to 50 years post-operation.

2. *How do we protect communities from potential contamination?*

Answer:

- During the early stages of CCUS project development and as part of the UIC Class VI permitting process, the project applicant must identify all sources of drinking water, including groundwater sources (USDWs). When identifying sources, applicant must factor in injection well design to ensure the communities are protected from potential contamination. This is a rigorous evaluation process that includes interaction with adjacent or nearby communities, centers of expertise including state geologic surveys and water boards, local groundwater districts, property (surface) owner, subsurface mineral owners, and other stakeholders in the vicinity of the proposed CCUS/Class VI project.
- CCUS surface operations must be designed, permitted, and operated under other regulatory programs, such as the Hazardous Liquid Pipeline Act for safety of pipelines, Clean Water Act programs for surface wastewater/stormwater discharges, Resource Conservation and Recovery Act programs for solid waste management, and Clean Air Act programs for the capture and processing (atmospheric) aspects of facility operations. Proposed CCUS/Class VI operators must run their facilities in compliance with all of these additional program

permits, in conjunction with their UIC Class VI permits.

3. *Can you explain how the US government can continue to support the development and deployment of new technologies that enable the decarbonization of traditional, critical industries, and access to testing and CO2 delivery infrastructure to scale?*

Answer:

The US government can support CCUS/UIC Class VI technologies and operations by taking the following actions:

- Continue to fund and provide technical support from DOE Office of Fossil Energy and Carbon Management in technically evaluating proposed operations (e.g., sequestered CO_2 plume fate and transport modeling) and researching new CO_2 sequestration technologies.
- Continue to fund and provide technical support from DOE for grants to bring both pilot-scale and full-scale injection-based CCUS operations at key geographic locations for regional operations such as carbon hubs and at Direct Air Capture facilities.
- Continue to fund and provide technical support from USGS to generate and provide geologic and hydrologic data needed by proposed project operations.
- Appropriate and provide new UIC Class VI regulatory program funding to support initial and continued training and staffing of geoscientists, engineers, chemists, and other technical specialists in the state/tribal UIC program staff. Funding should include the EPA UIC Program, which will be necessary to permit and regulate CCUS/Class VI projects in non-primacy states.
- Foster a cooperative federalism-type approach to CCUS/UIC Class VI operations among states/tribes, EPA, other federal agency stakeholders (e.g., US Department of Energy, US Department of Interior- Bureau of Land Management, and US Forest Service) to ensure all participants and interested parties have unified project goals and responsibilities.
- Fund state-development of Class VI regulatory data management tools to help streamline permitting processes and ease necessary data sharing between states and permittees.

Senator CAPITO. Thank you very much, Mr. Yates.

Our final witness is Jack Cavanaugh, who is the Manager of Carbon Management for Breakthrough Energy. Mr. Cavanaugh focuses on carbon capture technologies for the organization as a member of the CCUS Federal Lands Permitting Task Force.

Thank you very much, Mr. Cavanaugh, for joining us today. We look forward to your testimony.

STATEMENT OF JACK ANDREASEN CAVANAUGH, MANAGER OF CARBON MANAGEMENT, U.S. POLICY AND ADVOCACY, BREAKTHROUGH ENERGY

Mr. CAVANAUGH. Chairman Capito, Ranking Member Whitehouse, and members of this committee, thank you for the opportunity to appear before you today. I am here to discuss the USE IT Act, Class VI wells, and the challenges and opportunities this committee faces as it continues to foster carbon management, including carbon dioxide removal.

My name is Jack Cavanaugh, and I oversee carbon management at Breakthrough Energy. Breakthrough Energy was founded to accelerate energy innovation and build the industries of the future without emissions, and we deploy for-profit investment funds, nonprofit grant-making programs, and policy efforts to achieve that mission. I serve on the White House Task Force for Carbon Capture Utilization and Sequestration on the Subcommittee, Federal Lands and the Outer Continental Shelf, established through the bipartisan efforts of this committee and the USE IT Act.

I am also a Husker. It is great to see you, Senator Ricketts. I was born and raised in the great State of Nebraska. A natural gas pipeline runs through my family farm in South Hastings and was recently retrofitted to carry CO_2. This was made possible by the 45Q tax credit. We are happy to have the infrastructure on our land and proud to be part of the growing carbon management economy.

Carbon management includes carbon capture for power and industrial sectors, pipelines, geologic storage, and carbon removal. My testimony reviews important research, including the Potsdam Institute paper on the absolute need for CDR going forward, and we need gigatons. To put a gigaton in perspective, a single blue whale weighs around 146 metric tons, which means six million blue whales constitute a single gigaton, and we need multiple gigatons of both CCS and CDR from here on out.

The total summary of the research is this: the world is warming, it is warming faster, and it will continue to warm, mostly because of carbon dioxide emissions that we are putting into the air. We have no choice. We should reduce carbon emissions wherever we can, remove those that we cannot reduce, and also use carbon dioxide removal as an environmental remediation tool for legacy emissions.

Each small rise in temperature matters, and each small rise results in climate impacts getting progressively worse. The rise in temperature is having steep physical and economic impacts. Wildfires in California, hurricanes in Florida, all have resulted in hundreds of deaths and tens of billions in economic damages. Insurance has simultaneously pulled out due to this climate risk.

The U.S. is the dominant Country and driving force in carbon removal today. Corporations and countries are paying U.S. companies for carbon removal, and investors from around the world are coming to build here. This is fundamentally due to the bipartisan policy support for CDR, the commitment to cutting edge research and development coupled with an incredibly innovative private sector.

We have the policy infrastructure, like the DAC Hubs Program from the Infrastructure Investment and Jobs Act, the USE IT Act from this committee, the 45Q tax credit, and the Class VI well program. We have the early stages and the incredible potential for the physical infrastructure of carbon capture and removal technologies, pipelines, and safe, proven geologic storage. This innovation and infrastructure combination sets the United States apart. Thousands of good paying jobs are currently being created with hundreds of thousands more upon scale-up.

Carbon management brings economic development. It brings a more competitive America and a healthier environment for American citizens. This is only possible if we can permit and build fast enough. The committee should work with the Administration to make sure the USE IT Act, the White House task force delegated by the USE IT Act, continues to be a priority. Specifically, the task force needs to replace its two political appointees before it can conclude its recommendations and share it with both this committee and Congress.

We need Federal permitting clarity and efficient Federal permitting regimes for CO_2 pipelines and all forms of CDR, which are currently not sited federally, sited or permitted federally. We need authorized funds for continued research and development on driving down the costs of all use cases for carbon management technologies. We need the next phase of Federal Class VI program to reach permitting decisions on project level timelines. We need to provide lessons learned and a clear roadmap, the information EPA needs to reach decisions, on applications from States seeking Class VI primacy.

Advancements in these areas will allow the U.S. to secure domestic energy supply resource production. It will strengthen our supply chains, trade, and our national security. We have a rich history in this Country of coming together and advancing technologies to overcome the most pressing challenges, but to rise to this challenge, we need clear permitting regimes, funding, and public-private partnerships to deploy these necessary carbon management technologies.

If we do not deploy this technology, China will. China will enjoy the economic development, hundreds of thousands of jobs, and a healthier environment. America is leading the way, and the future, as always, is a policy choice. This committee has put our Country on a path to achieve American dominance in carbon management, in energy, and in a healthier environment.

Breakthrough Energy stands ready to work with you to help our Nation's carbon management policies reach their full potential. Thank you.

[The prepared statement of Mr. Cavanaugh follows:]

Testimony of:

Jack Andreasen Cavanaugh

Manager, U.S. Policy and Advocacy

Breakthrough Energy

Before the U.S. Senate Committee on Environment & Public Works

Hearing on Advancing Carbon Capture, Utilization and Sequestration Technologies and Ensuring Effective Implementation of the USE IT Act

February 12, 2025

WEB
breakthroughenergy.org

Chairman Capito, Ranking Member Whitehouse, and Members of the Committee:

Thank you for the opportunity to appear before you today to discuss the implementation of the USE IT Act and ways to advance carbon management technologies.

My name is Jack Andreasen Cavanaugh, and I oversee carbon management policy at Breakthrough Energy. Breakthrough Energy was founded to accelerate energy innovation and build the industries of the future without emissions, and we deploy for-profit investment funds, nonprofit and philanthropic programs, and policy efforts toward that mission. Innovative technologies are at the heart of our work, and carbon management practices like carbon capture and its associated infrastructure are central to reducing emissions in the industrial and power sector of our economy. In addition to its emissions reduction benefits, Breakthrough Energy also views carbon management as beneficial to the economy through the jobs it creates, the economic opportunities it provides for our communities, and its strategic benefits to American industries.

Alongside my role at Breakthrough Energy, I serve on the White House Task Force for Carbon Dioxide Capture, Utilization, and Sequestration Subcommittee for Federal Lands and Outer Continental Shelf Permitting. This Task Force was established by the USE IT Act, and it has been instrumental in convening industry experts to accelerate the rapid, efficient, and safe deployment of carbon management technologies and infrastructure across the U.S.

Not only do I work on carbon management professionally, but I also live it in my personal life. I was born and raised in Hastings, Nebraska. My family has a small farm south of town. In 2024, we agreed to allow a CO2 pipeline project that was a retrofit of an existing natural gas pipeline to cross our land. My mother, uncles and I worked with the company and fellow farmers to ensure the infrastructure was installed safely, and everyone was compensated fairly. This project would not have been possible without the 45Q tax credit, the decades of federally-funded research and development of low-carbon fuel[1], pipeline and storage technologies. This pipeline will take carbon dioxide (CO2) from bioethanol facilities and send it to Class VI wells in Wyoming for safe geologic storage. It is the perfect example of public/private partnership opportunities in carbon management, benefiting Americans.

[1] https://tallgrass.com/newsroom/press-releases/tallgrass-to-capture-and-sequester-co2-emissions-from-adm-corn-processing-complex-in-nebraska

WEB
breakthroughenergy.org

Figure 1: *Pipeline and Safety Shut Off Installation on the DGRS farm outside Glenville, Nebraska*

Climate Justification for Carbon Management

Breakthrough Energy has a mission to help deploy technologies that abate emissions because of their role as the primary driver of climate change. This mission drives Breakthrough's efforts on carbon management, and I want to briefly review some of the current climate science that helps guide that work, noting for the Committee that this is not my own research and that I am not a climate scientist.

Global temperatures have risen 1.3 C (2.34 F) since pre-industrial levels as a result of human activity, namely, the burning of hydrocarbons which contribute to the greenhouse gas effect. To put this number in perspective, the difference in global average temperature between the middle of the last ice age – 20,000 years ago – and today is around 6 C[2]. The primary driver of this warming has been carbon dioxide (CO2), but other greenhouse gases like methane, nitrous oxide, and halocarbons contribute to warming. Figure 2 below[3], from the Lead Climate Scientist for Stripe, Dr. Zeke Hausfather, shows the change in warming over time, relative to all drivers of that warming. The take-away from this figure is simple: the rate of warming has increased over the last century, and CO2 emissions have consistently been the main positive contributing factor for the rate of warming.

[2] https://news.ucar.edu/132755/scientists-nail-down-average-temperature-last-ice-age
[3] https://www.theclimatebrink.com/p/exploring-the-drivers-of-modern-global

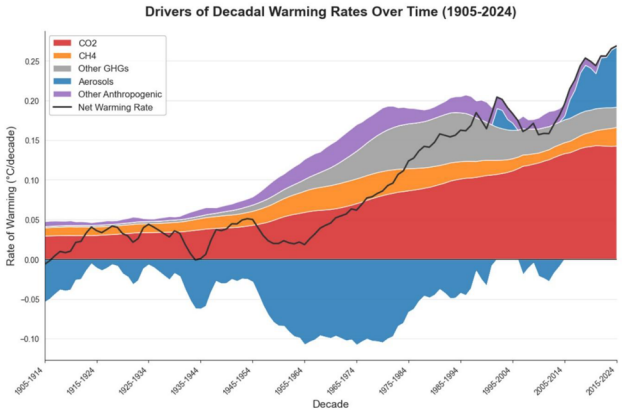


Figure 2: *Analysis of decadal warming rates (black line) as the sum of different contributing factors (colored areas) between 1905 and 2024.*

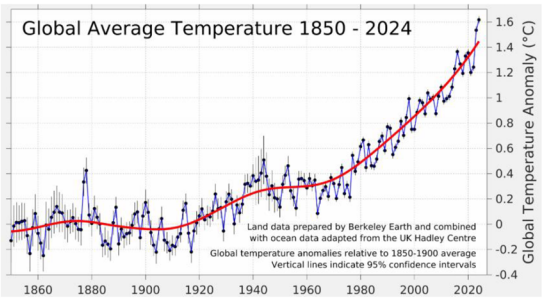


Figure 3: *Global Average Temperature anomalies, note the 1.6 C for 2024*[4]

[4] https://berkeleyearth.org/global-temperature-report-for-2024/

As the above Figure 3, from Berkeley Earth shows, in 2024, the global temperature was 1.6 C warmer than pre-industrial levels, which marks the first time, within a year, that warming passed the 1.5 C target set forth in the 2015 Paris Climate Accords. While the 2024 data does not yet mean we have exceeded 1.5 C for long term warming, each individual 0.1 C rise in temperature matters, and the climate impacts of each subsequent 0.1 C rise in temperature means climate impacts get progressively worse[5].

Today, climate impacts are already taking place with considerable impact to our economy.

Homes in Florida[6] and California[7] have become uninsurable due to increasing costs associated with natural disasters. Hurricanes and fires have caused billions of dollars in damage to each state, and in the case of California, these fires could have been mitigated not just through insurance products, but also better land management practices, building design, and urban planning.

Whether you are looking at discrete phenomena, like the passing of 1.5 C targets for 2024, long term trends, the increasing warming rate, or the effects of the warming, the climate is changing, and warming, largely due to the increased emissions of greenhouse gases, namely CO2.

And yet, we can change that trend, and narrative. We have technologies that can not only bring us a more stable, and healthy climate, but also usher in a new era of economic prosperity. Carbon capture with storage (CCS) or utilization (CCUS), and carbon dioxide removal (CDR) are two of those critical technologies. In many sectors, CCS is the best short- to medium-term solution available to eliminate emissions. Meanwhile, we know we will need carbon removal over the long run to draw down carbon already in our atmosphere.

Carbon Management's Role in Decarbonization

The world has several available technologies to decarbonize every sector of the economy. Some, like nuclear, hydro, wind, solar, and batteries, are proven and being deployed at scale today. Others remain in the lab or at demonstration-stage, being developed by groundbreaking entrepreneurs and innovators across the U.S. who are building the industries of the future. And across all of these sectors, there is a suite of technologies that fall into the bucket of "carbon management", including carbon capture both for power sector and industrial applications, as well CDR. Breakthrough Energy supports all these technologies.

A central driving theme of our organization is "Energy is prosperity"[8]. There is a direct positive correlation between energy usage and quality of life[9], and so we strongly stand on the side of those

[5] https://www.un.org/en/climatechange/science/climate-issues/degrees-matter
[6] https://www.tampabay.com/news/business/2024/06/09/florida-other-states-beg-insurers-not-drop-climate-threatened-homes/
[7] https://www.cbsnews.com/news/fires-california-palisades-fire-homeowners-insurance-state-farm-fair-losses/
[8] https://www.breakthroughenergy.org/newsroom/articles/energy-is-prosperity/#:~:text=Breakthrough%20Energy%20was%20created%20to,understand%20their%20perspectives%20and%20imperatives.

in the U.S. and around the world who want to use energy to provide a better quality of life for their families and communities. That's why our approach is centered on providing the world with the technologies that can provide energy, and the prosperity it brings, without emissions.

Power Sector Applications

With the growing electricity demand in the power sector, driven by AI innovation[10], we see a clear market signal for clean firm power[11]. Nuclear, geothermal, hydropower and natural gas with CCS are all tools we should use to satisfy this demand. West Virginia has been a leader in the installation of CCS at a new natural gas facility[12] and the state recently received conditional approval for their Class VI primacy application[13]. Carbon capture in the power sector has been progressing and natural gas CCS facilities have the technical capacity to achieve 90% capture rates[14]. It is important that natural gas facilities not only achieve this 90% capture rate but also use high-quality carbon removal for any remaining process emissions and eliminate upstream methane leakages. This ensures that the power is not only reliable, but also clean. This type of CCS technology is referred to as "post-combustion" CCS, that is the carbon is captured post combustion of the natural gas. There is another new technology to produce low carbon power, known as the Allam Cycle.

Net Power is developing a technology using the Allam Cycle, which uses oxy-combustion to produce power by burning natural gas. However, this process only produces carbon dioxide and water in a closed-loop system. The Allam Cycle has demonstrated capture rates above 93%[15] and provided it accounts for process emission and upstream leakages, it could also play a role in providing clean, firm power if it is proved at scale.

Industrial Applications

While there are several promising solutions to decrease emissions in the industrial sector, including from chemical, plastic, cement, and ammonia production, these technologies don't yet exist at scale. This stands in contrast to the electric power sector, which is replete with already-deployed low-carbon generation options. The industrial sector relies heavily on fossil fuels, not just as a power and heat source, but as an input into the industrial process itself. This is why carbon capture is so valuable for the sector, especially in the short- to medium-term while emerging

[9] https://www.researchgate.net/figure/Quality-of-Life-Indicator-against-a-Energy-consumption-per-capita-and-b-Electrical_fig1_317689456
[10] https://www.energy.gov/articles/doe-releases-new-report-evaluating-increase-electricity-demand-data-centers
[11] https://sustainability.atmeta.com/blog/2024/12/03/accelerating-the-next-wave-of-nuclear-to-power-ai-innovation/
[12] https://www.eenews.net/articles/climate-law-spurs-ccs-at-new-west-virginia-gas-plant/
[13] https://governor.wv.gov/article/governor-morrisey-and-wvdep-secretary-ward-announce-epas-approval-west-virginias-class-vi
[14] https://netl.doe.gov/sites/default/files/netl-file/24HCR_Bui.pdf
[15] https://netl.doe.gov/sites/default/files/2020-06/8-Rivers-Capital-Final-Pre-FEED-Report-Allam-Cycle-Coal-%208924331RFE000015-Public-Version-May-19.pdf

technologies mature. Many of the high-heat industrial applications, like cement, cannot achieve consistent, low-cost, high-grade heat from non-fossil technologies deployed today[16].

This asymmetry in the industrial sector necessitates a clear view in where CCS is most likely to be needed and where it is not.

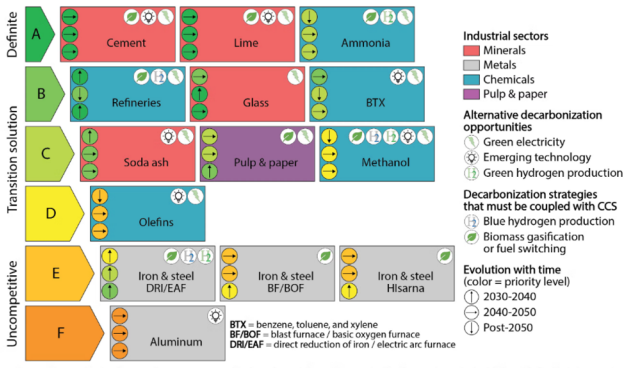


Figure 4: *Prioritization of industries for CCS adoption, "A" being the top priority and "F" the industries for which alternative decarbonization strategies may be more competitive. The ranking shown applies to today, and the evolution of that ranking is depicted by the arrows on the left-hand side of each industry box. In addition, alternative solutions for decarbonization or solutions that can be combined with CCS for increased decarbonization are shown on the top right corner of each industry box.*

Figure 4 is a U.S. CCS Ladder for Industrial Decarbonization from the University of Pennsylvania[17]. It shows where the U.S. is most likely to need CCS for decarbonization. This analysis looked at five key criteria establish a ranking from which CCS is best applied and where other decarbonization tools may take the lead:

1. CCS feasibility
2. CO2 mitigation potential
3. Alternative decarbonization technology readiness and availability
4. Potential for CCS to enable fossil-fuel or emissions-intensive technology lock-in
5. Geospatial dispersion

[16] https://www.energy.gov/eere/iedo/cement-and-concrete-manufacturing#:~:text=Ninety%20percent%20of%20emissions%20from,clinker%2C%20necessary%20in%20making%20cement.
[17] https://kleinmanenergy.upenn.edu/commentary/blog/u-s-ccs-ladder-for-industrial-decarbonization/

While CCS is not the best way to decarbonize every single industrial sector, Figure 4 clearly shows that alternative low-carbon cement production technologies are not at the scale needed today to meet current demand, so CCS is currently the best way to continue to produce cement, at scale, without the emissions. This is because cement emissions come from two sources, fuel and calcination process in the cement kiln. This means that even if we completely electrify the input energy, we will still have CO2 released during the calcination process. For those process emissions, CCS is the best pathway for decarbonization. [18]. This is true for other sectors like ammonia, which could deploy CCS and steam methane reformation (a mature technology) to capture the carbon dioxide from a natural gas feedstock, while using the hydrogen for ammonia production. Glass production uses high thermal heat, currently from fossil fuels. There are not cost-competitive alternatives to provide the thermal heat needed for glass production, and capturing the emissions with CCS is the best available pathway for decarbonization.

Carbon capture in the industrial sector not only reduces carbon emissions but also decreases local air pollution, leading to better health outcomes[19]. It will also make the U.S. more competitive in a global market that values decreasing pollution. Not only are many of these industrial products the bedrock of civilization, but they also encompass key exports for the United States economy. The U.S. is at a global disadvantage related to the trade of these materials as the relative low-carbon-intensive production of these products is not adequately priced into global markets.

Carbon Dioxide Removal

The United States is also making advances in the deployment and use of CDR. These technologies and approaches remove carbon dioxide directly from the atmosphere and range from planting trees and soil carbon management to direct air capture (DAC) systems, which remove CO2 directly from the air we breathe.

The need for CDR to decarbonize the globe, meet climate targets and draw down atmospheric carbon after decarbonization is clear.

According to a 2023 study by the Potsdam Institute[20], CDR is needed in nearly every one of the hundreds of decarbonization scenarios modeled. Furthermore, this paper states “CDR from new technologies must increase 1,300-fold by the year 2050”. This sentiment is echoed in essentially all large scale climate models, including Rhodium Group[21], Net Zero America from Princeton[22], the International Energy Agency[23], and the IPCC[24].

[18] https://www.energy.gov/sites/default/files/2023-11/Industry%20Guide%20to%20CCS%20at%20Cement%20Plants_Nov%2029%202023_0.pdf
[19] https://www.catf.us/resource/air-pollutant-reductions-carbon-capture/
[20] https://www.pik-potsdam.de/en/institute/departments/climate-economics-and-policy/mcc-archive/mcc-news-3006
[21] https://rhg.com/research/pathways-to-net-zero-us-emissions-beyond-2030/
[22] https://netzeroamerica.princeton.edu/the-report
[23] https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage/direct-air-capture
[24] https://www.ipcc.ch/report/ar6/wg3/downloads/outreach/IPCC_AR6_WGIII_Factsheet_CDR.pdf

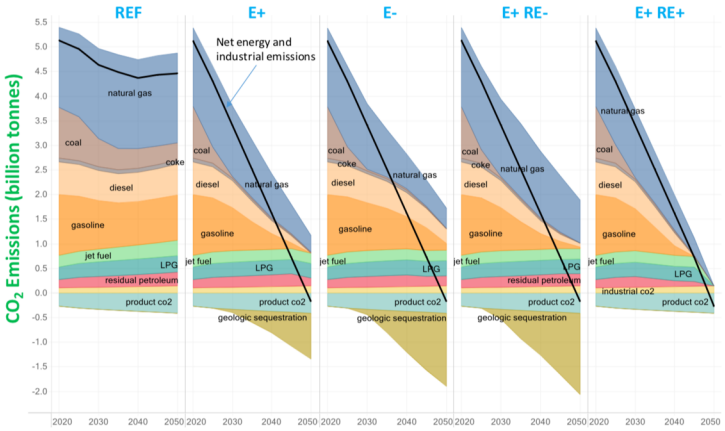


Figure 5: *Net Zero America Study CO_2 emissions for the U.S. energy and industrial system in different pathways, geologic sequestration includes CDR and CCS pathways*

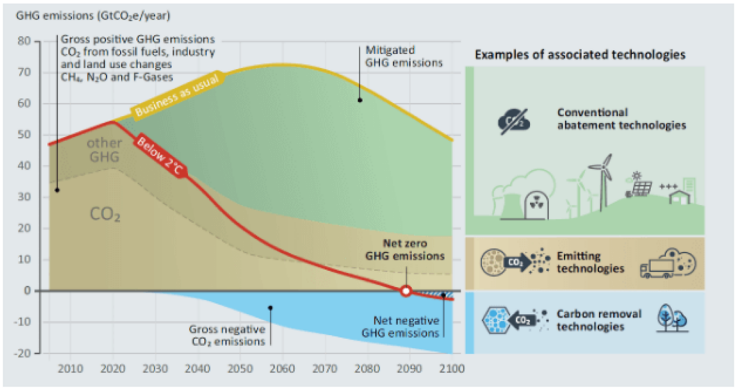
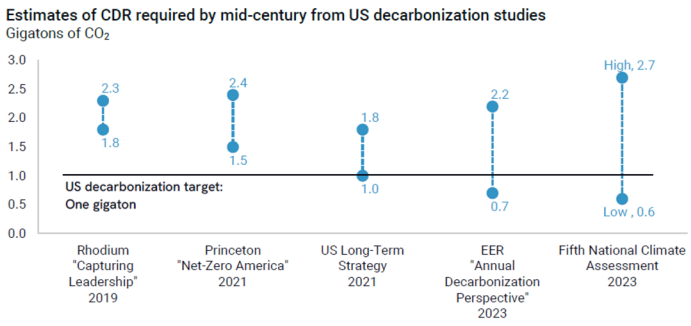


Figure 6: *UNEP 2017*



Source: Rhodium Group; Princeton University Net-Zero America: Potential Pathways, Infrastructure, and Impacts; The Long-Term Strategy of the United States: Pathways to Net-Zero Greenhouse Gas Emissions by 2050; Evolved Energy Annual Decarbonization Perspective 2023: Carbon-Neutral Pathways for the United States; The Fifth National Climate Assessment

Figure 7: *Rhodium Group Landscape of CDR and U.S. policies to Scale Solutions*

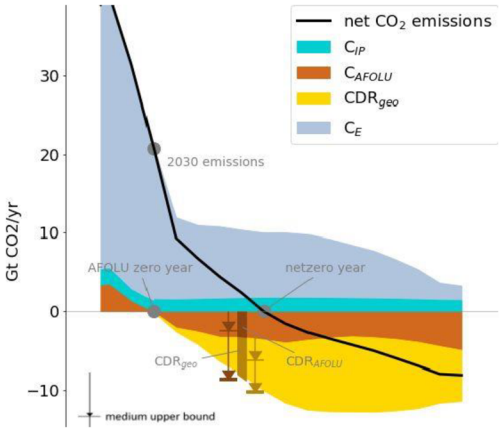


Figure 8: *Greenhouse gas emissions reduction pathways to achieve net zero. Cutout from fig.1a, Warszawski et al (2021)*

The CDR industry will need to scale up to remove gigatons of carbon from the atmosphere in the near and long term. As figure 7 shows CDR could be responsible for removing between .6-2.7 gigatons annually, just in the United States. Currently the U.S. has removed less than .01% of that total.[25]

To put all these numbers in perspective, a male African elephant weighs, at most, 6.8 metric tons, according to the San Diego Zoo. So, a gigaton is well over a hundred million African elephants. As for sea life, the blue whale can weigh as much as 146 metric tons, according to NOAA. So, a gigaton is more than 6 million blue whales[26]. And the world will need multiple gigatons of CDR, every year.

State of Play for Carbon Removal

CDR encompasses a wide swath of technologies and pathways including but not limited to afforestation, reforestation, soil carbon management, ocean alkalinity enhancement, enhanced rock weathering, biomass energy CCS, biomass burial, bio oil injection, biochar, ex-situ mineralization, in-situ mineralization and DAC paired with geologic storage of CO2.

Each of these pathways is at a different technological readiness level, which correlates to their ability to deploy at scale. Many biomass pathways are actively deploying projects across the US, from California, to Colorado, to Arkansas. Enhanced Rock Weathering (ERW)[27] is the process of taking minerals like olivine and spreading them on agricultural lands. Over time these minerals interact with water and bind CO2 from the atmosphere in the form of carbonates. This effectively removes the CO2 permanently as the carbon is now back in a solid form. ERW is undergoing trials in places like Illinois which will not only remove carbon, but could also increase crop yields, and decrease the need for fertilizer across the Midwest and Great Plains.

Each CDR pathway that is deploying projects, and selling carbon credits should be held to rigorous standards. For nearly all CDR pathways (except for DAC) there is not an overarching regulatory regime enforceable by the government.

These challenges are currently being addressed both by governments, with the EU and its carbon removal certification framework, the U.S. Department of the Treasury Released a Joint Policy Statement and Principles on Voluntary Carbon Markets[28], and the work of NGOs like the Carbon Removal Standards Initiative[29] which ensures rigor and accountability in the CDR sector through the uniquely powerful mechanism of regulatory standards.

[25] https://www.cdr.fyi/
[26] https://www.washingtonpost.com/news/energy-environment/wp/2015/07/01/meet-the-gigaton-the-huge-unit-that-scientists-use-to-track-planetary-change/
[27] https://climate.mit.edu/explainers/enhanced-rock-weathering
[28] https://home.treasury.gov/news/press-releases/jy2372
[29] https://www.carbonremovalstandards.org/

Regardless of the stage of development of each technology we must ensure that carbon removal has some key characteristics as outlined by the Carbon Removal Alliance[30]:

1. Permanent – The carbon that is removed must stay securely removed for as long as possible, ideally on a geologic time scale.
2. Net-negative – All carbon removal technologies will result in some emissions throughout their value chain. We must ensure accurate life cycle analysis are done to enumerate the net amount of carbon that is removed.
3. Additional – Each project must demonstrably result in carbon removal that would not have otherwise occurred without the project existing, ensuring an actualized impact on the climate.
4. Verifiable – Projects must be able to clearly monitor, measure, report and verify all claims they are making relative to the carbon being removed. This verification should be audited by disinterested third parties both before, during and after the project.
5. Co-benefits – Carbon removal can deliver a wide range of benefits to local communities and ecosystems. Projects should strive to provide clear benefits to communities, and minimize risks.

The Committee should work across federal agencies to ensure that no matter the CDR pathway, all projects done in the United States are held to the highest standards and best practices outlined above. This is already taking place with DAC.

DAC stands out, especially in the United States[31]. Due to legislation in the Bipartisan Infrastructure Law, billions were made available to DAC to build out large scale, one-million-ton-per-year facilities, across the country. This program coupled with the 45Q tax credit has made the United States the preeminent location to build DAC. Companies and investment from across the globe are coming to the United States to build DAC. Due to the strong public/private bipartisan partnerships, the DAC industry has grown from an idea on a piece of paper, more than a decade ago, to billions in investments from major financial institutions, venture capital and project financing.

A straightforward example of this is the Cypress Project in Louisiana. Climeworks, one of the original DAC companies from Switzerland, has partnered with Breakthrough Energy Ventures portfolio company Heirloom, a DAC company born out of research at University of Pennsylvania and developed in San Francisco, to build a DAC hub facility. They have partnered with Battelle to build a first-of-a-kind integrated project, that will bring up to 1,000 jobs and economic development[32] to the community, and carbon out of the air.

DAC also creates a pathway for existing expertise in the oil and gas industry. Oil and gas workers and companies have deep technical knowledge on fluid dynamic systems both surface and subsurface, alongside their project development capacity. Given that DAC is a large, complex fluid dynamic system from capture to storage, it is a natural complement to the oil and gas skill set and presents a compelling strategic opportunity for the industry. Further, it presents competitive

[30] https://www.carbonremovalalliance.org/
[31] https://www.breakthroughenergy.org/newsroom/articles/direct-air-capture/
[32] https://www.heirloomcarbon.com/news/two-direct-air-capture-facilities-in-northwest-louisiana

advantages to oil and gas companies operating within global markets to offer energy products with lower carbon intensity.

This is no better exemplified than the purchase of Carbon Engineering[33], one of the first DAC companies, by Occidental Petroleum. This commitment from Oxy, and the subsequent investment by Blackrock into their Stratos facility[34] in West Texas shows that the technology not only has pollution implications, but also economic ones. The movement of multinational corporations into the space signifies the maturity of the technology, and the long-term opportunity it holds.

Direct Air Capture and the Underground Injection Control Program

DAC is unique in the carbon removal space, in that every ton of CO2 removed from the air, wouldn't have been removed otherwise, meaning it is, by definition, additional. Once removed, CO2 is pumped thousands of feet underground and regulations under the Environmental Protection Agency's (EPA's) Underground Injection Control Program. That program, which governs Class VI and Class II wells, must ensure the CO2 remains underground permanently, and that the success of the capture is verifiable.

Class VI wells

The Class VI program was introduced in 2010 as a permanent solution for carbon storage. It was developed to protect drinking water under the Safe Drinking Water Act and is managed by the EPA. The U.S. has world class CO2 storage resources due to decades of research at the Department of Energy, state Geologic Surveys and educational institutions, and oil and gas exploration. Early pioneers in carbon storage like Dr. Julio Friedman, Dr. Sally Benson, Dr. Sallie Greenberg, Dr. Sue Hovorka, John Rupp, Dr. Sarah Forbes, Dr. George Guthrie and Dr. Roger Aines carried out these research programs before the 45Q tax credit, and created the bedrock of knowledge that culminated in the Class VI program and underpins the incredible safety record of CO2 storage. Carbon storage is safe, proven and effective, we have stored over 300 million tons of carbon underground since the 1990s with no major leaks or contamination of groundwater.

Prior to 2023, only two federal Class VI permits had ever been issued, both to a first-of-a-kind storage project in Illinois at the Archer Daniels Midland facility. The Class VI program has recently received a large influx of applications due to the programs in the Bipartisan Infrastructure Law and amendments to 45Q. The EPA has a number of tools they can use to hasten the review period of Class VI permits, first being the granting of Class VI primacy to states.

Most states have "primacy" over one of the six well classes in the UIC. Primacy simply means that the state carries out the responsibilities and regulations required for a well class, rather than the

[33] https://www.oxy.com/news/news-releases/occidental-enters-into-agreement-to-acquire-direct-air-capture-technology-innovator-carbon-engineering/
[34] https://www.oxy.com/news/news-releases/occidental-and-blackrock-form-joint-venture-to-develop-stratos-the-worlds-largest-direct-air-capture-plant/

regional or federal EPA. North Dakota (April 24, 2018), Wyoming (September 3, 2020) and more recently Louisiana (February 5, 2024) have received primacy over their Class VI wells, and West Virginia has received conditional approval.

Though EPA has accelerated both the pace of its own Class VI permitting and approved more state primacy applications, the agency could do more to make sure the program moves forward efficiently.

For states submitting primacy applications, EPA should create a pre-application checklist of required information with a pre-application meeting to ensure that once an application is submitted, it is complete. This can shorten review times and decrease the use of federal resources. In addition, upon acceptance, the federal government should provide resources like technical assistance and training, initial funding to help staffing, access to the national labs and their staff, and data transparency related to the proper creation, maintenance, and on-going administration of their Class VI program to ensure the Class VI state program maintains the safety of drinking water and prevents re-release to the atmosphere.

For those wells where EPA remains the regulatory agency and issues the permit, the agency should seek to allocate resources like technical expertise, funding, and use of geophysical sensing/monitoring equipment to the regions with the most Class VI applications and storage potential.

Class VI wells can also be deployed on federal lands and waters. While these programs are not in the direct jurisdiction of the EPW Committee, the Department of the Interior and the Bureau of Ocean Energy Management should issue regulations governing the injection of carbon dioxide into federally owned pore space and allow for the pre-permitting of reservoirs.

Although carbon storage is safe, proven, and effective, the Class VI program remains a major choke point for carbon management. Class VI permits have been a mitigating factor in the country's ability to deploy CCS, as companies wait for the permits to be issued. We can change this within the current legal and regulatory framework.

USE IT Act and Recommendations for Addressing Infrastructure Challenges

The USE IT Act is a valuable tool to help foster and coordinate the deployment of CCS and CDR at scale, decrease permitting times and provide the best recommendations on best practices to the entire carbon management sector.

The White House Task Force was fully appointed in the spring of 2024, and last met in December. As the Task Force has not yet finalized its recommendations, I cannot speak to specific content, but we are focused on the duties outlined in the Act. Our recommendations are intended to address real-world challenges associated with permitting on federal lands, based on practical experience. We are focused on actionable recommendations that can be executed immediately. And the Committee should wait to receive and review them thoroughly.

There are a few suggestions I would make to the Committee regarding the USE IT Act based on my own personal work on the Task Force and the conversations I have had with industry, communities, NGOs, and people in the carbon management policy area.

First, the Committee should direct the Council on Environmental Quality (CEQ) to establish guidance to assist project developers and operators of CCUS facilities and CO2 pipelines. The statute required the issuance of such guidance. This guidance should be informed by the Task Force on CCUS, as well as consultation with broader industry, NGO, and the public. This guidance should provide information to all parties on the best practices to deploy CCUS, including CO2 pipelines, efficiently and with concern for the local environment.

Second, the Committee should work with the Administration to ensure that Task Force work at the relevant agencies is funded, the Task Force is regularly convened and remains a priority, its work concludes on a timely basis and is disseminated and adopted.

Third, the Committee should authorize additional federal support for research and development across the carbon management portfolio. Priorities should include the continued advancement and development of our geologic storage resources, both in sedimentary basins and mineral reservoirs. The Committee should also prioritize funds for research on all forms of carbon removal including, enhanced rock weathering, ocean and biomass pathways. These pathways do not receive the same amount of policy support as DAC (45Q), but critical to achieving gigaton scale carbon removal. These additional authorized funds should also be used to continue driving down the cost of carbon capture, on both power sector and industrial applications with a priority given to the highest and most valuable use cases (i.e. cement, ammonia). Finally, these funds should also go to decreasing the energy usage and efficiency of DAC, focusing on the material development of solvents and sorbents used in the removal process.

Finally, we need permitting clarity on a number of key carbon management technologies. CO2 pipelines currently do not have a federal siting or permitting authority. This is causing critical infrastructure delays in its deployment as inter-state pipelines are difficult to build[35] without a federal authority. The Committee should act on the USE IT Act to clarify which CCUS projects and pipelines are eligible for permitting via the FAST Act, and designate pipeline corridors and/or critical pathway pipelines projects that are of the highest value for the decarbonization of industry/power and to drive down commercial costs associated with the deployment of CCS. The Committee should work across the government and agencies to create permitting regimes for forms of CDR that do not include geologic storage. These permitting regimes currently do not exist, or were not intended to be used for CDR. This will provide clarity to project developers and the industry as a whole, and increase deployment times.

[35] https://www.spglobal.com/commodity-insights/en/news-research/blog/energy-transition/102523-navigator-co2-carbon-capture-heartland-greenway-pipeline-cancellation

Conclusion

Today, America is leading the world in advancing carbon management and removal technologies. We have done it with quality research and development programs spanning across the federal agencies, to the national labs, research institutions and private actors. We have done it with bipartisan support for incentivizing the deployment of that research to scale up the technology. We have done it through the work of thousands of brilliant entrepreneurs. And we are seeing the early benefits of that work, as hundreds of thousands of new jobs[36] are to be expected as the CDR industry grows.

But we cannot rest on our laurels, we cannot be complacent in our leadership, and we cannot allow others to take the lead on this valuable set of technologies. If companies cannot make it work in the United States, they will go elsewhere, and the investments, economic development, and jobs will go with them. We are building it here. We can scale it here. And we should deploy it across the world. We can lead. We can, and we must.

[36] https://rhg.com/research/the-benefits-of-innovation-an-assessment-of-the-economic-opportunities-of-highly-durable-carbon-dioxide-removal/

Senate Committee on Environment and Public Works
Hearing Entitled, *"Advancing Carbon Capture, Utilization and Sequestration Technologies and Ensuring Effective Implementation of the USE IT Act."*
February 12, 2025
Questions for the Record for Mr. Jack Cavanaugh

Senator Markey:

1. Mr. Cavanaugh, a recent peer-reviewed study from Stanford published in Environmental Science & Technology compares the costs, emissions, and energy use of Carbon Capture, Utilization and Sequestration (CCUS)-based decarbonization strategies with direct renewable deployment. The analysis finds that for every dollar spent on CCUS instead of wind, solar, or electrification, total energy consumption, emissions, and social costs increase rather than decrease. In short, there is a large energy penalty when using renewables (i.e. wind, water, and solar) to power carbon capture, as it diverts clean energy away from directly replacing fossil fuels. Additionally, CCUS applied to fossil generation increases total energy consumption due to capture inefficiencies, meaning more fuel is required to maintain output.

   The accompanying graph illustrates this disparity, comparing four global decarbonization pathways—Business-As-Usual (BAU), BAU with Carbon Capture (CC), BAU with CC and Renewables (BAU-CC-WWS), and 100% Wind-Water-Solar (WWS). It shows that CCUS not only increases energy demand due to capture inefficiencies but also results in higher net CO2 emissions and total social costs compared to directly replacing fossil fuels with renewables. This analysis further highlights that even with CCUS, air pollution deaths remain significant, whereas a full transition to renewables eliminates them.

   Given the findings in the recent study, as well as advancements in energy storage and progress towards more comprehensive transmission planning, how does continued investment in CCUS compare to efforts prioritizing renewables that can yield greater emissions reductions with lower costs and energy penalties?

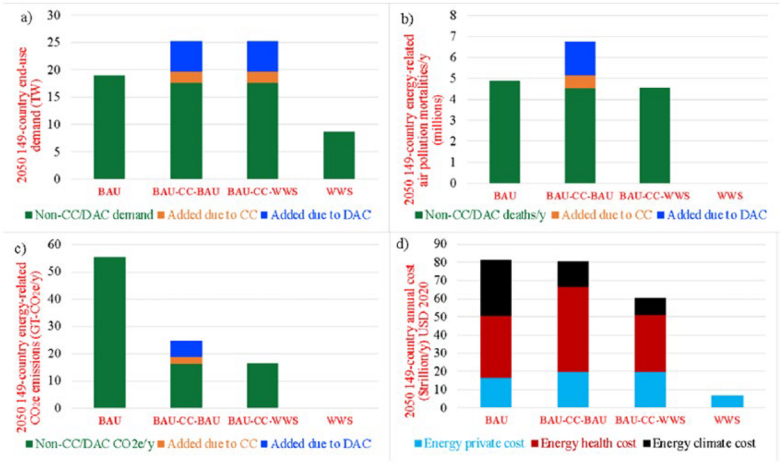


Figure: (a) 2050 annually averaged end-use demand across 149 countries under four scenarios: Business-As-Usual (BAU), BAU with Carbon Capture (BAU-CC-BAU), BAU with CC and Renewables (BAU-CC-WWS), and 100% Wind-Water-Solar (WWS). BAU-CC-BAU and BAU-CC-WWS include a 6.74% efficiency improvement, but CC and DAC introduce additional energy demand: 25% energy penalty (968.7 kWh/ton CO2) for CC and 77.4% (3,000 kWh/ton CO2) for DAC. (b) 2050 annual energy-related air pollution deaths. BAU results in 5.4 million deaths per year. WWS eliminates these deaths, while BAU-CC-BAU and BAU-CC-WWS *increase* deaths due to CC/DAC energy penalties: 25% from point sources, 77.4% from nonpoint sources. (c) 2050 energy-related CO2e emissions. CC captures 80% of CO2 from point sources, but energy penalties offset reductions. BAU-CC-WWS avoids added emissions from CC/DAC by using WWS electricity. (d) 2050 annual social energy cost, including private energy, health, and climate costs. BAU-CC-BAU and BAU-CC-WWS include capture costs: $100/ton CO2 for CC, $150/ton CO2 for DAC, and increased health costs from air pollution. WWS eliminates these additional costs. Source: Jacobson et. al, *Energy, Health, and Climate Costs of Carbon-Capture and Direct-Air-Capture versus 100%-Wind-Water-Solar Climate Policies in 149 Countries,* Environmental Science & Technology 2025 59 (6), 3034-3045 (Available online here)

Breakthrough Energy has not conducted any modelling similar to that conducted by the Stanford author of this study. In Breakthrough Energy's work monitoring the deployment of CCUS/DAC as well as other technologies, we have not observed the investment game be zero sum, such that a dollar spent on CCUS/DAC does not mean it is taken from renewables. We have focused on the use of these technologies to address emissions in the industrial sector that renewables cannot decarbonize, such as the process emissions

associated with cement. We can and are deploying a wide suite of technologies to remain competitive and decarbonize our economy. Those technologies vary widely by sector and application. In some cases, they will be renewables, in some CCUS/DAC, and in others technologies like thermal batteries and nuclear.

2. CCUS systems require substantial energy to operate, reducing net emissions savings. Direct Air Capture (DAC), for example, can consume up to 75% of the energy it removes. Even point-source CCUS retrofits on fossil fuel plants require 20–30% of the plant's output just to power the capture system. This means that, rather than displacing fossil fuel use, CCUS demands additional energy inputs, often sourced from fossil generation. How do you account for the energy penalty associated with CCUS, and can you provide a sector where the energy tradeoff of capture and storage is more efficient than simply replacing fossil energy with direct electrification?

Cement, and specifically the process-level emissions associated with cement production, cannot be decarbonized by replacing fossil fuels with direct electrification. Carbon capture with storage is the most efficient pathway for decarbonization in that sector today[1]. However this could change in the future as different non-fossil fuel technologies mature.

   a. Given the inefficiencies demonstrated in multiple studies, do you agree that CCUS increases total energy demand, requiring more infrastructure investment to achieve the same emissions reductions as renewables?

CCUS requires energy to operate, and, therefore, contributes to the demand for energy. Currently, however, the technology lags behind data center demand, cryptocurrency, and mining through 2050 according to the Department of Energy's long-term load forecasting[2]. We need abundant clean energy to decarbonize, and infrastructure build out (like transmission) is necessary for all the energy demand.

3. CCUS has historically been developed for Enhanced Oil Recovery (EOR), not climate mitigation. According to the Global CCS Institute, 82% of CO2 captured worldwide is used to extract more oil, a process that ultimately results in more net CO2 emissions than if the CO2 were never captured in the first place. Critics argue that CCUS serves as a social license for continued fossil fuel expansion, rather than a genuine decarbonization tool. Given the long-standing reliance of CCUS on EOR, what guarantees exist that government subsidies for CCUS will not primarily benefit oil and gas expansion rather than permanent storage?

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[1] Leeson, Duncan, et al. "A Techno-economic analysis and systematic review of carbon capture and storage (CCS) applied to the iron and steel, cement, oil refining and pulp and paper industries, as well as other high purity sources." *International Journal of Greenhouse Gas Control* 61 (2017): 71-84.

[2] https://www.csis.org/analysis/strategic-perspectives-us-electric-demand-growth

The fate of captured carbon is a matter of policy. Whether or not a CCS facility decides to permanently sequester the carbon or use it for enhanced oil recovery is influenced by the price of oil, the cost of capture, and the different credit rates for 45Q. In fact, the Petra Nova CCS facility shut down due to low costs of oil[3]. If the incentives and policies for permanent sequestration are greater than EOR, we will see more carbon permanently sequestered and less carbon used for EOR.

a. Can you provide examples of large-scale CCUS projects that do not use EOR and have demonstrated successful long-term sequestration at the scale required for meaningful climate mitigation?

The Slepiner project in Norway has successfully stored tens of millions CO2 for over three decades[4]. The use of EOR instead of dedicated storage is because of incentives/policy. If we chose to more heavily incentivize storage, more projects would choose dedicated storage instead of EOR.

Senator Blunt Rochester:

1. Mr. Cavanaugh, can you also speak to groundwater contamination from Class VI wells and the ways we need to protect communities from it?

The Class VI program at EPA was designed to ensure the protection of drinking water and comply with the requirements of the Safe Drinking Water Act. The best way to ensure protection against groundwater contamination is for the EPA, and the states with Class VI primacy, to have the resources they need to administer the program.

2. Mr. Cavanaugh, are there any gaps in the current regulatory framework governing the development and permitting of carbon capture projects that need to be addressed to better protect communities?

Whether it is federally owned or private pore space, we must ensure we have a full, robust legal and regulatory regime for storing CO2 in the subsurface. This includes, but is not limited to, establishing clear pore space ownership and right of way designations, subsurface trespass laws and long-term stewardship with indemnification backstops. These regulation is being done adhoc by the DOI and BOEM currently, but an Act of Congress make these permanent requirements. Some states have such policies in place, but all should have them in place to ensure safety.

3. Can you explain how the US government can continue to support the development and deployment of new technologies that enable the decarbonization of traditional, critical industries, and access to testing and CO2 delivery infrastructure to scale?

[3] https://carbonherald.com/petra-nova-carbon-capture-and-utilization-project-back-online/#:~:text=It%20was%20shut%20down%20in,assumption%20they%20would%20not%20drop.
[4] https://www.sciencedirect.com/science/article/pii/S1876610211008204

We must invest in research, development and deployment of capture, transport, utilization and storage across all sectors of the economy. This means full funding at DOE, EPA, PHMSA, BOEM, DOI and all responsible agencies. The US should find ways to monetize the clean product advantage in global markets. This will not only incentivize deployments of CCUS but also other critical technologies like geothermal and nuclear which can keep the US competitive, and decarbonize our economy.

4. Mr. Cavanaugh, what are the risks or opportunities in integrating into our economy CO2 utilization products, such as CO2 cured cement or CO2 derived electrofuels?

5. **In order for utilization technologies to deploy, we need a robust RD&D program to drive down the costs, and we need markets that value CO2 derived products, and products with a lower overall carbon footprint. This has historically been done with 45Q but it is insufficient to drive long-term adoption. The cost of capture, and conversion of that carbon dioxide into a product or fuel is generally too high compared to storage or EOR[5].**

    a. Many of these technologies require significant power sources to produce. Are we doing enough to ensure this energy is coming from green sources?

We will need cheap, clean, abundant power from all sources to power the decarbonization of the economy, and to keep the United States a leader in technological innovation. Our most pressing issue is the lack of ability to permit energy projects quickly, most notably, the large transmission lines that will carry electrons to all the valuable end uses.

6. Mr. Cavanaugh, Delaware has a number of chemical and agricultural businesses tackling carbon capture, utilization, and sequestration technologies (CCUS) with many small but capturable CO2 sources. How can we better incentivize those businesses to capture their CO2 streams?

Companies will make a decision to decarbonize when it makes financial sense. To incentivize those actions we can either support the deployment of decarbonization technologies (tax credits, grants etc.) or regulate emissions (carbon border adjustments, pollution pricing). Once the incentives or regulations for decarbonizing are aligned with the business case, these companies will decarbonize.

We should ensure policies in the United States are seeking to align business interests with decarbonization, in a tech neutral fashion.

7. Mr. Cavanaugh, the Inflation Reduction Act provided a significant investment into the 48C tax credit program for clean energy, critical materials, and greenhouse gas reduction technologies. How could disruptions to this program, such as a disbursement pause or removal, impact the development of CCUS technology and certification of planned projects?

[5] https://onlinelibrary.wiley.com/doi/full/10.1002/ente.201600747

Disruptions to revenue streams associated with projects, including tax credits, will delay and potentially make the projects no longer viable due to the cost of capital associated with delays.

Regardless of the tax credit or projects, delays will negatively impact deployments.

Senator CAPITO. Thank you. Very good.

I am going to refer my time to Senator Husted. He has to leave. As we know, there are several committee meetings going on at the same time here, so there will be a lot of in-and-out, but go ahead, Senator.

Senator HUSTED. Thank you very much, Chairwoman Capito, for arranging the hearing and giving me chance to ask a couple of questions.

It is, my background, Ohio, the State I represent, has a large oil and gas shale play in the Utica Shale Basin. I have spent a lot of time at the State level working with our EPA on injection wells and the primacy issues that we have at the State level.

I really have been impressed at how the people who work in this area in our State really understand the unique nature of how things happen in our State, what the geology is, what the history of these regulations are. I am a big fan of primacy in general and am interested in learning more about how we do this for carbon sequestration for Class VI primacy.

Dr. Yates, just give us, give me some perspective on how States are better suited to do this. My belief is that they are better suited to handle primacy. I just want to hear your thoughts on my conclusions, and if you agree with that, or if you have advice to the contrary.

Mr. YATES. Thank you, Senator, for that question. We do quite a lot of work with Ohio. Both Ohio EPA and Ohio DNR are very involved with our organization on UIC, and you are right, very knowledgeable and conscientious staff that do really, really good work, and our leaders and our organization.

You are right. States are best suited; they are better suited. One of the reasons is just a simple numbers game. Rather than one agency trying to manage wells for multiple States, having staff in your State have management authority over the wells in your State.

Then I think another important piece is just the overwhelming amount of knowledge that State staff have about the operations in their State: previous UIC projects, access to data on those non-Class VI UIC, those other well classes, the ability to engage with their State geologic surveys and understanding the history. They have more staff that can focus, and they have better access to data information to make these management decisions to approve wells. Thank you.

Senator HUSTED. Thank you.

Just to followup with that, if I could, Madam Chair, it is, the EPA, the States have, for example, in Ohio, we have primacy in everything except for these Class VI wells, and so it works, it has worked. It has worked successfully.

Tell me what lessons are there? If I were to talk with our State regulators in this, what lessons have we learned that they should know regarding underground injection for carbon capture and as we prepare to look at this Class VI provision for States to have the primacy? What is it that you have learned that is applicable, that everybody should know?

Mr. YATES. One of the things that we have learned over time managing the UIC program, both in Ohio and nationwide, are the

existing geologic plays that exist that can hold this carbon, so we have that data. We know a lot about the underlying geology because of both the Class II program, which is injecting produced water from oil and gas, and then also using CO_2 for enhanced recovery.

We have got experience, actually, injecting CO_2 through the Class II program, and then we have, at the Ohio EPA and at other State agencies, additional deep geology experience and understanding from the Class I program that injects other types of wastes for, again, long-term storage. We just have a wealth of information among these State agency staffs on how UIC works, where the successes have been, where the challenges have been, and even specifically with CO_2 injection that is outside the Class VI program.

Senator HUSTED. Thank you very much.

Senator CAPITO. Senator Whitehouse?

Senator WHITEHOUSE. Thank you very much, Chairman.

Mr. Cavanaugh, the new Director of the Department of Energy's Loan Programs Office has stated that he is exploring canceling existing already approved loans. This could affect $69 billion in issued loans and loan guarantees and $41 billion in conditional commitments, including a billion-dollar conditional commitment to Monolith for a carbon utilization project in Nebraska.

How would cancellation of these loans and the continuing freeze in related Federal grants and loans hinder the development of U.S. domestic CCUS?

Mr. CAVANAUGH. Thank you for the question, Senator. We support, and I think it is important that all government spending and taxpayer dollars are spent efficiently. Freeze on funding on things like guaranteed loan and, specifically with this project in Monolith, would undoubtedly hamper the project's ability to deploy, and very likely would render the project to unable to come to a final investment decision, and end up becoming operational.

Public-private partnership, investment from private industry, especially in the carbon management sector, is not just dependent on the innovation that they are bringing forward, but also with the firm support of the Federal Government and programs like the LPO, the Direct Air Capture Hubs.

To put it succinctly, with a freeze, with a delay in these funds, the likelihood that these projects reach full operation is incredibly dubious.

Senator WHITEHOUSE. There has been reliance, both by private parties and States, on these loans and commitments, correct?

Mr. CAVANAUGH. That is correct.

Senator WHITEHOUSE. The other topic I wanted to touch on with you is what I see as fossil fuel industry's split personality around carbon capture. When the industry wants to reassure everyone that it is safe to continue to pollute, they trot out carbon capture as the rhetorical vehicle for excusing continuing to pollute.

When it actually comes to putting money into a carbon capture project on a plant or accepting an EPA power plant reg that implements that, they do not spend the money, and they claim that the thing they said is the answer is actually not feasible.

Any comments on how we works our way through that split personality problem?

Mr. CAVANAUGH. Yes, thank you for the question, Senator. I think, first and foremost, when you are looking at these oil and gas companies, these are publicly traded companies, and in their investor decks, it is actually very clear to be able to see who is deploying billions of dollars on actually putting steel in the ground on projects, and who is spending——

Senator WHITEHOUSE. The Good actors.

Mr. CAVANAUGH. Sorry?

Senator WHITEHOUSE. The good actors.

Mr. CAVANAUGH. The good actors, and who is spending millions of dollars on marketing campaigns.

Second, outside of this public transparency, we also have strong regulatory regimes in the United States, on like the Class VI Well Program, like PHMSA, with CO_2 pipelines, to ensure that when they do deploy these technologies, they are done in a safe manner.

Finally, I think it is important to note that the oil and gas industry does have an incredible overlap and work force relative to the deployment of some of these technologies. In particular, direct air capture has a massive work force development piece there, where you are not only relying on the expertise, especially on the transportation of CO_2 and injection into the subsurface that you already have within these companies, but you are also then recruiting new folks into climate technology.

Senator WHITEHOUSE. I think it is important to note the discrepancy between what significant segments of the industry say about carbon capture and what they actually do about it when it comes to either their wallets or the regulatory environment that they operate in.

Let me ask, my time is short, so if you do not mind, Mr. Connors and Mr. Yates, I will ask these questions for the record so you have time to respond in writing.

For Mr. Connors, my question is how U.S. Federal agencies can improve coordination with State and local governments, both on CCUS and CO_2 transportation permitting. As the Chairman and I have both announced, we are hoping to work together on rekindling permitting reform here and with the Energy Committee. so this could be very helpful to us in that effort, if you would respond to that.

Mr. Yates, with respect to Class VI well permitting, how can the current approach be streamlined or improved to expedite project development and deployment while maintaining real safeguards for drinking water? If you can get back to us on that, I think your answers would be very helpful to our permitting reform effort. Thank you for being here today.

Thank you, Chairman. Now, I am off to the Budget Committee.

Senator CAPITO. I know that will be fun for you.

I mentioned in my opening statement that the USE IT Act was signed in 2020. I also alluded to the two CCUS permitting task forces that had been established, one for Federal lands and one for non-Federal lands. I am interested to know.

I am going to start with you, Mr. Connors, and then I am going to go to you, Mr. Cavanaugh, because you are on one of the com-

mittees, I believe. Now that these task forces have been chartered and are operating, do you believe that will make an impact on identifying opportunities to improve the permitting through these task forces as the law requires? What is your opinion of the two committees now that are moving forward, and is that going to be as helpful as we would hope?

Mr. CONNORS. Chairman Capito, I am confident today, you mentioned it was a slow start to get these task forces established, but starting really in this summer, but in the fall, and as of recently, I have actually been given the opportunity to lead the authorizing of a section focused on permitting.

A lot of the information that we have talked about today in terms of Class VI permitting and reforms will be within that report, so I actually have a lot of confidence that the report will be helpful to this committee and the other committees.

Senator CAPITO. Does that report go to these two task forces? I mean, that is required by the law, the report?

Mr. CONNORS. Correct. The task forces are tasked with preparing guidance for this Senate committee, Senate Energy and Commerce, House of Representatives Committees for Natural Resources and Transportation Infrastructure, and the guidance is being prepared by both task forces to identify permitting and other challenges, and then ultimately making key recommendations to improve permitting process and promote the efficient, orderly, and responsible development of specifically CO_2 Class VI permitting.

Senator CAPITO. Right, good.

Mr. Cavanaugh, what is your perspective on this, your view as a member of the Federal lands permitting task force?

Mr. CAVANAUGH. Thank you, Chairman Capito.

Yes, I share similar sentiments to Mr. Connor's. The Task Force on Federal Lands is working to provide recommendations that are not only an amalgamation of the total experience in the room, which includes both industry, public policy experts, as well as folks from communities that will be receiving CCUS technologies, but also working across a number of different agencies on Federal lands and the outer continental shelf. You are not only dealing with the Department of Interior, but also BOEM, as well.

Our recommendations will take into account the total information that we have from everyone, and we will also be actionable in the near term.

The one thing that I do want to stress, and this came from the gentleman who is leading my task force on the Federal lands, is we need to replace the new political appointees before we are able to conclude the task force and give recommendations to you and to Congress. Thank you.

Senator CAPITO. have not, thank you. Mr. Connors, you mentioned that there are nine projects in North Dakota, is that correct, that have been permitted?

Mr. CONNORS. Yes, that is correct.

Senator CAPITO. Could you just kind of, really quickly, so that I can understand, because I think somebody mentioned it. I can not remember which one, that some projects are easier than others to permit. Could you tell me what those nine projects, generally, are

they natural gas plants, are they ethanol plants? What are they, industrial?

Mr. CONNORS. Chairman Capito, there are a variety of industrial sources. The first project that was permitted was a single ethanol plant that is sitting right on top of ideal geology.

Senator CAPITO. have not, so they have their well right there.

Mr. CONNORS. They have been operating since June 2022.

Senator CAPITO. have not.

Mr. CONNORS. There is also another ethanol plant, again, sitting on top of ideal geology, and that was also permitted. These were, in terms of scale, 180,000 to 200,000 metric tons of CO_2 are being captured and injected on an annual basis.

There is a third project that is operating that is co-located with the Great Plains Synfuels Plant is through, CO_2 is being captured through the coal gasification process, and they are storing CO_2 right there onsite. They are also capturing that CO_2 stream and transporting it via 205-mile pipeline to southern Saskatchewan for enhanced recovery, and they have been doing that since 2000.

There are also permits that have been issued for CO_2 capture and storage for the Milton R. Young Station, and currently that is operated by Minnkota Power Cooperative, and they are currently working on determining their final investment decision for that carbon capture project.

The latest project that has been approved is the Summit Carbon Solutions Project, and that is three large storage units that have been permitted in North Dakota, there.

Senator CAPITO. What is that, is that a power generator?

Mr. CONNORS. Summit has aggregated, I believe it is over 50 ethanol and other biofuels facilities in the corn belt in Iowa, southern Minnesota, eastern Nebraska, and eastern South Dakota, and North Dakota with intents to construct a network of pipelines to bring that CO_2 to western North Dakota.

Senator CAPITO. have not. Well, I would just say, I think that is very interesting, because I think part of what the Ranking Member was alluding to that certain types of projects have not really been able to move forward with the Class VI for whatever reason, but you did line out what those reasons are: cost of the retrofit, CO_2 pipeline permitting, and then the long lead times, which has led to probably some confusions. If the political appointees can be going forward and confirmed, that might alleviate some of the long lead time issues.

Senator Cramer?

Senator CRAMER. I feel like my work is done. This is really great, actually.

[Laughter.]

Senator CRAMER. Along the same theme, and maybe, Mr. Connors, you could just help us. How was it that North Dakota was first? When I think of the small number of resources we had, now, we have a long history, as you have just pointed out, we have been capturing and piping and utilizing CO_2 for 25 years. We were doing it way before it was cool.

Other than that, what is it that put North Dakota at the front? How did we do it so quickly, and what lessons can be learned in terms of getting that Class VI primacy authority?

Senator CAPITO. We thought it was you.

[Laughter.]

Senator CRAMER. Yes, well, I would like to take credit, but I think it was more than that.

Mr. CONNORS. Chairman Capito, Senator Cramer, thank you for the question. This began in the early 2000's, and the State of North Dakota recognized early on that our economic pillars for North Dakota, our agriculture and our energy industry, which are both intensive in terms of CO_2 emissions. We set out in the early 2000's to develop frameworks, regulatory frameworks, to provide certainty specifically to our energy industry, that if they were to be able to advance carbon capture technology, that they would have the certainty in order to store that CO_2.

North Dakota took the approach of developing a resource management framework, so CO_2 storage in North Dakota is regulated much like we regulate oil and gas. It is in the public interest to promote geologic storage of carbon dioxide.

We declare CO_2 as a valuable commodity for its industrial use, specifically for enhanced oil recovery, and we regulate the pore space in North Dakota like a resource, under a resource management framework. That gives the State the ability to create unitization or unitize these projects in order to allow landowners to monetize their resource or monetize their pore space, looking to maximize the use of that pore space.

All nine projects that have been approved in North Dakota all have units that have been established by the State regulatory authority.

Senator CRAMER. You touched on something that I have said for a long time. By the way, John Harju, I will never forget, as a utility regulator, when PCOR became an idea, and you presented, and I thought, what in Sam Hill is this? This sounds crazy to me, and look at where you are today. Look where I am; that is even weirder, but anyway.

[Laughter.]

Senator CRAMER. By the way, when it comes to primacy, and I appreciate all your testimony on this, one of Cramer's convictions is that Federal mediocrity should never be imposed on a State's excellence. I am sorry that it takes so long to do what should be obvious in terms of just, general philosophy of governance, not to mention constitutional. We will get there.

Mr. Connors, you laid in your testimony, referenced something that is intriguing to me and I think we should explore a little bit, and that is the aquifer exemption issue. Can you sort of walk through that a little bit with me? First of all, what are the dangers, and second of all, why do you need the exemption? If we do not get the exemption, how does that affect the availability of space for storage?

Mr. CONNORS. Chairman Capito, Senator Cramer, thank you for the question.

This is an extremely important technical challenge that the industry is facing today. It is a little bit of a complex challenge, so I will do my best to explain it in a way that makes sense to everyone.

It really has to do with the way in the terms of our Safe Drinking Water Act, the way we define underground source of drinking water. It is a broad definition. The definition of an underground source of drinking water includes a process for identifying aquifers that meet some criteria for serving public water supply, but they will not and they would never be a public water supply.

You have deep, subsurface geologic formations that do meet some criteria for water quality, but there are certain criteria that would eliminate those formations to be used for drinking water, whether it is other constituents, or it just not economical to develop, or that formation will not produce enough water to be a drinking water source.

It is a complex challenge, but EPA created a process to allow for the exclusion of those formations, to be able to use them for underground injection. When the EPA published the Class VI rule in 2010, they excluded, aquifer exemptions are not allowed for Class VI injection. All the other well classes are allowed to have or apply for aquifer exemptions other than Class VI.

What that means to this committee is that there are formations that are ideal and suitable for CO_2 storage that will never be used for drinking water, yet you cannot permit or inject into those formations because of the current regulations.

Senator CRAMER. Does Congress need to address that, or why, and what is the blockade?

Mr. CONNORS. Chairman Capito, Senator Cramer, the challenge with it, it is kind of a three-pronged solution.

Congress can address it and direct EPA to amend their rules and allow for aquifer exemptions for Class VI. EPA will have to amend their rules and remove that provision. Then the third piece is also challenging. EPA is the final authority when it comes to making that decision for aquifer exemptions, and that still takes a long lead time. I have previously administered North Dakota's Class II UIC Program, and it would take a year or 2 years to get an aquifer exemption from the EPA when they do allow it for that injection well class.

Senator CRAMER. I am glad I asked. Thank you.

Senator CAPITO. Senator Ricketts?

Senator RICKETTS. Chairman Capito, thank you very much for holding this, and also my regards to Ranking Member Whitehouse as well for this important hearing. I look forward to working on a bipartisan way to be able to get all the members of the committee on these common-sense carbon arrangements and programming, which is a win-win-win-win, right? It is great for consumers; it is great for the environment; it is great for farmers; it is great for bioproducers. It really is something that we need to continue to pursue. I congratulate the State of North Dakota on your great progress on it already.

It is also great to have Mr. Cavanaugh, to have you here. It is great to have a husker, as you mentioned before, so thanks for taking the time to be a witness, and thank you to all of our witnesses for being here.

Nebraska is actually the second-ranked ethanol State in the Country, and I know the Chairman knows this because of my service on this committee the last 2 years. She has heard me often-

times talking about why I love this committee so much because we get to talk about ethanol all the time.

Ethanol is great because it saves consumers money at the pump, helps cleanup our environment, and as mentioned, is great for our farmers and ranchers. Nebraskan farmers benefit from the certainty of premium markets associated with the biofuel industry. As we are talking about it, if you could lower the carbon score through ethanol, right, you can actually charge a premium for it. That is a good thing. That is the market at work. It is a fantastic thing.

Carbon pipelines help add that premium to biofuels and biofuel markets by lowering that carbon intensity even further through this carbon sequestration. Nebraska and other midwestern States tend to benefit greatly from pipeline projects like Tallgrass Pipeline, which originates in Beatrice, Nebraska and terminates in eastern Wyoming. Tallgrass has the capacity to do ten million cubic tons of CO_2. That is like two million cars being taken off the road.

The potential for growth of this carbon storage industry is just another reason why we ought to be doing E15 year-round and implement the renewable fuels standard on time. Ensuring the development of carbon storage infrastructures requires compliance with different agencies and regulatory schemes.

I would certainly agree with my colleague from Ohio when he said he agrees with the primacy of States, because again, having been a former Governor, I know what a great job our Department of Environment and Energy did in that primacy.

In Tallgrass's case, the State of Wyoming was responsible for issuing the Class VI well permit through EPA's Underground Injection Control Program. The Wyoming Department of Environmental Quality successfully did that. It was a huge win for Nebraska and the Midwest and neighboring States.

While I am relieved to hear the Tallgrass project has that Class VI permit, so many other projects have not had that same success. According to the EPA, only eight Class VI wells have been permitted. One hundred sixty-one are still awaiting that permitting, or are still pending.

Again, getting back to the Ranking Member's concerns, maybe this is one of the reason why other companies do not jump in. If you only have eight Class VI wells permitted and there are 161 waiting, why would I jump in on this? The EPA has got to get it going. This is just unacceptable.

At the beginning of last year, Senator Fischer and I led a letter asking the EPA about Class VI well permit approval process. A biofuel stakeholder has been waiting 33 months for a permit, despite the commitment from the agency that the process would take no longer than 24 months. I have actually got copies of those letters right here, and without objection, I would like to submit these letters that we sent to the EPA and the response for the record.

Senator CAPITO. Without objection, so ordered.

[The referenced information follows:]

OFFICE OF WATER
WASHINGTON, D.C. 20460

March 20, 2024

The Honorable Pete Ricketts
United States Senate
Washington, D.C. 20510

Dear Senator Ricketts:

Thank you for your January 24, 2024, letter to the U.S. Environmental Protection Agency regarding the agency's Underground Injection Control Class VI program. The EPA recognizes that carbon capture and storage technologies play a crucial role in decarbonizing the global economy and meeting the Biden-Harris Administration's goal of achieving a net zero economy by 2050, particularly for the industrial sector, while cutting pollution and creating good-paying, clean energy jobs in communities across the nation. The EPA is committed to ensuring that carbon management projects are designed, built and operated safely and responsibly, and in a way that reflects the best science.

The EPA recently made several announcements showing the progress the agency is making to approve UIC Class VI permits and primacy applications. On December 19, 2023, the EPA announced draft decisions on four Class VI permits for Carbon TerraVault LLC. The proposed site for this activity is Kern County, California. On December 29, 2023, the EPA signed a final rule granting the State of Louisiana's request for primary responsibility for the permitting, compliance, and enforcement of Class VI wells under the UIC Program. On January 24, 2024, the EPA issued permits to Wabash Carbon Services LLC to construct two Class VI wells for the eventual injection and permanent storage of carbon dioxide underground, one at a site in Vermillion County and another in Vigo County, Indiana.

We agree on the importance of the UIC Class VI permitting process being transparent, timely, and in compliance with all regulations. The EPA is committed to reviewing UIC Class VI permits as expeditiously as possible when the agency is the permitting authority. The EPA's goal is to make a permit determination 24 months after receipt of a complete application.

Reviewing a UIC Class VI permit application entails a multidisciplinary evaluation to determine whether the application includes the required information, is technically accurate, and supports a risk-based determination that underground sources of drinking water will not be endangered by the proposed injection activity. A wide variety of technical experts – from geologists to engineers to physical scientists – review permit applications submitted to the EPA. We are continuously working to develop staff expertise and increase capacity, and we have effectively deployed appropriated resources over the last five years to scale our expert team from just a few people to 34 FTEs across our headquarters and regional offices.

Additionally, through an interagency agreement with the Department of Energy, several National Laboratories with deep expertise in carbon storage contribute to capacity building activities and support the EPA's technical reviews of the subsurface modeling portions of permit applications.

To help inform the public about the UIC Class VI program and increase transparency, the EPA recently has updated the Underground Injection Control Class VI website. The website includes new sections on the Class VI permitting process, the lifecycle of Class VI projects, current Class VI projects under permitting review, and public participation. The website also includes a tracker that shows the status of Class VI permitting applications currently in the review process. The EPA will continue efforts to further enhance transparency around the UIC Class VI program, as well as support a broader understanding of the regulatory framework in place to ensure the safe and successful development and deployment of carbon capture and sequestration projects in the United States.

The EPA appreciates the funding Congress has provided in both the EPA's annual appropriation and the Bipartisan Infrastructure Law for UIC Class VI work. These additional resources and staff capacity have been invaluable as the number of applications submitted to EPA for review continues to grow. The EPA is hard at work implementing the UIC Class VI program, working hand in hand with states, communities, and permittees and ensuring all stakeholder needs are appropriately considered.

Again, thank you again for your letter. If you have further questions, please contact me or your staff may contact Laura Gentile in the EPA's Office of Congressional and Intergovernmental Relations at gentile.laura@epa.gov or (202) 564-3158.

Sincerely,

Bruno Pigott
Acting Assistant Administrator

EPA Must Immediately Stop CO2 Injection Wells to Protect Public Safety and Drinking Water

The Honorable Michael Regan
Environmental Protection Agency
1200 Pennsylvania Avenue NW
Washington, DC 20460

October 22, 2024

Dear Administrator Regan,

We, the undersigned organizations dedicated to environmental justice, public health, scientific integrity, and sustainable climate policy, are writing to ask you to suspend permits for injecting carbon dioxide (CO2) underground, permitting of new CO2 injection wells, approval of primacy applications for CO2 injection wells, and to direct states with primacy over injection wells to halt injections and permitting of wells. The Environmental Protection Agency (EPA) must exercise its broad authority to protect sources of drinking water from "imminent and substantial endangerment" under the Safe Drinking Water Act, 42 U.S.C. § 300i, which has been revealed by the multiple recent leaks of carbon dioxide from underground injection control wells.

These demands stem from 1) multiple leaks of CO2 and equipment failures at the Archer Daniels Midland (ADM) facility in Decatur, Illinois; 2) new information about an increase in non-compliance violations in Texas Class II wells starting in 2011; 3) a higher percentage of Class II Texas CO2 injection wells that have failed one or more mechanical integrity tests when these wells are compared to other Class II wells; and 4) findings at EPA that steel used for well construction at the ADM site, and others around the country, is prone to corrosion in CO2 injection wells. Our demands also align with October 2024 recommendations from the White House Environmental Justice Advisory Council. The disproportionate development of injection wells and other carbon capture infrastructure on environmental justice communities will increase the risk of harm to communities already overburdened by pollution and is inconsistent with the administration's climate justice goals.

This June, EPA specifically communicated its concerns in an email to injection well applicants with pending permits that steel and cement used in wells "are NOT suitable for construction of these wells in most instances, particularly under potentially corrosive conditions when both water and CO2 are present." Yet, EPA continues to allow injections at wells with unsuitable conditions. While ADM has, after two leaks, temporarily ceased injection, EPA should proactively exercise its authority to protect the public from leaks before more occur, rather than rely on profit driven corporations to decide when they will stop putting the public at risk.

These leaks, as well as the new findings in Texas, highlight the broader risks posed to drinking water, public health, and our climate by both Class VI and Class II injection wells used for CO2

storage and oil recovery respectively. These concerns are not only with the well construction materials, but also with the EPA's lack of transparency and oversight associated with these leaks.

The events at the ADM facility have brought to light systemic problems with CCS technology and its regulation, raising serious concerns that CCS is neither safe nor viable. Reported failures at monitoring and detection systems due to corrosion and the migration of CO2 outside the intended storage zone expose multiple levels of failure. What is perhaps more concerning is that EPA has identified that injection wells around the country have the same design and material flaws that led to corrosion at at least one of ADM's leaking wells, raising concerns that CO2 injection wells could very well be leaking significant quantities of CO2 into groundwater and the atmosphere.

To date, ADM has acknowledged the release of at least 1,394 metric tons of CO2 between 2018 and 2022. We also know that ADM's Illinois CO2 injection operation had:

- experienced intermittent electrical shorts in September 2020 that were affecting the gauges; and
- experienced surface leaks on November 28, 2021 and another on June 28, 2022. Both were vented to the atmosphere; and
- detected characteristics of CO2 contamination in the Ironton-Galesville formation above the confining zone sometime after 2021; and
- identified malfunctioning monitoring gauges by January 2022; and
- found a subsurface leak of 307 metric tons in 2022. According to ADM's reporting to EPA, the company took "temporary measures to isolate the CO2 leakage" which consisted of removing the tube, plugging the well with cement, and closing a downhole flow control valve and two wellhead valves at the surface to prevent further leakage. ADM's response to the EPA's Notice of Violation indicates that the company identified the corroded pipe in October 2023 and at that time stopped using the well.

Neither EPA nor ADM made efforts to inform the public of any of these failures. It wasn't until September 13, 2024, when investigative journalists reported 8,000 metric tons of CO2 had leaked in March of 2024 that the public became aware that there were any problems at this facility.

This timeline raises questions about the transparency and effectiveness of the monitoring and enforcement process. Despite reporting that the presence of CO2 was detected outside the confinement zone in 2021, that Monitoring Well #2 was totally malfunctioning in January of 2022, and that the first subsurface leak was detected as early as 2022, EPA waited until August of 2024 to issue a notice of violation to ADM, and September to send an enforcement order. It is important to note that ADM was publicly silent on these leaks, both while they were negotiating state legislation that passed in May, and during negotiations with the City of Decatur regarding easements that would allow ADM to store CO2 under Lake Decatur.

Following release of the enforcement order, ADM reported another leak in another monitoring well that it claims was discovered in response to EPA fact-finding requests, which prompted ADM to stop injecting CO2 into its well. As with the 2018 leak, this additional breach highlights the uncertainty about how long that other well had been leaking, what caused these leaks, why the required testing regimes under ADM's permit failed to detect the leak, why injection was not stopped earlier, and why we rely on corporations to monitor themselves for pollution instead of EPA regulators.

The threat to drinking water and public health posed by CO2 injection wells cannot be overstated given that leaks from the injection of CO2 into underground saline formations can migrate into overlying freshwater aquifers and be released into the atmosphere. Once CO2 dissolves in water, it forms carbonic acid, which lowers the pH of the water, eroding and corroding rock and well equipment, and mobilizing toxic metals such as lead, arsenic, and mercury. These metals are particularly concerning for drinking water sources near injection sites. The release of CO2 into the atmosphere adversely impacts our climate. Even at relatively low concentrations, it can impair cognitive, cardiovascular, neurologic, hearing, and vision function through asphyxiation and toxicity as was, in part,demonstrated by a CO2 pipeline rupture in Satartia, Mississippi that sent dozens of people to the hospital and highlighted the challenges to first responders needing to respond to CO2 releases into the atmosphere.

Another serious concern associated with CO2 sequestration is induced seismicity from injecting CO2 underground, which can cause fractures and re-activate faults, either of which can result in additional pathways for CO2 migration. In combination with malfunctioning equipment, the injections can create unpredictable and widespread impacts from leaks on the water we drink and the air we breathe.

EPA's oversight of carbon dioxide injection wells is lacking in general, and is highlighted by the lack of transparency and oversight relating to these well failures. These concerns are not limited to Class VI wells like the one operated by ADM, but extend to Class II wells, a much larger universe of thousands of potential injection sites across the country used to extract oil. The practice of injecting CO2 into these wells carries many of the same risks associated with Class VI wells used for CCS; however, the regulations governing Class II wells are less stringent, posing an even greater risk of leaks.

EPA has approved primacy for permitting Class VI wells to Wyoming, North Dakota, Louisiana and granted primacy for dozens of states for permitting Class II wells. Several states have begun the process of gaining primacy or program revisions for class VI wells. Many of these states, such as Louisiana, which was just granted primacy, have a history of favoring oil and gas interests over the health and wellbeing of their residents. A summary of peer review literature, regulatory actions, and other sources highlight this history in Louisiana specifically, raising serious questions about the appropriateness of EPA's decision to grant primacy to states.

The concerns raised in this letter also bear on the efficacy of the 45Q tax credit for carbon oxide sequestration. 26 U.S.C. §45Q. Section 45Q(f)(2) expressly requires that the Secretary of

Treasury consult with EPA to define the term “secure geological storage,” which must be achieved for a taxpayer to claim this credit. The statute requires the Secretary of Treasury to determine “adequate security measures for secure geological storage . . . such that the qualified carbon oxide does not escape into the atmosphere.” Rather than establish its own program to ensure “secure geological storage,” Treasury relies on the EPA’s Underground Injection Control program contained in 40 C.F.R. Part 98 for both sequestration and enhanced oil and gas recovery facilities. 26 C.F.R. §1.45Q-3. The well failures at the ADM Decatur sequestration facility put into question whether the EPA’s Underground Injection Control program’s well construction standards are adequate to prevent “escape into the atmosphere” and ensure permanent secure geological storage in the near term, much less on a geologic time scale.

Given the potential for significant harm to the environment, human health, taxpayers, and our climate, we urge EPA to take immediate action to update rules and regulations for CO2 injection wells. These revisions are needed to ensure more rigorous permitting, transparency, and oversight to ensure safety of existing wells. Until these revisions are finalized, EPA should:

- Halt CO2 injections into Class II and Class VI wells across the country;
- Halt permitting of new Class II and Class VI injection wells;
- Halt approval of State primacy applications for Class II and Class VI injection programs; and
- Direct States with primacy to halt injections as well as approvals of new Class II and Class VI injection wells.

The risks associated with carbon capture and storage, particularly the injection of CO2 into Class II and Class VI wells, are too great to ignore. The recent events at the ADM facility in Decatur are a warning sign that current regulatory practices are inadequate. We urge EPA to act now to protect drinking water, public safety, and the environment from the dangers of CO2 injection, transportation, and storage.

Sincerely,

Original Signatories:

Food & Water Watch

350 Chicago (Illinois)

Blacks in Green (Illinois)

Central Illinois Healthy Community Alliance (Illinois)

Citizens Against Heartland Greenwashing Projects (Illinois)

Eco-Justice Collaborative (Illinois)

Citizens Against Predatory Pipelines (Illinois)

Climate Reality Project: Chicago Metro Chapter (Illinois)

Coalition to Stop CO2 Pipelines (Illinois)

Faith in Place (Illinois)

Fox Valley Peace and Justice Group (Illinois)

Illinois Environmental Council (Illinois)

Illinois People's Action (Illinois)

Nuclear Energy Information Services (Illinois)

Prairie Rivers Network (Illinois)

Save Our Illinois Land (Illinois)

Third Act (Illinois)

Unitarian-Universalists Advocacy Network of Illinois (Illinois)

BOLD Alliance

Commission Shift (Texas)

CURE (Minnesota)

Institute for Policy Studies Climate Policy Program

Public Goods Institute

Science and Environmental Health Network

350 Bay Area Action (California)

Signatories

ACES 4 Youth

Alliance for Affordable Energy

Alliance for the Wild Rockies

Alliance of Nurses for Healthy Environments

American Holistic Nurses Association (AHNA)

Benicians for a Safe and Healthy Community

Better Path Coalition

Biofuelwatch

Blacks in Green

BOLD Alliance

Breathe Easy Susquehanna County

Breathe Project

Carbondale Concerned Citizens

Center for Biological Diversity

Center for International Environmental Law

Central Illinois Healthy Community Alliance

Citizens Against Heartland Greenwashing Projects

Citizens Against Predatory Pipelines

Citizens Against Predatory Pipelines (Illinois)

Clean Power Lake County

Climate Action Evanston

Climate Code Blue

Climate Equity Policy Center

Climate Reality Project Greater New Orleans Chapter

Climate Reality Project: Chicago Metro Chapter

Coalition Against Death Alley

Coalition Against the Rockaway Pipeline

Coalition to Stop CO2 Pipelines (Illinois)

Commission Shift

Communities Against Carbon Transport & Injection (CACTI)

Concerned Citizens of St. John

Concerned Health Professionals of New York

CT COALITION FOR ECONOMIC AND ENVIRONMENTAL JUSTICE

CURE

Dakota Resource Council

Deep South Center for Environmental Justice

Delaware Riverkeeper Network

Don't Gas the Meadowlands

Earth Ethics, Inc.

Eco-Justice Collaborative

Eco.Logic

Elders Climate Action

Elders Climate Action (ECA) Northern California (NorCal) Chapter

Elders Climate Action (ECA) Southern California (SoCal) Chapter

Elmirans & Friends Against Fracking

Faith Coalition foe the Common Good

Faith in Place Action Fund

Fenceline Watch

First Unitarian Universalist Society of New Haven, Social Justice Cttee

Food & Water Watch

For a Better Bayou

Fox Valley Citizens for Peace & Justice

Fox Valley Electric Auto Association

FracTracker Alliance

FreshWater Accountability Project

Friends of the Earth

Go Green Winnetka

Good Neighbor Steering Committee of Benicis

Great Plains Action Society

Greater Highland Area Concerned Citizens

Greater New Orleans Interfaith Climate Coalition

Greenfire Coalition Writers' Forum

Health Professionals for a Healthy Climate

Healthy Gulf

Human Impact Partners

Illinois Environmental Council

Illinois Water Authorty Association

Inclusive Louisiana

Indigenous Environmental Network

Institute for Policy Studies Climate Policy Program

Iowa Citizens for Community Improvement

ISEE-Justice40 Consortium

JPAP

Illinois People's Action

Louisiana Just Recovery Network

Louisiana League of Conscious Voters

Memphis APRI

Metro East Green Alliance

Metro East Green Alliance (Illinois)

Mi Familia en Accion

Micah 6:8 Mission

Move Past Plastic (MPP)

NAACP Peoria Branch

Natural Habitat Evanston

New Mexico Climate Justice

New Mexico Environmental Law Center

New York Climate Action Group

Ní Bthàska Stand Collective

No False Solutions PA

No North Brooklyn Pipeline Alliance

North American Climate, Conservation and Environment(NACCE)

Nuclear Energy Information Service (NEIS)

Nuclear Energy Information Services (Illinois)

Ocean Conservation Research

Oil and Gas Action Network

Oil Change International

Oilfield Witness

People for a Healthy Environment

Peoria Riverkeeper

Physicians for Social Responsibility

Physicians for Social Responsibility - Concerned Health Professionals of PA

Physicians for Social Responsibility - New York

Physicians for Social Responsibility -Los Angeles

Physicians for Social Responsibility Colorado

Physicians for Social Responsibility Florida

Physicians for Social Responsibility Los Angeles

Physicians for Social Responsibility Maine

Physicians for Social Responsibility Oregon

Physicians for Social Responsibility Oregon

Physicians for Social Responsibility Pennsylvania

Physicians for Social Responsibility San Francisco Bay

Physicians for Social Responsibility Texas

Physicians for Social Responsibility, New Mexico

Port Arthur Community Action Network(PACAN)

Port Arthur Community Action Network(PACAN)

Prairie Group of the Sierra Club

Prairie Rivers Network

Presente.org

Public Goods Institute

Resistor Sisterhood

Retired Physician--Professor of Medicine UIC

Santa Cruz Climate Action Network

Save Our Illinois Land

Science and Environmental Health Network

Sierra Club - Houston Group

South Bronx Unite

Sowing Justice

Sunflower Alliance

Sustainable Springfield Inc

Terra Advocati

Texas Campaign for the Environment

Texas Environmental Justice Advocacy Services

Texas Permian Future Generations

The Enviro Show

The Park Church in Elmira

The People's Justice Council

The Raices Collab Project

The Texas Drought Project

The Wei LLC

Third Act Illinois

TRIAA-Divest!

Turtle Island Restoration Network

Unitarian Universalist Advocacy Network of Illinois

Unitarian Universalist Church in Anaheim

Unitarian Universalist Church of Urbana-Champaign, Social Action Council

United For Clean Energy

United Native Americans

Universalist Unitarian Church of Peoria

Utah Physicians for a Healthy Environment

Vermont Climate and Health Alliance

Vessel Project of Louisiana

Veterans for Climate Justice

Washington Physicians for Social Responsibility

Waterspirit

WE ACT for Environmental Justice

Wellington United Church of Christ

West End Revitalization Association - WERA

Western Organization of Resource Councils

WindSolarUSA, Inc.

1000 Grandmothers for Future Generations

198 methods

350 Bay Area Action

350 Chicago

350 Eugene

350 New Orleans

350 Seattle

350 Wisconsin

350 Hawaii

United States Senate

WASHINGTON, DC 20510

January 24, 2024

Ms. Radhika Fox
Assistant Administrator
U.S. Environmental Protection Agency
Underground Injection Control Program
Office of Water
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Dear Assistant Administrator Fox,

We write today to request information regarding how the Environmental Protection Agency (EPA) has prioritized the permitting of Underground Injection Control Program Class VI Wells. In both Fiscal Years 2023 and 2024, EPA has requested $11.4 million for this program. As you know, these wells play a critical role in the safe storage of carbon dioxide through geological sequestration, adding value throughout the supply chain of essential industries.

It has come to our attention that several applicants have been awaiting approval for their Class VI Injection Well permits for an extended period of time. This delay not only hinders the progress of important projects but also creates uncertainty among stakeholders about the efficiency and effectiveness of the permitting process.

In light of the critical role that Class VI Injection Wells play in the safe storage of carbon dioxide, it is essential to ensure that the permitting process is transparent, timely, and in compliance with all regulations. We are reaching out to seek information on the reasons behind the delays and to understand the steps being taken to expedite the processing of these permits.

As applications for this program continue to increase, it is crucial that the office works swiftly to process applications.

Therefore, we ask—by no later than February 24, 2024—that you answer the following questions:

- What is the average processing time for Class VI Wells permits currently?
- Are there any significant variations in processing times, and if so, what factors contribute to these variances?
- How is the EPA communicating with applicants regarding the status of their Class VI Wells permits?
- Are there plans to enhance transparency in the permitting process to keep stakeholders informed about the progress and potential delays?

- Are there plans to implement or enhance technological solutions to increase efficiency in the permitting process?
- Please provide us with the specific steps EPA plans to take in the coming months to process these permits.

Your prompt attention to this matter is greatly appreciated. Please do not hesitate to contact our offices should you have any questions.

Sincerely,

Pete Ricketts
United States Senator

Deb Fischer
United States Senator

Senator RICKETTS. These delays and excuses demonstrate what we already know to be true: that the Biden Administration was not serious about a holistic approach to clean energy, and favored toxic Chinese-based suppliers for batteries. Second, State governments often are better stewards of taxpayers' dollars, as we have demonstrated by what is going on in North Dakota and should play a more active role in the Federal programming for implementation.

Federal roadblocks for CO_2 permitting stand in the way of leveraging every penny that could be going to helping Nebraska farmers feeding and fueling the world. Farm country is struggling and access to the biofuel market supported by the Class VI wells would pad producers' bottom lines.

I am encouraged by the bipartisan support from both Chairman Capito and Ranking Member Whitehouse and other members of this committee for the USE IT Act. This legislation includes language specifically to streamline the permitting process for CO_2 pipelines. There are critical provisions in the USE IT Act, like expedited permitting to review development of cases of carbon infrastructure.

As a Governor of Nebraska, I am going to Lean Six Sigma to be able to streamline our processes. For example, we are able to bring some of our permits down from 110 steps to 22 steps and cut the time to issue them from 190 days to 65 days. We ought to be looking for those same sort of answers in our EPA.

Mr. Connors, your work in North Dakota on carbon sequestration is impressive with regard to Class VI. How has Class VI well permitting been different from what it would be in the USE IT Act's passage?

Mr. CONNORS. As I mentioned, when you have Class VI primacy, like you do in North Dakota, and certainly Nebraska, I believe, has decided to pursue Class VI primacy, the State regulator is able to evaluate these complex applications in a much more efficient manner.

We have a drastic comparison. On the Federal level, it takes EPA two to 4 years to issue a Class VI permit. The most recent ones were just the permit to construct, so that operator is going to have to turn around and actually apply for the authorization to inject, which is an unknown timeframe.

In North Dakota and Wyoming, who have both issued these project permits, North Dakota takes about 8 months to issue a permit, and Wyoming takes about 12 months, on average, to issue their first three permits.

It is efficient. This is an efficient process. These are complex applications, but certainly, you would have a regulator that is able to work through that process in a more efficient manner.

Senator RICKETTS. Thank you, Chairman, for being lenient with the time here, but I just wanted to say, as a Governor, I wholeheartedly agree with your assessment of it, that the States can be much more efficient in getting this done. Again, for example, when I talked about that Lean Six Sigma process, we at the State, we can not change any of the environmental regulations. Is that right, Mr. Connors?

Mr. CONNORS. That is correct. In order to receive Class VI primacy, your State program has to be as stringent as the Federal

EPA's program in protecting underground sources of drinking water.

Senator RICKETTS. Yes.

Mr. CONNORS. EPA recognized when they published the Class VI rule in 2010, in the preamble of that rule, that States are best positioned to regulate and implement this program, because they can enact a broader framework, and that is the framework that I was discussing, where States can regulate a project, they can create pore space unitization, and EPA is just limited to regulating the injection well.

EPA recognizes that the States are best positioned and suited to regulate this activity and to be able to do so in a manner that is more efficient. The way we talk about it in terms of these regulatory frameworks is, the State is really positioned to regulate from cradle to grave, and that is an important piece, where the State can regulate the project. EPA has limitations to what their regulatory authority is when they are the implementation authority.

Senator RICKETTS. Thank you, Mr. Connors. I appreciate your answer there, because that is something that, again, as a former Governor, I appreciate. Nobody cares more about having clean air or clean water in the State of Nebraska than Nebraskans, and that is why we do such a great job with the environment, and that is why we need primacy.

Thank you for your indulgence.

Senator CAPITO. Thank you.

Senator Curtis?

Senator CURTIS. Thank you, Madam Chair.

I actually would like to pick up where my colleague left off. Utahns, I think, find themselves equally as concerned about leaving the Earth better than we found it, clean air, clean water, and clearly, the ability to take carbon out of the air is a very, very important part of that. I firmly believe our Nation's energy security depends on what I call affordable, reliable, and clean energy. Carbon capture can play a critical role in achieving that balance.

Companies in Utah are eager to innovate, but often faced delays in obtaining approvals from Federal agencies to implement new technologies. The USE IT Act is an important law that clarifies the role of Federal research agencies in advancing carbon management technologies, including carbon capture through research, development, and demonstration efforts.

Additionally, the USE IT Act ensures that carbon capture, utilization, and storage projects qualify for streamlined permitting under the FAST Act, which was originally designed to expedite the review of surface transportation infrastructure projects.

Mr. Yates or Mr. Connors, or both, currently, only two carbon capture and sequestration projects are listed as FAST 41 covered projects on the permitting dashboard for Federal infrastructure projects. What actions can the Administration take to fully implement the USE IT Act, particularly ensuring a more efficient permitting process?

Mr. YATES. Thank you, Senator Curtis. That is a really great question.

One of the problems for States as they apply for primacy is, EPA uses what they call a crosswalk, which can be a very good tool, but

it is a complicated tool. There is not very good transparency to States on the process of where they are within primacy. Making that a more transparent process, training that is for both States and EPA simultaneously on what the crosswalk's purpose is and how it is to be used would be very helpful in speeding primacy.

If we can get States primacy faster, we have already talked a great deal today about how States are more efficient with their permits. I would say an answer to your question is reviewing EPA's process, causing them to be more transparent. Often, States will get a copy of the crosswalk with things highlighted, but no description of what any of those highlights mean. Specific questions to States on what is holding up the primacy process. It is EPA's role to determine whether or not a State's rules and regulations meet or exceed Federal. It is not the State's role to do that, but we are getting confusing information back from EPA during that primacy process.

Senator CURTIS. Thank you. Yes, go ahead, Mr. Connors.

Mr. CONNORS. As we have mentioned, there is, last I checked, 161 well permits that have been backlogged at the EPA regional offices. The No. 1 solution is, there are States that are in the preapplication process to apply for primacy.

If EPA were to grant Texas alone primacy, 35 percent of those applications would go to the State of Texas. There are a lot of projects in Texas. If the EPA were to grant primacy to the States that are in the queue, that are pursuing primacy, it is about 40 percent, and there are several States that have announced that they are pursuing primacy. That is another 50 percent of the applications.

Those other 50 percent of the applications are in States that have not indicated that they are interested in pursuing Class VI primacy. EPA could focus their resources on California and Illinois, where there are a lot of projects today, but granting States primacy that have applied and expediting that process is crucial to alleviating the backlog.

Second of all, EPA can incentivize more States applying for primacy and requesting that authority from EPA if they knew that EPA was going to expedite that process. I think there would be an advantage there.

Senator CURTIS. That is great.

Madam Chairman, we need to talk to Mr. Zeldin and give him a few minutes to get his feet underneath him and then light a fire underneath him. I would like to agree with my colleagues about just the difficulty of Class VI permits. I do not need to go deeply into that because I know it has been discussed today, but I do want to add my voice to that.

Mr. Connors, what resources can the Federal CCUS Permitting Task Team, in coordination with the DOE, provide to States, particularly those with Class VI primacy, like Utah, to assist in the review and the permit of processes, review of permits?

Mr. CONNORS. The Underground Injection Control Program historically, and I think it has been around for about 40 years now, historically there are grants that the States apply for through EPA, and there is funding resources to those States that have primacy.

For the history of Class VI, which began in 2010 when EPA published the Class VI regulations, there has been no resources through those UIC grant applications. The States are applying for and administering those Class VI programs with their own State funding to do so, and so additional funding for the States, to have those resources to implement their Class VI programs, would be extremely helpful.

Senator CURTIS. Thank you.

I thank the witnesses, but I also thank the Chair. This is a really important topic, and I suspect most of America does not really understand fully the potential here. Thanks for holding this hearing, and I look forward to additional discussions. I yield my time.

Senator CAPITO. Thank you.

Apparently, Senator Schiff is going to be coming. We were just called for our votes, so I am going to ask a question.

Mr. Cavanaugh, you have done a lot of work on direct air capture. I guess I am curious to know, are any of the wells that have been permitted direct air capture wells, and what kind of, Mr. Connors lined out three difficulties for getting these projects moving, retrofitting, permitting on the pipelines, and long lead times.

How does direct air capture work into this? Is the technology fully proven, and who is doing this work?

Mr. CAVANAUGH. Thank you, Chairman Capito.

To my knowledge, there has been one conditional permit in West Texas for the Occidental Petroleum Stratos facility, a Class VI well, the Brown Pelican Project, that is specific for direct air capture project.

As a general rule, Class VI wells, you need, mostly from an economic standpoint, you need about a million tons a year down well to make it worth putting in a permit for. As of yet, there are no direct air capture projects that can remove a million tons a year, so, unlikely that many Class VI wells will uniquely be situated for a single direct air capture project.

Direct air capture shares many of the similar challenges associated with point source capture. However, instead of removing it from a relatively concentrated source, out of a power plant, industrial sites, moving directly out of the ambient air. The No. 1 thing that we can do to drive down the cost of direct air capture is cheap, abundant power.

At the end of the day, 80 percent of the cost associated with DAC is heat, 20 percent is related to electricity. We need cheap, abundant power sources, whether that is natural gas with CCS, nuclear, hydro, geothermal. We need not just those projects to be built, but we need the large transmission lines to be able to carry that energy to these projects to drive down the cost on the capture side.

They share the same concerns on pipeline permitting and CO_2 storage, although a benefit of direct air capture is because you are pulling out of the ambient air, you can site directly on top of geologic storage to minimize the amount of pipelines you need.

Senator CAPITO. Right. Let me ask you this: can you combine a direct air capture project with a point source capture project to make it to that scale that you have talked about? Is that permissible? I do not know.

Mr. CAVANAUGH. Yes, absolutely. This is happening today with a lot of direct air capture projects, where they are deploying, for instance, the South Texas DAC Hub and also the Cyprus Project, which is a direct air capture hub facility in Louisiana, are deploying in industrial-rich areas where they can aggregate the carbon capture from these industrial sources alongside of their direct air capture to make the unit and project economics better.

Senator CAPITO. You know, it is interesting that you mention the need for more energy, because as you create the energy, and you mentioned, you said natural gas with CCUS, so than you are double CCUS-ing in one project, here. You are CCUS-ing to get the energy to do the direct air capture.

I do not see how the economics of that will work. Maybe into the future, hopefully. We have a repeating theme here, and I mentioned it in my opening statement of the reliabilities, because not only is this an intensive process, the process that we see on AI and other things are putting great pressures on our potential for providing electricity for all of this.

The key to all of this, and it is not the only key, but it is the key to every one of these projects, is a permitting process that you can move along. You can not permit a nuclear plant, you can not permit a pipeline, you can not permit a transmission line. You are sort of, at every point of the project, all hands point to permitting. Any help that you can give us with permitting Class VI and those pipelines, I think, will cross benefit all projects.

I think what is good about it is, as Senator Whitehouse said, this is going to be a bipartisan push. It is the only way to do it effectively, to get it into legislation, because we see what happens with the regulatory environment, is the shifts of Administrations go from one to the other at the Federal level.

I would just say, I really appreciate you all being here today. I am going to go to Senator Cramer, and we will go a couple more minutes, and if Senator Schiff does not show, we will just ring it down.

Senator CRAMER. Yes. Thank you, Madam Chair.

This is a really fascinating discussion. Quite honestly, we could take it into lunch if you want, and sit around a table somewhere in a cafeteria.

I run the risk of sounding silly, perhaps, in asking a couple of these questions, but we have referenced, now, on the energy, particularly the electricity issue, the challenge that we have. We have talked about all the permitting. There is a linear permitting, whether it is a transmission line or a gas pipeline to get there, the CO_2 pipeline, you know, and then to do all that, you have to have a generator of some sort, right?

We have that challenge in permitting, and then it really would help to have customers on the other side of it, because we can generate a lot of electricity and create transmission lines to nowhere, and that does not help anybody.

This is a very big issue. This is a very big and complex issue. As we prepare for permitting, we are going to be needing a lot of help, but we need to do it, to the Chairman's point.

You have alluded, Mr. Connors, to Class II wells and the ability to look at the similarities of all of these sources. There are a lot

of Class II wells that are approved and permitted. Is there any reason why the application for a Class VI well, in space, it has already got a Class II well, does that complicate the Class II designation in any way? Do you know, or does there need to be a fixing of that?

This could apply to all of you, but we will start with you, Mr. Connors. Does that question make sense, even? It is possible it does not.

Mr. CONNORS. Yes. Chairman Capito, Senator Cramer, I appreciate the question, and that is a question that I do get somewhat often.

There are different standards for well construction when it comes to a Class VI well versus a Class II well. Again, both are protective of the underground sources of drinking water. That is the cornerstone of the regulatory framework. A Class VI well has more specific requirements for the way that that well is constructed in terms of well design and engineering that would not be compliant, typically, in, say, a Class II disposal well.

We also have Class II wells that are used for injection of CO_2 for enhanced oil recovery in our oil fields, and certainly, there is phenomenal opportunity there as we look at the U in CCUS, utilizing the CO_2.

Senator CRAMER. Yes, I noticed we have not talked about that a lot, and I wanted to get to that, so thank you. Keep going.

Mr. CONNORS. That is where I think you have an opportunity to advance and accelerate widescale carbon capture and utilization and storage to be able to have, when we are able to capture CO_2 and address the economics associated with capturing CO_2 from some of our largest emitters, and again, these are the industrial sectors, the industrial operators, that are the life bread of the community in terms of economics, in terms of industrial tax base.

It is a dual challenge, but if the economics do make sense to retrofit with carbon capture technology, we can have readily available CO_2 that, I believe, and I am optimistic about leads to greater innovation and greater utilization of that CO_2. I think the opportunity is in front of us if we are able to knock down some of these barriers.

Senator CRAMER. One of you, early on, actually referenced the difference between a commodity and a waste product, or a pollutant. That is what makes it a commodity, is the utilization piece of it.

We really have not talked a lot about that, but Mr. Cavanaugh, I sense that you had something to say about my wonky question about wells, and you explained it well, but anything you would want to add to that?

Mr. CAVANAUGH. Thank you, Senator.

No, I would just say, on something like enhanced oil recovery, enhanced oil recovery is sort of a microcosm of climate in and of itself. Climate change is a complex, societal problem, but fundamentally, a simple math one. We need to reduce emissions very quickly and remove those that we can not reduce.

Enhanced oil recovery is when you inject CO_2 into an already existing field to push out more oil. In a world where you have stagnant or declining oil demand, oil produced from enhanced oil recovery is the lowest carbon intensive barrel of oil that you can get out

of the ground. We have seen a demand for this globally with these barrels being sold right now. I think it is around 6 percent of current U.S. production is with enhanced oil recovery.

It is a simple math problem: however much CO_2 you sequester in the ground, you subtract that from the total that would come from the combustion of the oil, and you receive more carbon intensive oil. Anyway, from your utilization question, I think it is a positive pathway.

Senator CRAMER. Yes. We actually have, in Southwestern North Dakota, a project that produces net negative oil as a result. I do not know what all the great potential is for that, but it is fascinating.

My time is up. This has really been fun. I mean, I know I am nerdy, but this has actually been fun. Thank you, guys.

Senator CAPITO. Well, great. Listen, Senator Schiff is, I think, voting, so with no further questions, I would like to ask the witnesses and all of my colleagues, thank them for their participation today. Thank you. I know some of you have travelled quite far, so I appreciate that.

Senators who wish to submit written questions for the record have until 5 p.m. on Wednesday—I believe Senator Whitehouse was going to be submitting some written questions—February 26th to do so. The nominees' responses to those questions for the record are due back to the committee no later than 5 p.m. on Wednesday, March the 12th.

With that, the hearing is adjourned, and thank you all.

[Whereupon, at 11:18 a.m., the hearing was adjourned.]

CO2 Pipeline Moratorium Now!

May 30, 2023

Dear President Biden:

Billions in public subsidies are spurring the development of pipelines to transport hazardous carbon dioxide (CO2). Due to serious safety concerns, we call on you to issue an executive order putting a moratorium on all federal permits for CO2 pipelines and related infrastructure, and urging states to do the same until the Pipeline and Hazardous Materials Safety Administration (PHMSA) finalizes robust new safety regulations that protect communities and the environment.

PHMSA is planning to propose revised regulations in the fall of 2024, in response to a rupture of a pipeline transporting CO2 in Satartia, Mississippi that hospitalized residents and posed significant challenges for first responders who were ill equipped to respond to such an emergency. However, we are facing a massive build-out of CO2 pipelines now; in the absence of updated federal regulations, our communities face the risk of much larger and more devastating ruptures.

Further, the Army Corps of Engineers is already receiving preconstruction notifications from CO2 pipeline companies under its nascent Nationwide Permit 58, which was not designed to handle vast complex networks of pipelines containing a uniquely dangerous material. The dangers will be compounded if the Corps permits these pipelines before PHMSA has completed its rule.

There are many issues that are unique to CO2 pipelines that PHMSA must address prior to the construction of any new pipelines, but chief among our concerns are:

Adequate Safety Zones: The CO2 pipeline rupture in Satartia, which sent dozens of people to the hospital, showed us that current dispersion modeling is inadequate for CO2 pipelines, as the impacted people were outside of the official area of concern for ruptures. Typical pipelines that transport methane and oil can measure impact areas from a rupture in feet or yards, while pipelines that transport CO2 could spew CO2 for miles, creating an invisible cloud of suffocating gas that can asphyxiate everything in its path. Pipeline developers, relying on outdated data on impact areas, are looking to build CO2 pipelines near schools, shopping centers, and other densely populated areas. This will put hundreds or potentially thousands of people at risk of serious harm, and even death, from a CO2 rupture.

Contaminants: Contaminants in CO2 pipelines from the point of capture can in and of themselves create risks to pipeline integrity. For instance, water in wet CO2 from ethanol production can create carbonic acid, which can weaken pipeline integrity and increase the chance of a rupture. Pipeline operators are planning pipelines that will contain CO2 from many sources, including industrial sources and power plants, which could lead to introduction of countless contaminants that could interact in unpredictable ways in high pressure pipeline environments, furthering risks of CO2 pipeline ruptures. PHMSA must set maximum levels of contaminants that are based on an understanding of the ways these contaminants will interact in pipelines and how those interactions could contribute to ruptures.

CO2 Definition: Currently PHMSA only sets safety safety rules for supercritical CO2, leaving gaseous and liquid CO2 unregulated. This could leave thousands of miles of pipelines that are not covered by any safety regulations, despite the tremendous risks.

Safety coordination and resources: The incident in Satartia showed how first responders are not prepared to deal with dangers from CO2 ruptures. Most notably, they lack equipment that can protect them from high levels of CO2 and allow vehicles to function without adequate oxygen in the air to support combustion powered vehicles. PHMSA must require pipeline operators to update required procedural manuals and provide regular training and equipment to first responders to ensure they are adequately prepared for a large-scale evacuation that could occur from a CO2 rupture.

Odorants: There are no requirements for odorants in CO2 pipelines, which can alert the public and first responders to a threat from a CO2 rupture. A cloud of CO2 is impossible to detect since it is invisible and odorless. PHMSA must require odorants in pipelines and must immediately inform first responders and regulators at the first signs of a pipeline rupture.

You must make sure these rules are in place before your administration issues any permits for new CO2 pipelines. The absence of strong regulations leaves urban and environmental justice communities at greater risk, since carbon capture and storage will be increasingly located in industrial areas. Therefore, it is imperative that you issue an executive order putting a moratorium in place on all federal CO2 pipeline permits until PHMSA finalizes its CO2 pipeline rule. We stand ready to work with your administration and other policymakers to ensure the strongest possible rules to protect communities are in place before developers are able to build any new pipelines to transport CO2.

Sincerely,

1000 Grandmothers for Future Generations

198 methods

350 Bay Area Action

350 Conejo / San Fernando Valley

350 Triangle

350.org

350ma-Berkshires

Agricultural Justice Project

Alabama Interfaith Power & Light

Alaska Community Action on Toxics

Alliance for Affordable Energy

Bayou City Waterkeeper

Between the Waters

Biofuelwatch

Blue Mountains Biodiversity Project

Blue Ridge Environmental Defense League

Bold Alliance

Catskill Mountainkeeper

Center for Biological Diversity

Center for International Environmental Law

Center on Race, Poverty & the Environment

Central Illinois Healthy Community Alliance

Chatham Research Group

Citizens Against Heartland Greenway Pipeline

Citizens Against Longwall Mining

Clean Air Action Network of Glens Falls

Clean Energy Now Texas

Climate Generation

Coalition to Stop CO2 Pipelines

Commission Shift

Concerned Citizens of Wagon Mound and Mora County

CT Climate Crisis Mobilization

CURE

Dakota Resource Council

Detroit Hamtramck Coalition for Advancing Healthy Environments

Don't Gas the Meadowlands Coalition

Earth Action, Inc.

Eco-Justice Collaborative

ELEE

Environmental Transformation Movement of Flint

Extinction Rebellion San Francisco Bay Area

Fairbanks Climate Action Coalition

FCCPR Climate Crisis Task Force
Federated Conservationists of Westchester County

Florida Rising

Food & Water Watch

For the Greater Good

For the Many

Fox Valley Citizens for Peace & Justice

FreshWater Accountability Project

Fridays for Future US

Friends For Environmental Justice

Friends of the Earth

GAIA (Global Alliance for Incinerator Alternatives)

Good Neighbor Steering Committee of Benicia

Grassroots Environmental Education

Great Plains Action Society

GreenFaith

Health Professionals for a Healthy Climate

Healthy Gulf

Houston Climate Movement

Hudson River Sloop Clearwater

Illinois People's Action

Imagine Water Works
Indigenous Environmental Network

Ingleside on the Bay Coastal Watch Association

Institute for Agriculture and Trade Policy

Institute for Policy Studies Climate Policy Program

Interfaith Council for Peace and Justice

Iowa Citizens for Community Improvement

Lakeville Friends of the Environment

Louisiana Against False Solutions Coalition

Louisiana Bucket Brigade

LULAC Council 7259

M-W & Associates

Micah Six Eight Mission

Michigan Climate Action Network

Michigan Environmental Justice Coalition

Milwaukee Riverkeeper

MN350

Mountain Lakes Preservation Alliance

Movement Rights

MoveOn.org HobokenRESIST

Native Movement

NC Climate Justice Collective

New Energy Economy

New Mexico Climate Justice

New York Lawyers for the Public Interest

New York Progressive Action Network

Nicaragua Center for community Action

NJ State Industrial Union Council

NM No False Solutions Coalition

North American Climate, Conservation and Environment(NACCE)

Northeast Organic Farming Association of New Hampshire (NOFA-NH)

Northeast Organic Farming Association of Vermont (NOFA-VT)

Northeast Organic Farming Association-Interstate Council

Nuclear Energy Information Service (NEIS)

NYPAN Greene

Occupy Bergen County

Oil and Gas Action Network

Oil Change International

Our Future West Virginia

Partnership for Policy Integrity

Physicians for Social Responsibility -- New York

Physicians for Social Responsibility Arizona
Physicians for Social Responsibility Florida

Physicians for Social Responsibility Iowa

Physicians for Social Responsibility Pennsylvania

Physicians for Social Responsibility Wisconsin

Physicians for Social Responsibility-Los Angeles

Physicians for Social ResponsibilityColorado

Plastic Pollution Coalition

Prairie Earth Nursery

Preserve Montgomery County VA

Preserve Salem

Progressives for Climate

Property Rights and Pipeline Center

Protect Our Water, Heritage, Rights (POWHR)

Public Goods Institute

Rachel Carson Council

Rio Grande International Study Center

Rise Up WV

ROAR (Religious Orders Along the River)

Roots Return Heritage Farm LLC

Safe Energy Rights Group

San Antonio Bay Estuarine Waterkeeper

San Francisco Bay Physicians for Social Responsibility

SanDiego350

Save Our Illinois Land

Science and Environmental Health Network

Seneca Lake Guardian

Sisters of St. Dominic of Blauvelt, New York

SOMA Action

Southwest Detroit 48217 and the Original United Citizens of Southwest Detroit

Stand.earth

Stop the Algonquin Pipeline Expansion

Sunflower Alliance

Tampa Heights Acupuncture LLC

Taproot Earth

Terra Advocati

The Last Plastic Straw

The People's Justice Council

The Quantum Institute

The Revolving Door Project

Turtle Island Restoration Network

Unitarian Universalists for a Just Economic Community

Unitarian Universalists for Social Justice

Unite North Metro Denver

United Native Americans

Uptown Progressive Action, a NYPAN chapter

Vote Climate

Wall of Women

Waterspirit

WESPAC Foundation, Inc.

WildEarth Guardians

Women's International League for Peace and Freedom-Triangle Branch

Repeal Wasteful and Dangerous Carbon Capture Subsidies

February 10, 2025

The Honorable Mike Crapo
Senate Committee on Finance
219 Dirksen Senate Office Building
Washington, DC 20510-6200

The Honorable Jason Smith
House Committee on Ways and Means
1139 Longworth HOB
Washington D.C. 20515

The Honorable Ron Wyden
Senate Committee on Finance
219 Dirksen Senate Office Building
Washington, DC 20510-6200

The Honorable Richard Neal
House Committee on Ways and Means
1139 Longworth HOB
Washington D.C. 20515

Dear Chairs Crapo and Smith and Ranking Members Wyden and Neal:

As a broad based alliance representing organizations and communities across the United States, we urge you to repeal the 45Q tax credit and other subsidies for the carbon capture and sequestration (CCS) industry in the upcoming reconciliation package. These subsidies waste billions in taxpayer money, endanger public safety, and prop up a fundamentally flawed and unreliable technology. By eliminating these programs, Congress can protect communities, ensure fiscal accountability, and demonstrate responsible stewardship of public resources.

The Financial Costs of CCS: A Wasteful Investment for Taxpayers

CCS has proven to be an inefficient and costly endeavor. Despite years of taxpayer support, the industry has consistently failed to meet performance benchmarks or achieve meaningful emissions reductions. Projects like Petra Nova in Texas, heralded as CCS success stories, have struggled with operational issues and were ultimately shut down, wasting hundreds of millions of taxpayer dollars. Meanwhile, other projects continue to overpromise and underdeliver, all while demanding more federal support.

A recent investigation by the Treasury Inspector General for Tax Administration highlights the fiscal irresponsibility of continuing to subsidize CCS. The report found widespread abuse and fraud in the 45Q tax credit program, with nearly $1 billion claimed for unverified or non-existent carbon sequestration. Despite these findings and rapidly growing federal subsidies to CCS, the IRS has yet to revise its rules to prevent future abuse, leaving taxpayers vulnerable to ongoing exploitation. For a Congress committed to fiscal responsibility, continuing to fund an industry rife with fraud is indefensible.

Safety Risks: A Danger to Communities

Beyond financial waste, CCS poses significant safety risks to American communities. There are few examples of operational CCS injection projects in the US. Multiple wells have failed such as at the ADM's Decatur carbon storage site in Illinois, projects throughout Texas. Additionally, CO2 transportation projects have also faced safety concerns. The 2020 CO2 pipeline rupture in Mississippi sent dozens to the hospital and left many with permanent disabilities underscores the dangers of transporting and storing carbon dioxide. These accidents led to evacuations,

hospitalizations, and severe disruptions, exposing the inadequacies of safety regulations and oversight which still exist today.

Transporting CO2 in pipelines and injecting it underground is inherently risky because CO2 reacts with trace amounts of moisture to form carbonic acid that can corrode pipelines and well equipment and release heavy metals from rocks in aquifers, putting communities and drinking water near this infrastructure at risk of serious harm. The 45Q subsidy incentivizes a rapid buildout of these unsound pipelines and injection wells, already sparking a tremendous backlash against the industry.

Communities near CCS infrastructure face ongoing threats to their health and safety, with limited recourse to hold companies accountable. The technology itself involves risks that cannot be fully mitigated, necessitating pipelines and injection wells that are destined to leak, which threatens public safety and drinking water, making it unsuitable for widespread adoption. Congress has a responsibility to protect its constituents from these dangers by ending subsidies that incentivize the expansion of hazardous CCS projects.

Water Supply Concerns: A Vital Resource at Risk

CCS operations also jeopardize critical water resources, which are already suffering from basic supply concerns. Depletion of groundwater and widespread drought are impacting farmers and communities across the country. Capturing and injecting carbon dioxide underground requires vast amounts of water, competing with agricultural, industrial, and residential needs in already water-stressed regions. Moreover, the risk of groundwater contamination from CCS storage sites poses a long-term threat to drinking water supplies.

The United States cannot afford to compromise its water security for a technology that has consistently failed to prove its value. Prioritizing CCS subsidies over investments in water infrastructure or conservation efforts demonstrates a misplaced set of priorities that harms everyday Americans.

Eminent Domain Abuse and Indigenous Community Impacts

The rapid expansion of carbon pipelines, driven by subsidies like the 45Q tax credit, has intensified eminent domain abuses, forcing land from families and communities without consent. For Indigenous communities, these projects perpetuate a legacy of exploitation and violations of sovereignty. Companies frequently fail to conduct meaningful consultation or secure Free, Prior, and Informed Consent, leaving tribal nations sidelined until plans are finalized.

These pipelines also bring increased risks of violence to Indigenous women and children due to transient workforces housed in "man camps." Documented cases of human trafficking and abuse have accompanied such projects, compounding harms in communities already facing systemic inequities. Safety concerns further underscore the risks, as hazardous CO2 pipelines threaten reservations and nearby rural areas with incidents like the Satartia, Mississippi rupture. Most small or rural communities lack the infrastructure to manage such emergencies, heightening risks to lives and ecosystems.

Stand for Fiscal Responsibility and Public Safety

Repealing 45Q and other CCS subsidies aligns with bipartisan values. For those on the right, the waste of taxpayer money on a failing industry contradicts principles of fiscal conservatism and efficient governance. The widespread fraud in the 45Q program underscores the need for tighter fiscal oversight and accountability.

For those on the left, the risks to public safety, drinking water, and local communities highlight the urgency of ending support for CCS. The industry disproportionately burdens rural and vulnerable communities, exacerbating existing inequalities. Protecting these communities from avoidable harm should be a priority for all members of Congress. CCS claims to deliver greenhouse gas emissions reduction, but consistently fails to do so, in spite of massive public subsidies.

As stewards of taxpayer resources and public safety, you have an opportunity to demonstrate leadership by ending subsidies for the CCS industry. Repealing 45Q would free up tens of billions of dollars that could be better used to support American families, modernize infrastructure, and invest in proven energy solutions.

We urge you to act decisively in the upcoming reconciliation package by repealing 45Q and other CCS subsidies. The American people deserve a government that prioritizes their well-being and financial security. Let us move forward together toward a future that reflects our shared values of fiscal responsibility and public safety.

Sincerely,

National Original Signatories

Bold Alliance
Food & Water Watch
Indigenous Environmental Network
Institute for Policy Studies Climate Policy Program
North American Climate, Conservation and Environment (NACCE)
Oil Change International
Public Goods Institute
Science and Environmental Health Network
350.org

State and Regional Original Signatories

Better Path Coalition
Concerned Health Professionals of Pennsylvania
Dakota Rural Action
Dogwood Alliance
Eco-Justice Collaborative
Illinois Water Authority Association
Ní Bthàska Stand Collective
Turtle Island Restoration Network
350 Seattle
350 Bay Area Action

Signatories

Accelerate Neighborhood Climate Action
Alaska Community Action on Toxics
All Our Energy
Allegheny County Clean Air Now
Alliance for Affordable Energy
Alliance for Democracy

Alliance For Just Money
Animals are Sentient Beings
Bayou City Waterkeeper
Benicians for a Safe and Healthy Community
Better Path Coalition
Between the Waters
Beyond Plastics
Biofuelwatch
Bold Alliance
Breathe Project
Buckeye Environmental Network
Businesses for a Livable Climate
Call to Action Colorado
CASA
CatholicNetwork US
Center for Coalfield Justice
Central Illinois Healthy Community Alliance
Centre for Citizens Consering Environment & Management (CECIC)
Cherokee Concerned Citizens
Citizens Action Coalition of IN
Citizens Against Heartland Greenwashing Projects
Citizens Against Predatory Pipelines
Clean Energy Action
Climate Conversation Brazoria County
Climate Hawks Vote
Climate Justice Alliance
Climate Organizing Hub
Climate Reality NEPA
Climate Reality Project: Chicago Metro Chapter
Coalition to Ban Unsafe Oil Trains
Coalition to Stop CO2 Pipelines
Coastal Watch Association
Color Brighton Green
CO Small Business Alliance
Colorado Businesses for a Livable Climate
Colorado Farm & Food Alliance
Commission Shift
Communities for a Healthy Bay
Community for Sustainable Energy
Concerned Health Professionals of New York
Concerned Health Professionals of Pennsylvania
Concerned Ohio River Residents
CURE
Dakota Resource Council
Dakota Rural Action
Davenport FFF
Defend Our Health
Delaware Riverkeeper Network
Divest NJ
Dogwood Alliance
Don't Gas the Meadowlands Coalition
Don't Waste Arizona
Earth Ethics, inc.
Earthworks
Eco-Justice Collaborative
Economic Justice Action Group/1st Unitarian Church - Portland OR
Elders Climate Action
Empower NJ
Empower our Future
Family Farm Defenders
Food & Water Watch
For a Better Bayou
Fort Bend County Environmental Movement
Fossil Free Tompkins
Fox Valley Citizens for Peace & Justice
FracTracker Alliance
FreshWater Accountability Project
Fridays For Future NYC
Fridays For Future USA
Friends of the Earth
Good Neighbor Steering Committee of Benicia
Grassroots Environmental Education
Great Plains Action Society
Greater New Orleans Housing Alliance
Green House Connection Center
Gulf Fossil Finance Hub
Gulf South Fossil Finance Hub
Healthy Gulf
Hearwood

Hoboken RESIST
Illinois People's Action
Illinois Water Authority Association
Imagine Water Works
Indigenous Environmental Network
Indivisible Ambassadors
Indivisible CA Green Team
Indivisible East Bay
Institute for Policy Studies Climate Policy Program
Interstate 70 Citizens Advisory Group
Intertwined faith community
JCAN: Jewish Climate Action Network NYC
John Muir Project
Junior Philanthropists Foundation
Just Transition Northwest Indiana
JUUstice Washington
Larimer Alliance for Health, Safety, & Environment
Lebanon Pipeline Awareness
Linnton Neighborhood Association, Tank the Tanks
Littleton Business Alliance
Long Island Progressive Coalition
Louisiana People Against Carbon Capture
M-W & Associates, Environmental Policy
Mayfair Park Neighborhood Association
Mental Health & Inclusion Ministries
Metro East Green Alliance
Mi Familia en Accion
Micah Six Eight Mission
Mid-Ohio Valley Climate Action
Milwaukee Riverkeeper
Mind's Eye Productions
Montana Environmental Information Center
Montbello Neighborhood Improvement Association
Move Past Plastic (MPP)
Movement Rights
NEPA Green Coalition
New Energy Economy
New Jersey Tenants Organization
New Mexico Climate Justice
Ní Bthàska Stand Collective
No False Climate Solutions PA
North American Climate, Conservation and Environment(NACCE)
North Braddock Residents For Our Future
North Country Earth Action
North Range Concerned Citizens
Northern Plains Resource Council
Nuclear Information and Resource Service
NY Climate Advocacy Project
NYPAN environmental committee
Ocean Conservation Research
Oil and Gas Action Network
Oil Change International
Oregon Alliance for Democracy
Our Sacred Earth
Partnership for Policy Integrity
Partnership for Southern Equity
Physicians for Social Responsibility
Physicians for Social Responsibility - Los Angeles
Physicians for Social Responsibility Pennsylvania
Plastic Pollution Coalition
Prairie Rivers Network
Progressive Democrats of America - Central New Mexico
Progressives for Climate
Protect PT
Public Goods Institute
RapidShift Network
RISE St. James Louisiana
Rise to Thrive
Rivers & Mountains GreenFaith
San Francisco Bay Physicians for Social Responsibility
Save Ohio Parks
Save Our Illinois Land
Save the Environmental Protection Agency
Schuylkill Pipeline Awareness
Science and Environmental Health Network

Seven Circles Foundation
Solarize Albany
Southwest Organization for Sustainability
Spirit of the Sun
Sunflower Alliance
Sunrise Movement Houston
Sunrise Movement Pittsburgh
Susan Adams Family Farm
System Change Not Climate Change
Tank the Tanks
Texas Campaign for the Environment
Texas Permian Future Generations
The Center on Race, Poverty, and the Environment
The Enviro Show
The Last Plastic Straw
The Science Roundtable on Carbon Capture and Storage
Third Act NYC
Third Act Richmond
Third Act Virginia
TIAA-Divest!
Tompkins County Climate Protection Initiative
Turtle Island Restoration Network
Unitarian Universalist Advocacy Network of Illinois
Unitarian Universalists for a Just Economic Community
Unitarian Universalists for Social Justice
Unite North Metro Denver
UNM Leaders for Environmental Action and Foresight
Valley Improvement Projects (VIP)
Vessel Project of Louisiana
Wall of Women
Washington Physicians for Social Responsibility
Waterspirit
WE ACT for Environmental Justice
Western Organization of Resource Councils
Western Slope Businesses for a Livable Climate
Womxn from the Mountain
Working for Racial Equity
Youth United for Climate Crisis Action
Zero Hour
198 methods
350.org
350 Bay Area Action
350 Colorado
350 Conejo / San Fernando Valley
350 Seattle
350 Silicon Valley
350 Tacoma
350 Triangle
350 Brooklyn
350 Corvallis
350 Hawaii
350NYC

WESTERN GOVERNORS' ASSOCIATION

MICHELLE LUJAN GRISHAM
GOVERNOR OF NEW MEXICO
CHAIR

SPENCER COX
GOVERNOR OF UTAH
VICE CHAIR

JACK WALDORF
EXECUTIVE DIRECTOR

February 12, 2025

The Honorable Shelley Moore Capito
Chairman
Committee on Environment
and Public Works
United States Senate
456 Dirksen Senate Office Building
Washington, DC 20510

The Honorable Sheldon Whitehouse
Ranking Member
Committee on Environment
and Public Works
United States Senate
456 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Capito and Ranking Member Whitehouse:

In light of the Committee's February 12 hearing, Advancing Carbon Capture, Utilization and Sequestration Technologies and Ensuring Effective Implementation of the USE IT Act, attached please find Western Governors' Association (WGA) Policy Resolution 2025-01, Energy in the West.

Western states are leaders in the development and deployment of a range of decarbonization technologies and strategies, including carbon capture, utilization, and storage. The permitting process to transport and geologically store carbon dioxide represents a significant hurdle for industry, and Western Governors believe that regulatory certainty and enhanced coordination are critical to addressing these barriers. Western Governors outline bipartisan recommendations to achieve this in the 2024 initiative report, Decarbonizing the West (attached), which was the culmination of a year-long stakeholder engagement process led by former WGA Chair, Wyoming Governor Mark Gordon.

I request that this document be included in the permanent record of the hearing, as it articulates Western Governors' collective and bipartisan policy positions and recommendations on this important issue.

Thank you for your consideration of this request. Please contact me if you have any questions or require further information.

Sincerely,

Jack Waldorf
Executive Director

Attachments

Policy Resolution 2025-01

Energy in the West

A. BACKGROUND

Western energy production, and its related delivery, are indispensable to meeting our nation's energy demands, and the energy sector is a significant contributor to the economic success of many western communities. Electricity generation and delivery systems are undergoing rapid, significant change across the West. The increasing effects of extreme weather events, the integration of clean energy and distributed energy resources, rapidly increasing demand from data centers and new technologies, the electrification of vehicles and buildings, and the retirement of traditional energy generating assets are all contributing to fundamental shifts in the electricity sector. Ensuring the reliability of energy generation and delivery systems is a priority of every Western Governor.

Western Governors recognize that approaches to energy use and development vary among our states and territories. The West has the vast majority of high-quality energy resources in the United States, including geothermal energy capacity, wind and solar power resources, the majority of oil and natural gas, coal, hydropower, and non-federal United States petroleum. Further, the West has the largest contiguous areas of high-yield biomass energy resource potential, is uniquely situated to produce low carbon intensity, clean hydrogen, and leads the nation in domestic uranium production and advanced nuclear reactor technology development. The presence of federal lands affects energy projects and infrastructure deployment across the West. Planning, permitting, and siting energy generating assets and transmission and pipeline infrastructure requires close coordination between states, private developers, utilities, and federal agencies to create an effective state-federal partnership in energy development, land management, and environmental protection.

B. GOVERNORS' POLICY STATEMENT

Governors' Energy Priorities

1. Western Governors recognize the following as energy policy priorities for the West:

    a. Secure the United States' energy supply and delivery systems, and safeguard against both physical and cybersecurity risks.

    b. Ensure energy is clean, affordable, equitable, and reliable by providing a balanced portfolio of resources.

    c. Increase energy efficiency associated with electricity, natural gas, and other energy sources and uses to enhance energy affordability and to effectively meet environmental goals.

    d. Advance efficient environmental review, siting, and permitting processes that facilitate clean energy development and the improvement and construction of necessary energy infrastructure, while ensuring environmental and natural resource protection.

e. Improve the United States' electric grid's reliability and resilience.

f. Protect western wildlife, natural resources, and the environment, including clean air and clean water, and reduce greenhouse gas emissions.

g. Make the West a leader in energy education, technology development, research, and innovation.

h. Utilize an all-of-the-above approach to energy development and use in the West, while protecting the environment, wildlife, and natural resources, and reducing emissions.

Grid Modernization and Resilience

2. A robust, resilient, and well-maintained energy delivery system is vital to the economy and quality of life in the West. Grid infrastructure in the West faces potential disruptions due to natural disasters, particularly wildfires and extreme heat events, as well as a growing cyber threat landscape. Increased grid threats due to wildfires and extreme weather events highlight the need to develop and use energy systems that are both reliable and resilient to climate change. Upgrades to transmission and distribution infrastructure, including information technology systems, are needed to properly address these risk factors, as well as anticipated increased electricity demand. Coordination between electricity providers and states in energy markets can lead to cost-effective energy for ratepayers and leverage regional resources.

3. Transmission infrastructure in western states often crosses one or multiple federal lands jurisdictions. In these situations, close coordination between states, utilities, and federal agencies is needed to ensure that projects are planned, permitted, and sited in a timely, efficient manner. Western Governors encourage federal agencies to streamline project-permitting reviews to minimize timelines without compromising environmental and natural resource protection or states' roles in those processes.

4. Western Governors encourage Congress to provide federal agencies, particularly the Bureau of Land Management (BLM), the Environmental Protection Agency, the Department of Energy (DOE), the Federal Energy Regulatory Commission, the U.S. Forest Service (USFS), the Bureau of Ocean Energy Management, and the U.S. Fish and Wildlife Service with additional support to enhance staff and resource capacity to conduct environmental review and permitting activities associated with transmission infrastructure.

5. Western Governors recommend federal agencies leverage designated West-wide Energy Corridors to support the effective and efficient permitting and siting of energy infrastructure assets. Where applicable, Western Governors encourage BLM and USFS to integrate designated corridor specifications into local land use plans.

6. Western Governors believe clear, coordinated, and consistent wildfire mitigation strategies, including application of federal vegetation management practices, is integral to maintaining the health of western forests, preventing dangerous and damaging wildfires, and maintaining grid reliability. The Governors support effective and efficient cross-jurisdictional coordination that enables vegetation management for federal transmission and distribution rights-of-way.

Innovation and Technology

7. Western Governors encourage innovation and application of short- and long-duration energy storage, including battery, hydrogen, pumped hydropower, geothermal, and compressed air technologies, where cost-effective. Western Governors also support reconsideration of federal definitions of short- and long-term energy storage with an eye toward incentivizing progressively longer storage capacity.

8. The potential for geothermal energy in the West is vast and brings many benefits, from baseload energy generation to heating and cooling efficiencies. The Heat Beneath Our Feet Chair initiative report is a roadmap for accelerating the development and deployment of geothermal technologies. Western Governors incorporate the recommendations identified in the Heat Beneath Our Feet Chair initiative report into this resolution by reference.

9. Western states are leading the development and deployment of decarbonization technologies and strategies, including carbon capture, utilization, and storage, engineered carbon dioxide (CO_2) removal, and natural sequestration. The Decarbonizing the West Chair initiative report contains recommendations to advance these technologies and strategies to position western states at the forefront of innovation and reduce CO_2 in the atmosphere. Western Governors incorporate the recommendations identified in the Decarbonizing the West Chair initiative report into this resolution by reference.

10. Western Governors are committed to considering advanced and small modular reactors as a reliable and emission-free energy resource.

11. Western Governors are committed to developing regional hydrogen hubs to spur economic development and add more clean energy sources to the region's resource mix.

12. The developing floating offshore wind industry presents a strong economic and sustainable energy generation opportunity for the West. Western states can work collectively, and in consultation with tribal governments and in coordination with stakeholders, to address workforce, economic, infrastructure, social, environmental, and manufacturing challenges associated with offshore wind planning, siting, and deployment.

13. Western Governors commend efforts by the United States Geological Survey and state geological surveys to identify potential critical minerals deposits for alternative energy technologies and other consumer products vital to modern society.

14. Governors also support development of emerging tools and technologies that address barriers to mineral supply chain reliability, including technologies that help recycle or reuse existing critical mineral resources for use in clean energy technologies.

15. Western Governors are committed to leveraging the vast expertise in the West's industry, academic institutions, and national laboratories to make the region an international hub for new energy technology research and development, and energy education.

16. Western Governors encourage Congress and DOE to support and fund research, development, demonstration, and deployment of advanced energy technologies.

17. Western Governors support the creation of public-private research and development partnerships among industry, academia, the national laboratories, and federal agencies to identify promising new technologies, including energy efficiency technologies that advance clean energy with reduced environmental impacts.

Economic and Workforce Development

18. Western Governors and states are committed to encouraging training and education in energy-related fields and ensuring there is an adequate workforce operating under the highest safety standards.

19. Many western states and communities have been affected by localized job losses due to changes in the energy sector and the closure of coal power plants. Western Governors and states are working diligently to facilitate the creation of employment opportunities for displaced energy sector workers.

20. Western Governors offer their support for the U.S. Department of Agriculture (USDA) Rural Energy for America program, which has benefited farmers, ranchers, and rural businesses that are often underserved by other federal energy efforts.

21. Western Governors support funding and long-term authorization for the State Energy Program (SEP), Weatherization Assistance Program (WAP), and Low-Income Home Energy Assistance Program (LIHEAP).

22. Western Governors support legislative measures that promote flexibility for rural electric cooperatives to refinance or adjust loans secured through the USDA Rural Utilities Service.

23. Western Governors support increasing the development and use of energy storage and low- and zero-emissions vehicles and associated infrastructure. WGA's Electric Vehicles Roadmap initiative report provides valuable insights on strategies to effectively integrate electric vehicle charging equipment with local grid infrastructure.

24. Western Governors call on the federal government to lift a barrier to domestic free trade between the contiguous United States and the noncontiguous states and territories in the Merchant Marine Act of 1920 by allowing those jurisdictions to receive energy commodities produced on the mainland but transported by foreign vessels, should those jurisdictions, and the jurisdictions whose ports are being used to ship these materials, desire it.

25. Redundant federal regulation of energy development, transport, and use is not required where sufficient state or territorial regulations exist. Existing state authority should not be replaced or impeded by Congress or federal agencies. Where additional regulations are necessary, federal agencies should consult and coordinate with states, territories, and tribes to ensure collaboration and understanding of unique circumstances within individual states, territories, and tribal nations.

C. GOVERNORS' MANAGEMENT DIRECTIVE

1. The Governors direct WGA staff to work with congressional committees of jurisdiction, the Executive Branch, and other entities, where appropriate, to achieve the objectives of this resolution.

2. Furthermore, the Governors direct WGA staff to consult with the Staff Advisory Council regarding its efforts to realize the objectives of this resolution and to keep the Governors apprised of its progress in this regard.

This resolution will expire in December 2027. Western Governors enact new policy resolutions and amend existing resolutions on a semiannual basis. Please consult http://www.westgov.org/resolutions for the most current copy of a resolution and a list of all current WGA policy resolutions.

Decarbonizing the West

The Initiative of Wyoming Gov. Mark Gordon

Dear Friends of the West,

Western Governors have a long tradition of addressing complicated issues in thoughtful and bipartisan ways that often lead to national policy reform. An important issue western states are facing is the concern about the effects of carbon dioxide in the atmosphere. That is why I chose to focus my Chair initiative at the Western Governors' Association on decarbonizing the West. This topic is not one which yields to simplistic ideas, but rather will benefit from a fuller understanding of policy implications and a more comprehensive discussion of strategies and technologies that can be brought to bear in our approaches to managing carbon.

It is my hope that with an honest dialogue about these strategies, as well as by working together to more fully understand the broad social and economic costs associated with them, WGA can help advance environmentally sound, economically reasonable, and ultimately tenable paths forward as we address decarbonization. Moreover, it is my intention that this report will show effective efforts to manage carbon in the West are already within our grasp and can proceed without compromising our standard of living or hopes for the future.

To this end, it is important that we acknowledge that if the concern is about CO_2 emissions in our atmosphere, then our focus must be on CO_2 more broadly, not just curtailing the use of fossil fuels. This latter approach is far too narrow, ignores important opportunities that will compromise our ability to address this issue in a timely fashion while presenting some unique obstacles. Therefore, this report highlights various technologies and approaches to carbon management, such as carbon capture, utilization, and storage, and nature-based sequestration strategies as well as combinations of them. There are exciting opportunities and developments across the horizon of carbon management and commitment that working together can lead to effective comprehensive solutions.

If people are only being told they have to give something up to address climate concerns, as we have seen, some can prove to be very reluctant to do so. On the other hand, if the conversation is more focused on what we can do to make our industries more efficient and how these opportunities can grow our economy as well as retain and improve jobs and careers while helping our environment and improving our standard of living, then we have a better shot at leading the global effort on decarbonization.

Before I go any further, I thank Idaho Governor Brad Little, Colorado Governor Jared Polis, and Oregon Governor Tina Kotek for taking their valuable time to host workshops in service to this goal. Their willingness to collaborate on challenging issues like decarbonization is what makes Western Governors such a special group. It has been my distinct honor to work with each of them.

The workshops these Governors hosted served as a perfect forum for state leaders to convene with federal representatives, industry experts, academics, nongovernmental organizations, and local stakeholders to share best practices and exchange critical information about emerging carbon management strategies.

The diversity of our states presents opportunities for each of us to pursue as we collectively work toward decarbonizing the West. The range of decarbonization pathways was on display at each of the workshops. In Gillette, Wyoming, we toured the Integrated Test Center, where cutting edge carbon capture technologies are being put to the test with storage sites being investigated nearby. In Boise, Idaho, we learned how forestry, agriculture, and soil management can play a role in sequestering carbon dioxide. The Denver, Colorado, workshop featured discussions on the many innovative direct air capture technologies being developed and tested in western states. And finally, in Portland, Oregon, we delved into the carbon sequestration potential of coastal ecosystems and how biomass can be utilized to remove carbon dioxide. Recognizing that carbon is an essential component of biology, it has been compelling to see these efforts underway and composing a front line in our strategy to reduce excess CO_2 in our atmosphere.

These conversations formed the basis for the policy recommendations outlined in this report. My hope is that they will spur common-sense policy reform we can all rally around and provide a foundation upon which Western Governors can work with our partners in the federal government to accelerate the development of these carbon management methods without compromising our livelihoods, communities, or future.

With a more mature slate of carbon management strategies on the table and an open mindedness to policy options, we will have a much more balanced way of looking at energy development and resource management that provides a range of options for western communities to manage carbon emissions. It will also set western states and territories at the forefront of carbon innovation on multiple fronts.

In closing, I thank all the state and federal agencies, national laboratories, academic institutions, industry proponents, and private citizens that participated in the Decarbonizing the West initiative. While this report marks the conclusion of the initiative, the work to advance these policies must continue. I look forward to confronting this challenge alongside you.

Sincerely,

Mark Gordon
Governor of Wyoming
WGA Chair

Greetings Friends of the West,

The vast resources encompassed in western landscapes and communities provide a strong foundation to effectively address carbon emissions.

The region's history of innovative energy production provides critical infrastructure and a talented workforce capable of advancing engineered carbon removal technologies like CCUS and direct air capture. Large subterranean formations throughout the West have the perfect geology for safely storing carbon in perpetuity. Our open spaces, wetlands, and bodies of water have the potential to naturally sequester millions of tons of carbon each year.

In June of 2023, Wyoming Governor Mark Gordon, Chair of the Western Governors' Association (WGA), launched the Decarbonizing the West initiative to examine opportunities for advancing new and existing decarbonization strategies as a means to reduce carbon dioxide (CO_2) in the atmosphere.

The collective urgency to reduce carbon in the atmosphere is reflected in the net-zero goals set forth by businesses, organizations, and governments nationally and across the globe. While there has never been more urgency to decarbonize, there has also never been more opportunity to do so.

Throughout the year-long Decarbonizing the West initiative, WGA convened a diverse group of stakeholders from public, private, and non-profit organizations to explore practical opportunities for implementing a wide range of carbon management solutions.

WGA is grateful to those who contributed to the initiative and participated in our survey, workshops, and webinars. A special note of appreciation goes out to our western Governors who hosted initiative workshops. The bipartisan leadership of Governor Gordon, Governor Jared Polis of Colorado, Governor Brad Little of Idaho, and Governor Tina Kotek of Oregon is the foundation upon which WGA developed this timely report.

As issues of decarbonization continue to gain momentum, this report serves as a resource for policymakers committed to safely and effectively reducing CO_2 in the atmosphere.

WGA Chair initiatives have a long track record of providing a unique platform for bipartisan policy discussions that yield practical and actionable results. These are collaborative endeavors strengthened by Governors' engagement across the West and generously supported by our sponsor community and stakeholders who help make this work possible.

I extend my deepest gratitude to Governor Gordon for his outstanding leadership as WGA's Chair and for his passion and commitment to this issue. The findings and recommendations found within this report will inform Western Governors' policy and help drive WGA's future advocacy work. I look forward to continuing these efforts alongside you.

Jack Waldorf
Executive Director
Western Governors' Association

EXECUTIVE SUMMARY

Wyoming Governor Mark Gordon, Chair of the Western Governors' Association (WGA), launched the Decarbonizing the West initiative in 2023 to examine how decarbonization strategies can position western states at the forefront of innovation and reduce CO_2 in the atmosphere. The initiative explored a wide range of engineered decarbonization approaches as well as natural sequestration through enhanced land and agriculture management practices, all of which present enormous opportunities for western states.

This report is the culmination of an extensive stakeholder process that engaged experts from across a range of states, industry sectors, and levels of government. This process was facilitated by the leadership and support of other Western Governors, who, through hosting a series of regional workshops, highlighted the growing need and diverse set of approaches to decarbonize the West.

The initiative examined federal policy recommendations in three focal areas that offer the greatest opportunities for near-term deployment of strategies to reduce the CO_2 in the atmosphere:

- Carbon capture, utilization, and storage and engineered carbon dioxide removal;
- Natural sequestration; and
- Cross-cutting and regional opportunities.

Wyoming Governor Mark Gordon moderated a panel at each of the Decarbonizing the West initiative workshops he attended. At the Colorado workshop, he sat down with experts from the Lawrence Berkeley National Laboratory, Great Plains Institute, and Global Thermostat to discuss regional and collaborative approaches for carbon removal.

Brad Crabtree, the Assistant Secretary for the U.S. Department of Energy's Office of Fossil Energy and Carbon Management, and Jason Begger, the Managing Director of the Wyoming Integrated Test Center, talked with Wyoming Governor Mark Gordon while walking the grounds of the Dry Fork Power Station in Gillette, Wyoming.

BACKGROUND

Achieving sensible, economy-wide decarbonization will require carbon removal and reduction strategies to be deployed in concert with carbon-free energy sources, energy efficiency strategies, expanded electricity generation and transmission, and the use of low-carbon fuels and feedstocks.

Recently, government and the private sector have catalyzed growth in the carbon capture and removal industry with the goal of capturing and storing billions of tons of CO_2 annually.

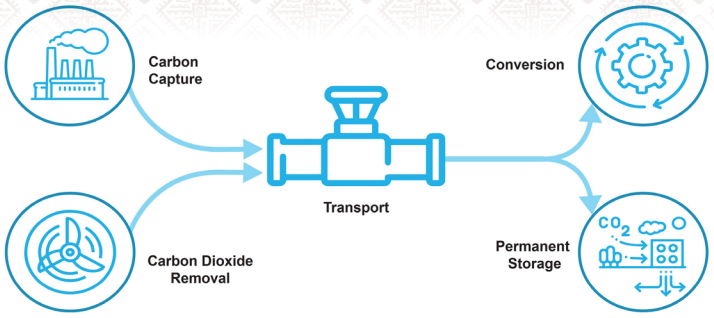
Carbon capture, utilization, and storage (CCUS) and other point source carbon reduction strategies prevent carbon emissions and thus play a necessary role in decarbonization. Carbon dioxide removal (CDR) is a broad term encompassing approaches that remove CO_2 directly from the atmosphere through engineered or natural means. Captured or removed carbon can be stored underground, including through Enhanced Oil Recovery (EOR), and in value-added products or in natural carbon sinks. CCUS and engineered CDR technologies like direct air capture (DAC) have demonstrated technology readiness to be deployed at a meaningful scale, but while deployment is proceeding, it faces policy and cost barriers.

In addition to these engineered solutions, nature-based solutions will also play a critical role in reducing carbon emissions. Forests, rangelands, wetlands, and coastal ecosystems can act as carbon sinks, sequestering large amounts of carbon, and there are a wide range of management strategies available for maintaining or enhancing such carbon stocks. Factors like rising temperatures and an increased frequency of natural disasters like drought and wildfire can threaten a landscape's ability to sequester carbon. Activities to mitigate these risks can enhance other environmental values like improved water and air quality and can produce meaningful carbon management benefits. Nature-based solutions like reforestation and restorative agriculture are already being implemented at large scale in some places. While most lands are not explicitly managed for carbon benefits, implementing certain land management practices can achieve numerous co-benefits while enabling these ecosystems to more effectively remove or sequester carbon dioxide from the atmosphere.

Offsets, which allow entities to compensate for their emissions by investing in activities that reduce or remove carbon elsewhere, generate the primary economic value for carbon management projects. Today, the majority of carbon offsets are transacted in voluntary carbon markets, which are growing rapidly in response to private sector demand.

Tax credits are another mechanism to incentivize the deployment of CCUS and CDR technologies. The 45Q tax credit, for example, was established in 2008 to provide monetary credit for carbon oxide (including CO_2, carbon monoxide, and carbon suboxide emissions) in geologic storage, stored through enhanced oil recovery, or via other means. Recent expansions of the credit offer a transformative opportunity to advance CCUS and CDR by encouraging investment and innovation in carbon removal solutions.

The range of engineered CO_2 removal technologies and nature-based sequestration pathways carry their own benefits and challenges, but all can play a role in decarbonizing the West.



DECARBONIZATION PATHWAYS

CCUS and Engineered Carbon Dioxide Removal

Point Source Capture

Carbon capture refers to the process of capturing CO_2 emissions from a large point source, such as a power generation plant or industrial facility. This is typically achieved by retrofitting emitting facilities such as coal or gas fired power plants with specialized technology designed to extract CO_2 from the process for other uses or permanent storage.

In addition to use on power generating plants, CCUS and other point-source capture techniques can also be a potent solution for decarbonizing hard-to-abate sectors like steel, cement, and petrochemical manufacturing. These sectors account for an estimated 30 percent of global greenhouse gas (GHG) emissions and often require the use of carbon within their manufacturing processes.

The U.S. Department of Energy (DOE) predicts CCUS will be the largest source of long-term emissions reduction, and that both carbon utilization and storage will be necessary components in reaching carbon reductions not achievable through other decarbonization methods and technologies.

Direct Air Capture

Unlike CCUS, which addresses point-source emissions, Direct Air Capture (DAC) removes CO_2 directly from the atmosphere for permanent geologic storage, including EOR or conversion into value-added products. Recent surges in innovation and investment have drawn increased attention to developing DAC technologies.

DAC is typically performed in a two-step, cyclical process involving capture and regeneration. Most systems use liquid solvents or solid sorbents to capture atmospheric CO_2 while filtering out other air components: high concentrations of CO_2 are separated, and the material is regenerated. Both solvent and sorbent systems are heat and energy-intensive processes and require varying amounts of electricity. Some DAC systems also use more novel approaches like mineralization, in which minerals are used in place of synthetic sorbents to leverage natural carbon absorption processes, facilitating efficient capture and storage at a large scale.

DAC offers quantifiable and permanent carbon removal, making it a valuable type of credit in voluntary carbon markets and under federal tax code.

Utilization and Conversion

By far, the largest use of carbon dioxide in the West is for EOR, producing a lower-carbon intensity and secure source of oil. There is also the potential for captured CO_2 to be converted into value-added commodities such as fuels, chemicals, and building materials, thus generating revenue and potentially reducing the overall cost of CO_2 capture and removal. However, life-cycle emissions for these products can vary widely and must be investigated.

Life-Cycle Analysis

For carbon reduction and removal projects, monitoring, reporting, and verifying project outcomes is a key factor in making projects economically viable and ensuring social license to operate. For use, conversion, and other projects that require an offtake agreement, in which carbon credits are purchased today at a set price in exchange for future carbon reductions, an alternative process is required to prove long term and net carbon reduction benefits.

Life Cycle Analysis (LCA) is a methodology to assess the environmental effects of a product or service throughout the course of its life. For example, LCA can be used to demonstrate the lower net carbon footprint of specific fuel types, such as oil produced through EOR. For manufactured products, LCA typically tracks stages from material extraction, processing, manufacturing, distribution, use, disposal, and end use. This analysis considers the net emissions of the production process, product quality, and a CO_2-derived product's ability to displace an incumbent product.

Geologic Carbon Storage

Once captured, CO_2 can be injected into subsurface geologic formations, such as saline formations, depleted oil and gas reservoirs, or reactive formations made of basalt or other minerals, where it is stored, preventing its release into the atmosphere. This process requires a Class VI well permit, obtained through the U.S. Environmental Protection Agency (EPA) or states granted with primacy to administer the EPA program.

Storage sites must possess specific characteristics like sufficient space, injectivity, integrity, and depth, to ensure safe and permanent storage of CO_2. Many western states possess suitable geology that could enable large-scale carbon storage. In addition, due to the long history of oil and gas production in some western states, many western energy communities possess institutional knowledge of subsurface geology and the technical expertise to manage it.

Enhanced Oil Recovery

Captured CO_2 can also be used in EOR, a process that involves injecting substances such as CO_2 into oil reservoirs to increase the amount of oil that can be extracted from aging or depleted fields. Captured CO_2 can be purified and used for EOR operations, reducing the emissions typically associated with this process. The process of EOR results in a low-carbon oil at a high volume and can help extend the production value of oil and gas fields that have passed their primary production phase while permanently storing large amounts of carbon.

Transportation

Carbon dioxide must be transported to its permanent storage site or utilization facility. Safe and reliable transport of CO_2 is therefore an essential consideration.

There are just over 5,000 miles of CO_2 pipeline infrastructure operating in the U.S. today, with the vast majority located in the West. Pipelines remain the safest and most cost-effective way to transport CO_2 and many other commodities. CO_2 pipelines have been used in the U.S. for nearly half a century and are subject to rigorous federal safety regulation.

For some conversion and utilization applications, multimodal transportation, including rail, barge, and tankers, is a sufficient, in-place option for delivering lower volumes of CO_2.

WEBINAR

Permitting Carbon Transport Infrastructure

Permitting carbon transport infrastructure "is nonnegotiable if we're serious about decarbonizing in this country," Scyller Borglum, the Underground Storage Market Lead at WSP, said during the final Decarbonizing the West initiative webinar.

To reduce inefficiencies within the permitting process, which can take decades, Borglum and her co-panelist, Harry Warren, a Senior Consultant at the U.S. Department of Energy's (DOE) Loans Program Office, said more regulatory certainty, interagency coordination, and communication are key.

"Everybody in the energy industry right now feels that the permitting process is painfully slow and frustrating," Borglum said. "I am acutely aware of the importance of having environmental assessments and environmental impact statements... We want to know that the t's have been crossed and the i's have been dotted, but I would argue that we need to take a good, hard look at what is not effective, and what's slowing us down beyond doing our due diligence."

During the final Decarbonizing the West initiative webinar, Scyller Borglum, the Underground Storage Market Lead at WSP, joined Harry Warren, a Senior Consultant at the U.S. Department of Energy's (DOE) Loans Program Office for a discussion about policy mechanisms that can be leveraged to advance carbon transport projects.

A good first step, Borglum and Warren said, is for the federal government to provide additional regulatory certainty about accepted pipeline pressures, pipe thickness, the depth at which pipelines must be buried, and how close they can be to a community, which many expect to be addressed in a forthcoming rulemaking from the U.S. Pipeline and Hazardous Materials Safety Administration.

"I think that will be something that communities and the states can look to and rely on as a new set of standards that, as long as they are complied with, will raise people's feelings that there aren't safety issues related to transportation that are not well understood," Warren said. "I certainly think that the extent of our process is one that people should feel good about the breadth and completeness of."

Natural Sequestration

Land Management

Terrestrial and coastal ecosystems play a crucial role in carbon management. Plants absorb CO_2 from the atmosphere and store the carbon in their biomass, which then accumulates in the soil or sediment. Restoring degraded lands and implementing sustainable land management practices can enhance carbon sequestration and ecosystem resilience. These practices also provide co-benefits, such as biodiversity conservation, watershed protection, and enhanced ecosystem services.

According to the Nature Conservancy's Reforestation Hub, 148 million acres of forests in the U.S. would benefit from reforestation. In addition to protecting western communities from post-fire disasters, reforesting this acreage could capture 535 million tons of CO_2 each year, the equivalent of removing 116 million cars from the road.

Agriculture and On-Farm Practices

Restorative and climate-smart agricultural practices offer significant potential for sequestering atmospheric CO_2 in agricultural soils and biomass. These practices include a range of techniques designed to enhance soil health, increase carbon storage, and reduce greenhouse gas emissions, in turn promoting long-term agricultural production.

Proven conservation practices, such as no-till farming, cover cropping, and agroforestry promote the accumulation of organic carbon in soil through enhanced plant growth, reduced soil disturbance, and increased biomass retention. By maintaining soil cover, utilizing high-carbon soil amendments like biochar, and minimizing soil erosion, carbon sequestration into the soil can be improved and stored for extended periods of time, enriching the health and productivity of soils.

Conservation practices also emphasize the reduction of greenhouse gas emissions associated with agricultural activities. Adopting precision agriculture techniques like optimizing feed and fertilizer use can minimize emissions of greenhouse gases released from agricultural soils and livestock production while providing additional on-farm benefits.

Biomass

Biomass is an organic material generated from a variety of sources, including wood and wood processing waste, agricultural crop residues, and other biogenic materials. These materials are carbon rich, making them promising feedstocks for fuel and energy production. Woody biomass can be used and converted to serve many beneficial purposes, including energy, soil amendments, forest products, and liquid fuel, and they can provide net CO_2 reduction and mitigation benefits.

Monitoring, Reporting, and Verification (MRV):

Monitoring, reporting, and verification (MRV) is a multi-step, quantitative accounting process that involves measuring the amount of CO_2 reduced from a certain activity and reporting those findings to an accredited third party, who then verifies those results to generate carbon credits from the activity. This third-party validation is a key step in providing assurances to buyers, communities, and other stakeholders that carbon projects capture, remove and store carbon.

Biomass carbon removal and storage (BiCRS) describes a range of technologies and processes that use biomass to remove atmospheric CO_2 and store it underground or convert it into low-carbon products. One primary BiCRS pathway is bioenergy with carbon capture and storage (BECCS), in which biomass is utilized to produce energy and the carbon released in the process is captured and stored — this represents a potential opportunity for large-scale CDR and can be used in existing energy infrastructure.

Other BiCRS pathways convert biomass residues to low-energy products like bio-oil, which can be stored more easily than other forms of carbon, potentially enabling large-scale, permanent carbon storage. This is an especially attractive option due to the mobility of the technology and the availability of storage sites.

Biomass can also be utilized for natural carbon dioxide removal and storage through the use of biochar as a soil amendment.

Voluntary Carbon Markets and Credits

Today, nearly all CO_2 removal projects are designed to generate carbon credits that are transacted via the voluntary carbon market. Voluntary carbon markets allow emitters to offset their emissions through the purchase of credits generated by projects that remove or reduce carbon emissions from the atmosphere. These markets are facilitated by a number of actors, including project developers, who generate credits; retailers and brokers, who provide sourcing and distribution services; and buyers or end purchasers, who purchase credits to offset their own emissions, generating revenue and capital for the project developer.

Each credit, which represents one ton of CO_2 avoided or removed, must be verified by a third party to ensure credits are high quality. Within this market structure, standard-setting bodies and registries audit, issue, and verify the integrity of carbon credits through a process called monitoring, reporting, and verification (MRV).

RECOMMENDATIONS

The Decarbonizing the West initiative examined how decarbonization strategies and technologies, including CCUS, DAC, and natural sequestration can position western states at the forefront of innovation and reduce CO_2 in the atmosphere. Under the leadership of WGA Chair and Wyoming Governor Mark Gordon, WGA conducted a robust stakeholder engagement process consisting of a public scoping survey, regional workshops, webinars, and conversations with industry experts.

The information gathered from these examinations is compiled into policy recommendations included in this section. The recommendations are organized into three categories to reflect different decarbonization pathways: CCUS and engineered carbon dioxide removal, natural sequestration, and cross-cutting regional opportunities.

Recommendations for CCUS and Engineered Carbon Dioxide Removal

Engineered carbon dioxide removal, which includes DAC and BiCRS, is an emerging industry driven by policy and private sector demand for carbon management solutions. Most engineered CDR technologies are still at pre-commercial stages of development. CCUS is more developed, with some commercial deployment and infrastructure in place. The following recommendations support the development of engineered CDR and CCUS technologies and alleviate some of the obstacles to deploying these solutions in the West.

Support Large-Scale Technology Development

CCUS and CDR require high capital expenditures. These up front costs and the newness of the technologies, particularly DAC, and lack of familiarity with geologic storage in some cases can pose financing challenges to project developers. Funding research and development programs can help developers prove the efficacy of their technology and clear initial hurdles of front-end investment and financing.

Capital expenditure incentives can be helpful in driving down front-end costs, especially early in the development process when costs are still relatively high. First movers in this space should be encouraged through incentives. This will encourage adoption of CCUS or other point source capture technologies in heavy industries or hard-to-abate sectors, where retrofits can be a costly expense with little reward.

Provisions in the Infrastructure Investment and Jobs Act (IIJA), the Inflation Reduction Act (IRA), and other initiatives are designed to generate interest and incentives for commercial deployment of CCUS. However, the authorization of billions of dollars of grants loses its usefulness when the funds are not actually being deployed. Several large CCUS projects that have received grants across the West are in limbo since funding contracts remain in the queue for months, sometimes much longer, awaiting final federal approval.

Pilot-scale projects and technological innovation can help drive down costs, but, to unlock the full commercial potential of DAC, additional and timely policy support will also be needed. The IIJA provided the DOE Office of Clean Energy Demonstrations billions of dollars to support demonstration efforts and front-end engineering and design (FEED) studies which can help technologies become more cost and resource effective. To achieve large-scale removal, more investment will be needed to construct pilot-scale facilities, improve operability, and demonstrate commercial feasibility.

Carbon technology development centers, such as Wyoming's Integrated Test Center or the National Energy Technology Laboratory's Direct Air Capture Test Center, provide opportunities for proponents to test and develop core technologies and evaluate operability and performance of the entire system at a large scale, under real-world conditions. Demonstrating the success of these core technologies provides opportunities to address challenges and threats in a low-cost and low-risk way, a step that is critical to securing capital backing and building commercial support. These institutions are vital partners in community engagement and education opportunities.

Recommendations to support large-scale technology development:

- DOE should fund pilot and commercial scale facilities for engineered CDR and CCUS technologies to improve operability and demonstrate commercial feasibility.
- DOE must dedicate sufficient resources to finalize CCUS and CDR funding agreements.

Wyoming Workshop

Wyoming Governor Mark Gordon launched his WGA Chair initiative, Decarbonizing the West, on September 21 in Gillette, Wyoming. During his opening remarks, he called on the West to put politics aside and unite in the name of decarbonization.

"If we can change the conversation from fossil [energy] bad, renewable [energy] good, to what do we do to make things work better, what do we do to reduce carbon dioxide in the atmosphere, what are our opportunities to grow our economy … we have a better shot of addressing this issue and leading the global charge," Governor Gordon told the crowd at Gillette College.

Governor Gordon proceeded to sit down with Brad Crabtree, the Assistant Secretary for Fossil Energy and Carbon Management, for a discussion about the federal landscape for carbon capture, utilization, and storage, as well as ongoing DOE efforts to advance the development and implementation of carbon capture technology.

"This approach… about technology, about pathways to getting to zero that retool industries to continue to support the livelihoods and communities that depend on those industries rather than transitioning away from them, is really needed right now," Assistant Secretary Crabtree said.

To this end, panelists spoke about the regulatory landscape for CCUS development as well as the experiments being conducted at the Wyoming Integrated Test Center to advance carbon capture technologies.

Wyoming Governor Mark Gordon aptly kicked off his Decarbonizing the West chair initiative in Gillette, Wyoming, where workshop attendees got a chance to tour the Wyoming Integrated Test Center – one of the world's only test centers for carbon capture and utilization technologies using actual coal-based flue gas from an operating coal-fired powered plant. The project in this picture, operated by Kawasaki Heavy Industries and the Japan Carbon Frontier Organization, will demonstrate a novel CO_2 separation and recovery technology using solid absorbents.

Create Regulatory Certainty for Removal, Transportation, and Storage

Engineered CDR and CCUS facilities must have access to the infrastructure necessary to store or utilize captured carbon. The permits required to inject carbon dioxide underground are a significant hurdle for the industry. Geologic carbon storage represents a safe way to store CO_2 long term and will be an essential enabler for large-scale carbon capture and removal.

In the 13 years since EPA's Underground Injection Control (UIC) Class VI program was established, EPA has issued just six Class VI permits, only two of which were constructed and are active today. Policy support and funding opportunities in the IIJA and the IRA, including an enhanced 45Q tax credit, have spurred interest in carbon storage projects, significantly increasing the number of pending permits in EPA's queue. Long and uncertain permitting timelines are a significant challenge to developers, motivating them to site projects in states that have been granted Class VI permitting primacy, or in countries with a more streamlined regulatory environment. EPA should continue efforts to expand regulator training and increase staff capacity to expedite the permitting process for Class VI wells within their jurisdiction and expediting state primacy applications.

States with primacy have demonstrated an ability to permit wells much faster than EPA, providing developers and investors with a layer of regulatory certainty to ensure their projects can be built. Granting states primary enforcement authority allows state agencies to leverage existing knowledge and expertise of geologic features, community perceptions, and other environmental factors to evaluate projects and permit wells in a more efficient and timely manner, and can help address the federal backlog of applications. Many western states already have primacy over other well classes and have established or designated responsible agencies to oversee these programs; these agencies are best positioned to make permitting decisions for geologic carbon storage.

To date, EPA has only granted Class VI primacy to three states: North Dakota, Wyoming, and Louisiana. The IIJA

provided $48 million in funding to help states and tribes establish UIC Class VI programs to regulate geologic carbon storage activities. In 2023, 25 states and tribes submitted letters of intent to EPA, signaling their interest in obtaining Class VI permitting primacy. As more states look to gain primacy, EPA should establish clear and consistent guidelines for obtaining primacy and should increase agency capacity to review state primacy applications in a more timely manner.

Underground injection regulations under the Safe Drinking Water Act enable EPA to issue exemptions for aquifers that do not or will not serve as drinking water sources. Historically, industries have used these exemptions for oil and gas extraction and waste disposal. EPA estimates that 98 percent of these exemptions are associated with oil and gas production, with a third of the exemptions being used for enhanced oil recovery, a process which involves subsurface CO_2 injection. Despite this, when EPA established the Class VI rule for geologic storage, it prohibited aquifer exemptions, hindering the consideration of suitable formations for geologic storage. EPA should allow aquifer exemptions for Class VI wells, thus unlocking substantial additional subsurface formations for geologic carbon storage.

Clear state-level regulatory frameworks for site characterization, injection rate limitations, and post-injection monitoring requirements are essential to managing the risks associated with carbon storage projects. These frameworks should address issues including delineation of pore space, subsurface property rights, interstate CO_2 flow, eminent domain, post-closure site monitoring, and liability for long-term storage. Regulatory certainty is crucial to garnering public trust, attracting investment, and supporting technological development.

Carbon transportation infrastructure and pipelines are often considered the backbone of carbon management, linking capture and removal operations to storage opportunities. Navigating permitting and approvals at the federal level is a significant and time-consuming challenge for developers, especially considering that there is no single federal siting authority for carbon transport or storage projects. To this end, state agencies can be more efficient and effective at permitting and regulating these projects. However, collaboration between state and federal agencies is essential to ensuring effective regulation of capture, transport, and storage activities, especially as states seek and gain Class VI primacy and begin to develop interstate systems.

Beyond siting, other facets of CO_2 pipeline development demand regulatory certainty to facilitate expanded development. The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) is responsible for overseeing safety of CO_2 pipelines and has initiated a public rulemaking to establish more robust regulatory frameworks for this industry. As it considers what these frameworks will look like, PHMSA should ensure that regulations are uniform; this can deliver much-needed certainty to investors and communities with safety concerns. Existing oil and gas frameworks can serve as a strong example for effective regulation that has been in effect for decades; this experience and expertise should be leveraged to establish similarly effective regulatory mechanisms for CO_2 transport.

Carbon transportation projects require large-scale infrastructure, inevitably crossing a patchwork of jurisdictions and land ownerships. This lengthy permitting process can require dozens of permits from numerous state and federal agencies, counties, and local governments. Because of their scale, these projects will likely require substantial review under the National Environmental Policy Act. While large

WEBINAR

Liability for Long-term Geologic Carbon Storage

The potential to permanently store vast quantities of captured carbon in the West's subterranean geologic structures is often talked about as a game changer in the world of decarbonization, but there are significant risks and liability concerns that give developers and investors pause.

Reice Haase, the Deputy Executive Director of the North Dakota Industrial Commission, and Madeleine Lewis, a licensed attorney and policy research scientist at the University of Wyoming's School of Energy Resources, joined WGA for a webinar in which they explored strategies for mitigating these risks and addressing the liability challenges that may be prohibitive to the development of geologic carbon storage projects.

One of the keys to this endeavor, they said, was to improve the industry's external communication, inviting frequent inspections, making data publicly available, and expanding community engagement to demonstrate the safety of the industry.

It's also critically important for fostering a philosophical shift in how we view carbon itself.

"We currently see [carbon] as a waste and have kind of a waste disposal type of regulatory framework," he said. "We really should see it as a beneficial use and really focus more on the use side of [carbon capture, utilization, and storage] and foster some of those markets and incentivize developments, seeing CO_2 as a resource for future use. I argue that would really be a truly global solution."

developers and industries have the resources and experience to navigate this process, it can be prohibitive to startups and new entrants to the market. For projects funded under their purview, federal agencies should serve as a conduit between project proponents and other relevant agencies to expedite the permitting process. This is already standard practice for pipeline projects funded by the Carbon Dioxide Infrastructure Finance Act (CIFIA) or other DOE Loan Program Office (LPO) programs. LPO has experience and demonstrated efficacy serving in a coordination role between federal agencies.

In 2021, the Council on Environmental Quality released a report on CCUS which inventoried the various federal permits that may be required for carbon capture, transport, and storage projects. Of the 16 identified, 11 would potentially affect the development of CO_2 pipeline projects. To provide clearer timelines and guidance for the permitting process, CCUS and CO_2 pipeline projects were made eligible under Title 41 of the Fixing America's Surface Transportation Act (FAST-41). The FAST-41 framework can serve as a clearinghouse for relevant federal stakeholders and may be a helpful tool to leverage for coordination throughout the permitting process.

Recommendations for creating regulatory certainty for removal, transportation, and storage:

- Federal policies aimed to limit CO_2 emissions should be tailored to state needs and promote, not impede, the development and deployment of CO_2 capture technologies. Federal regulations should seek to expand cost-effective deployment of CO2 capture at power plants and other industrial sources.
- EPA should expand regulator training and increase staff capacity to expedite the permitting process for Class VI wells within their jurisdiction.
- EPA should establish clear and consistent guidelines to states for obtaining primacy and should increase agency capacity to review state primacy applications in a more timely manner.
- EPA should include aquifer exemptions for Class VI wells.
- Congress and federal agencies should evaluate and address steps that may cause undue delays in permitting, including improved coordination of federal agency activities.
- PHMSA should ensure that CO_2 pipeline safety regulations are uniform and should leverage experience and expertise from the oil and gas industry to establish similarly effective regulatory mechanisms for CO_2 transport.

Catalyze Market Development

Policies at the federal level can contribute to the establishment of a market for carbon dioxide removal, giving the industry the certainty needed to continue growth and the development of a long-term, sustainable industry.

The Energy Improvement and Extension Act of 2008 established the 45Q tax credit, a performance-based tax credit to power plants and industrial facilities that capture and store carbon oxide, including CO_2, that would otherwise be emitted into the atmosphere. The 45Q tax credit did not become an effective driver for carbon removal technologies until it was expanded under the Bipartisan Budget Act of 2018 to include direct air capture. In 2022, The IRA implemented additional enhancements to 45Q, significantly increasing incentives for DAC, geologic carbon storage, and use for EOR.

The 45Q tax credit awards up to $60/ton for carbon capture and utilization from industrial or power generating facilities, including EOR, and up to $130/ton for DAC and utilization. While this is a significant increase from previous levels, credits for storage are considerably higher at $85/ton for carbon capture and geologic storage, and the $180/ton for DAC with storage. The utilization pathways are unfairly penalized compared to storage pathways, despite delivering similar carbon benefits.

To claim the 45Q credit for utilization, life cycle analysis is required to quantify the emissions reductions and net climate impact. This allows storage and utilization pathways to be compared on the same scale. Congress should level the 45Q tax credit to value storage and utilization pathways equally. This would prompt further innovation and support the deployment of a range of technologies that will be critical to an all-of-the-above decarbonization approach.

45Q also requires emissions to be captured at a "qualified facility" and stored permanently in geologic formations, or through a qualified use. These requirements may exclude certain CDR options, like certain BiCRS pathways, from claiming this credit, despite offering large-scale and permanent removal and storage options. Congress should consider additional technology-neutral incentives, complementary to 45Q, that support a menu of CDR options.

The IRA amended the 45Q tax credit to provide further clarity on the transferability of the credit by simplifying the process for monetizing 45Q; owners of qualified facilities can now sell portions of their credits to third parties or seek direct payments for the credits from the federal government. While this has helped spur project development, its current structure poses limitations for projects developed in partnership. Additional clarity on the transferability of the

credit is needed to ensure that both landowners and project developers can receive financial benefits from projects.

Tax credits like the 40B Sustainable Aviation Fuel Credit or the soon-to-be implemented Clean Fuel Production Credit are supportive measures designed to increase the production and sale of low-carbon fuel alternatives. However, many of these opportunities are limited to fuels or building composites. Establishing production tax credits to incentivize the production and deployment of low-carbon chemical compounds like ethanol or methanol can act as a significant industry and market catalyst.

EPA's Renewable Fuel Standard (RFS) program, established under the Energy Policy Act in 2005 and expanded by the Energy Independence and Security Act of 2007, seeks to reduce greenhouse gas emissions by mandating a certain amount of renewable fuel to replace or reduce petroleum-based transportation fuel. Gasoline or diesel refiners or importers must comply by blending renewable fuels into transportation fuel or acquiring Renewable Identification Numbers (RINs), which function as tradable credits.

RINs, in addition to state-level policies like California's Low Carbon Fuel Standard, have made it cost-effective for dairy farms to install anaerobic digesters to capture emissions like methane and utilize them for renewable electricity generation or fuel. Implementing co-digestion by accepting additional food or agriculture waste may yield significantly higher volumes of renewable natural gas, maximizing emissions reductions on dairies where digesters are sited. Despite providing clear benefits, the RINs system grants anerobic digesters a less cost-effective credit when food waste is added to the system, effectively disincentivizing the practice.

At WGA's 2023 Winter Meeting in Jackson Hole, Wyoming, Holly Krutka, the Executive Director of the School of Energy Resources at the University of Wyoming, and Charles Gorecki, the CEO of the Energy and Environmental Research Center at the University of North Dakota, spoke about how their states have created a hospitable environment for carbon capture, utilization, and storage projects by funding research and streamlining the permitting process.

In 2023, EPA published a final rule updating the RFS program; this rule, in part, eliminates this disincentive for the wastewater sector. EPA should extend this rule to agricultural digesters to make on-farm co-digestion more economically viable. Providing economic incentives for agricultural digesters to perform co-digestion under the RFS program can encourage more dairies to deploy digesters, produce higher yields of renewable natural gas, and divert larger amounts of organic waste.

Small landowners and farmers are eligible for federal incentives and tax credits for low-carbon fuel and avoided emissions, including RINs credits under EPA's RFS program and 45Q tax credits for sequestering carbon, but they can be difficult to leverage at smaller scales. Improving the transferability of RINs credits would help small landowners and farmers reap maximum benefits for implementing carbon reduction projects.

Recommendations to catalyze market development:

- Congress should amend Section 45Q of the U.S. Tax Code to provide credit based on the amount of CO_2 removed, regardless of whether it is stored or utilized.
- Congress should consider additional technology-neutral incentives, complementary to 45Q, that support a menu of CDR options including BiCRS and the production of low-carbon chemicals.
- EPA should update RFS rules to include co-digestion for agricultural digesters.
- EPA should improve the transferability of RINs credits under the RFS to allow small farmers and landowners to maximize benefits from carbon projects.
- The Department of the Treasury should improve transferability of RINs and 45Q credits for projects developed in partnership.

Denver Workshop

In just a few years, carbon removal technology went from a provocative idea to a legitimate piece of the decarbonization puzzle, with the potential to remove gigatons of carbon dioxide from the atmosphere.

The third workshop of Wyoming Governor Mark Gordon's Decarbonizing the West initiative convened carbon removal experts from around the region to examine the advancement of carbon capture and discuss opportunities for further accelerating its development.

"Here in Colorado, we're making bold progress towards achieving our renewable energy goals and we know that carbon management will be an important tool for our state," Colorado Governor Jared Polis told the workshop attendees in Denver, Colorado. "Western states are uniquely positioned to support the development of direct air capture. Abundant renewable energy resources, favorable geology for storage, supportive policies, and leadership really make it possible for the West to lead the nation, and even the world, in carbon removal."

Many of the panelists said the future of carbon removal technology is more dependent on developing good policy and regulatory frameworks than technological innovation.

"I think one of the big challenges with regional efforts is who's the consumer, who's the producer, and how do you balance that in a policy framework? How do you socialize the cost of things that you need to do? And how do we value carbon itself?" Governor Gordon asked the panel he moderated. "I think if we're going to move forward, we're going to have to build that framework across states."

Governor Jared Polis hosted a Decarbonizing the West initiative workshop in Denver, Colorado. It focused on carbon removal technologies for direct air capture and geologic carbon storage.

Enable Market Expansion

While supply-side incentives like 45Q are instrumental in encouraging the development of CCUS and CDR technologies, demand-side incentives are also needed to develop stable markets and ensure carbon removal activities are economically viable in the long term.

The IIJA directed DOE to establish and manage a $115 million CDR funding portfolio consisting of the DAC EPIC Prize, the DAC Pre-Commercial Technology Prize, the CDR Purchase Pilot Prize, and DAC Pilot Program. These programs provide funding to developers navigating different phases of pre-commercial CDR development. Continuing to support these programs, as well as implementing similar programs to support other technology solutions, can be a meaningful step in ensuring that these technologies can reach and thrive in commercial markets.

By ensuring predictable and reliable revenue streams, demand-side support policies will reduce financial risk and enable a more stable investment environment for CCUS and CDR technologies. Once technologies have been proven at pilot scale, demand-side incentives can help address remaining barriers to achieving commercial scale deployment.

The federal Buy Clean Initiative, created through Executive Order 14057, prioritized the use of low-carbon steel, cement, and other aggregates with low embodied carbon for federal infrastructure projects. Continuing and expanding these government procurement programs can be an effective way to expand the deployment of carbon capture, utilization, and conversion projects in hard-to-abate sectors.

Federal policy can also support the development of the CDR market by authorizing federal agencies to purchase carbon credits via the voluntary carbon market. DOE's CDR Purchase Pilot Prize enables the federal government to be a purchaser of CDR credits. This will help evaluate the success of carbon removal projects and drive market validation for CDR technologies by setting baseline frameworks for MRV, offtake agreements, and partnerships between public and private buyers. Continued

funding for this program would facilitate meaningful and high-level market validation for both existing and emerging CDR technologies.

Beyond carbon markets, public procurement can also help stimulate growth of nascent markets for carbon products. DOE's Office of Fossil Energy and Carbon Management Carbon Utilization Procurements Grant program will provide $100 million through the IIJA to offset 50 percent of the costs for states, local governments, and public utilities to procure and use carbon conversion products. Currently, these grants are only available to government entities; extending these procurement grant opportunities to the private sector can promote the adoption of low-carbon alternatives and can create broader product demand.

Recommendations to enable market expansion:

- The federal government should continue to support demand-side incentives through federal procurement policies and programs.

Invest in the Next Generation of CDR

Recent federal policy measures like the IIJA and IRA made historic investments in carbon removal and mitigation technologies, including CCUS and DAC, and are widely considered to be a launching point for many of the technologies available today. These investments have been particularly significant for DAC and point source capture development. However, CDR technology is developing rapidly, and many promising technologies were still emerging when those policies were developed and adopted. As a result, some newer CDR technologies will not qualify for the updated 45Q tax credit.

Current policies and incentives provide meaningful near-term investment and support, however, there are fewer opportunities supporting long-term technology development or the scale-up of early and emergent technologies. Congress should provide additional incentives, tax policies, and research and development funding that will be needed to address the next phase of development and bridge the gap from pilot or demonstration projects to commercial-scale deployment capable of large-scale removal. These policy mechanisms should be technology-neutral and support a diversity of approaches that advance current technologies to commercial levels and encourage the next generation of CDR technologies and pathways.

At the Integrated Test Center in Gillette, Wyoming, scientists from UCLA successfully injected carbon dioxide emissions from a coal-fired power plant into concrete, reducing the significant carbon footprint of concrete by up to 100 percent. The concrete blocks created using this technology cost no more to produce than traditional concrete and are now being used in the construction of several municipal projects across the State of Alabama.

Recommendations to invest in the next generation of CDR:

- Congress should provide additional technology-neutral incentives, tax policies, and research and development funding needed to address the next phase of development and bridge the gap from pilot or demonstration projects to commercial-scale deployment capable of large-scale removal.

Recommendations for Natural Sequestration

Forests, rangelands, and wetlands are dynamic ecosystems with complex ecological, social, and economic values that require careful management over the long term. Effective land management can bolster the significant carbon sequestration capacity in the West's natural environment. Long term stewardship encompasses various principles and actions to achieve ecological resilience, biodiversity conservation, and community resilience.

Effective and strategic land management practices that prioritize ecosystem health can also deliver secondary carbon benefits, including enhanced sequestration capacity. This section contains recommendations for supporting natural solutions to enhance carbon sequestration.

At the Decarbonizing the West initiative workshop in Portland, experts from Pew Charitable Trusts, The Nature Conservancy and the Oregon Department of Land Conservation and Development spoke about the importance of conserving and restoring wetlands as well as other coastal habitats as carbon sinks.

Innovate Funding Mechanisms to Support Land Management Projects

Forests store approximately two-thirds of terrestrial carbon in the U.S., representing about 90 percent of the land sector's capacity for additional carbon sequestration. However, challenges such as drought, insect infestations, wildfire, and increased tree mortality due to overstocked forests hinder their carbon sequestration potential. Enhanced forestry practices can work to conserve and restore forests and, when implemented well, provide meaningful carbon removal and sequestration benefits. In 2022, U.S. Department of Agriculture (USDA) Secretary Tom Vilsack released a memorandum entitled Climate Resilience and Carbon Stewardship of America's National Forests and Grasslands that directed USDA to pursue science-based carbon stewardship actions on natural and working lands.

The USDA memo places emphasis on cultivating robust forest ecosystems capable of capturing and retaining carbon while minimizing the risk of carbon emissions from wildfires. These strategies prioritize optimizing carbon storage while also preserving other ecosystem benefits, such as recreational opportunities, water resources, and wildlife habitats. Despite being highly effective management strategies, many of these approaches do not have clear, scientifically backed methods to quantify their carbon sequestration benefits, making them difficult to monetize via carbon credits, and in turn, difficult to finance.

Coastal wetlands, particularly forested tidal wetlands, play crucial roles in carbon sequestration and climate resilience. These ecosystems are vulnerable to degradation and efforts are underway to conserve and restore these habitats, but challenges such as static land use planning, high restoration costs, and funding limitations hinder progress. Collaboration, innovative financing mechanisms, and a holistic approach to coastal management are essential to address these challenges effectively and maximize the benefits of coastal ecosystems for both ecosystem health and carbon sequestration benefits.

Collaboration and diverse funding sources are essential to implement land management practices that optimize carbon sequestration at large scale. Given the multifaceted nature of land management and restoration efforts, involving a wide range of stakeholders is crucial for garnering support, expertise, and resources. This includes government entities at the federal, state, territorial, and local levels, as well as corporations, utilities, nonprofit organizations, and individual donors. Additionally, diverse funding sources help mitigate financial risks and ensure the sustainability of land management projects over the long term. Collaborative funding models,

such as public-private partnerships and multi-stakeholder initiatives, enable the aggregation and leveraging of funds to maximize the effectiveness of these projects.

Traditional funding sources may be insufficient or inaccessible for large-scale reforestation, forest management, and carbon sequestration initiatives. As such, there is a need to explore alternative financing options that can provide upfront capital, cover project costs, and generate returns for investors. One such mechanism is carbon finance, which involves securing funding from investors to finance forestry projects and repaying them through revenue streams generated by carbon credits or other ecosystem services. Carbon revenue streams have emerged as a promising source of funding for forestry projects, as they provide financial incentives for land management practices that enhance carbon sequestration and mitigate emissions. With innovative funding mechanisms, stakeholders can mobilize resources more effectively and accelerate progress towards forest conservation and sustainability goals.

Long-term stewardship requires securing funding and resources to support ongoing land management and conservation activities. This includes establishing endowments, trust funds, and conservation finance mechanisms that provide sustained funding for land management projects, research, monitoring, and education. By investing in long-term financial mechanisms, landowners can ensure the continuity and effectiveness of stewardship efforts, even in the face of economic uncertainties and changing political landscapes.

Recommendations to innovate funding mechanisms to support forestry projects:

- USDA should develop innovative carbon finance mechanisms to provide upfront capital to landowners seeking to implement projects.

Improve Access to Federal Dollars for Small Farmers and Landowners

Modifying on-farm practices can be a significant challenge for agriculture producers operating in a sector often characterized by narrow profit margins and large amounts of risk. The USDA's Natural Resources Conservation Service (NRCS) and Farm Service Agency offer several technical and financial assistance programs to help incentivize and facilitate the adoption of sustainable agriculture practices. The Environmental Quality Incentives Program (EQIP) is NRCS' flagship program, offering both technical and financial support to agricultural producers and landowners implementing conservation practices to address various concerns, including water and air quality, soil health, erosion reduction, and drought mitigation.

Several of these conservation practices can deliver clear co-benefits and opportunities for enhanced carbon sequestration across the agricultural sector. In accordance with the NRCS Soil Carbon Amendment (Code 336), agricultural producers can apply for financial assistance (made available through EQIP) to offset the costs of using biochar as a soil amendment to improve soil health and, in turn, carbon sequestration capacity. Other EQIP-incentivized conservation practices, like cover cropping, no-tillage, and enhanced nutrient management, can also be implemented to deliver meaningful carbon sequestration co-benefits.

NRCS Conservation Innovation Grants (CIGs) are another opportunity for farmers and agricultural researchers to obtain funding to help offset the costs and risks of practice changes. CIGs are competitive grants that invest in innovative conservation practices that result in increased crop yields, improved environmental quality, soil health, and wildlife habitats.

While these opportunities represent valuable funding streams, these incentives do not always reflect the technical capabilities of producers and can be difficult to access for small farmers. Directing federal dollars to be more responsive to the needs of independent farmers and to support the development and implementation of innovative practices under these programs can de-risk changes in practice and offset associated costs, motivating more widespread adoption of sustainable farming solutions. Increasing agency capacity to evaluate applications, distribute funding, and provide tech nical assistance will help maximize the effect of these programs.

Recommendations to improve access to federal dollars for small farmers and landowners:

- NRCS should prioritize providing Conservation Innovation Grants to small farms.
- Congress and USDA should increase funding to raise NRCS' capacity for providing technical assistance and reviewing applications for CIG and EQIP grants.

Idaho Workshop

The Boise workshop of the Decarbonizing the West initiative focused on strategies for expanding natural carbon sequestration methods as a way to not only decarbonize the atmosphere, but also create an avenue by which the West's legacy industries can thrive in a decarbonized future.

The first day of the workshop, hosted by Idaho Governor Brad Little, explored various nature-based solutions, including anaerobic digesters, conservation practices that promote the accumulation of carbon in soil, and the use of mass timber.

"Natural sequestration is a critical component of decarbonization efforts," Governor Little said during his opening remarks. "Healthy forests, soil, and rangelands can sequester enormous amounts of carbon. However, when those resources are poorly managed the opposite can be true."

The second day of discussion, led by WGA's Chair, Wyoming Governor Mark Gordon, keyed in on how states can work with local producers and the private sector to develop more mature carbon markets that would make it easier for producers to adopt these practices and generate revenues to help their operations be economically viable long into the future.

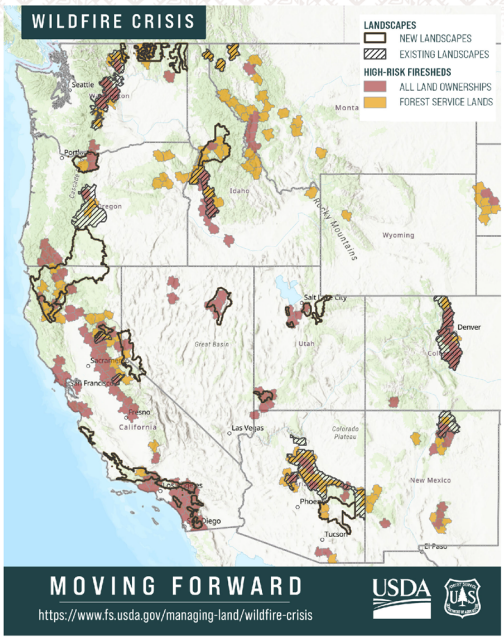
"We have to figure out how to get a durable marketplace," Governor Gordon told the crowd assembled in Boise. "The fact of the matter is that tax policy is dependent on administrations, so it isn't that durable. Marketplaces are, so trying to make this more of a discussion about the dynamics of how this market needs to evolve and really focusing on the state-led effort, I think is essential."

Governor Brad Little welcomed participants to the Decarbonizing the West initiative workshop in Boise, Idaho, which featured in-depth policy discussions on natural carbon sequestration, including agriculture, forestry, and land management.

Expand Opportunities for Biomass Sourcing

The presence of dense, overstocked forests has heightened the risk of uncharacteristic wildfires in the West. Restoring these overstocked forests can result in large quantities of biomass that have little economic value. Incorporating BECCS and other BiCRS pathways into federal forest and wildfire policies and programs can significantly enhance wildfire mitigation efforts across the West. By creating a market for the use of biomass residues, BiCRS encourages more active forest management, including wildfire mitigation, which increases overall ecosystem resilience. The costs associated with implementing these management practices, which vary widely based on the treatment, can be offset by BiCRS projects, reducing the net cost of collecting and transporting biomass feedstock.

Current policies impose limitations on how biomass from federal lands can be utilized and restrict its eligibility for clean energy incentives. EPA requirements for the RFS program currently prevent biofuels produced from forest biomass residues in western states from qualifying, based on EPA guidelines that determine specific areas at risk from wildfire. The Energy Independence and Security Act also includes a broad restriction on forest biomass feedstock sourced from federal land, barring it from eligibility for the RFS. Amending these guidelines to be more inclusive of western forest resources can help address feedstock sourcing challenges, creating opportunities for large-scale deployment of BiCRS across the West.



Recommendations for enabling opportunities for biomass sourcing:

- Congress and federal agencies should consider the role that BiCRS pathways can play in decarbonization and set target goals to stimulate innovation.
- The EPA should broaden biomass sourcing requirements under the RFS to include biomass residues.
- Land management agencies should facilitate offtake partnerships to improve feedstock supply chains.

Secretary of Agriculture Tom Vilsack announced that the Department is investing nearly $500 million to expand work on the USDA Forest Service's Wildfire Crisis Strategy to reduce wildfire risk to communities, critical infrastructure, and natural resources on 21 priority landscapes across the West. This work is beginning to reduce wildfire risk for some 550 communities, 2,500 miles of power lines, and 1,800 watersheds.

In the U.S., 2,115 multi-family, residential, commercial, and institutional mass timber projects were in progress or built as of March 2024, including the LEED Silver-certified Jackson Hole airport.

Ensure a Market for Forest Products

Mass timber refers to engineered wood products made from combining layers of lumber to create large structural elements, such as beams, columns, and panels, used in construction. These products offer a sustainable alternative to traditional materials like concrete and steel, as they utilize renewable resources and have lower embodied carbon. Forest products like mass timber are promising components of carbon management strategies due to their unique capacity to sequester and store carbon over long periods of time in the built environment. Trees absorb CO_2 from the atmosphere and, when harvested and incorporated into forest products, this carbon remains stored within the material. By promoting mass timber and forest products in construction, carbon can be effectively locked away for the building's lifespan, mitigating carbon emissions.

Expanding mill infrastructure presents a critical opportunity to bolster the market for low-value biomass and engineered wood products. Investing in the expansion and modernization of mill facilities, particularly in rural communities reliant on forestry, can unlock the latent value of underutilized timber resources. This expanded capacity can support the processing of smaller-diameter and lower-quality timber, which is often left unharvested due to limited market demand. By converting this low-value wood into high-quality products like mass timber, particleboard, or wood pellets, mills can create new revenue streams while simultaneously reducing waste and promoting active forest management practices.

The federal Buy Clean Initiative can drive increased adoption of sustainable construction materials within the building industry. The Buy Clean initiative prioritizes materials with low embodied carbon during the procurement process, stimulating market demand and drawing innovation and investment in sustainable manufacturing practices. Building codes that support the use of mass timber could also play a pivotal role in accelerating the adoption of these sustainable materials in construction projects. By incorporating provisions that recognize and facilitate the use of these materials, such as allowing taller timber buildings or streamlining approval processes, building codes could create a supportive regulatory environment for sustainable construction practices. Ensuring there is a robust workforce of trained foresters, architects, engineers, and builders who know how to process and use these materials is also an essential element to developing these markets.

Recommendations to ensure a market for forest products:

- The U.S. Forest Service should provide funding to rebuild and expand existing mill infrastructure to increase processing capacity for low-value wood products.
- The federal government should leverage procurement initiatives to drive increased innovation of production pathways and uptake of product adoption.

Oregon Workshop

Oregon Governor Tina Kotek kicked off the final workshop of the Decarbonizing the West initiative in Portland by speaking about the importance of interstate collaboration for successful decarbonization efforts.

"If our communities across the West are to thrive, we need to build a more resilient future that forges connection across our landscapes and brings rural and urban economies together on those solutions," she said. "We must not be daunted by the speed and the scale of the changes on the landscape that we're already seeing in the West... With the support of the Western Governors, I think we can be a model for the nation to actually make progress."

While the workshop's panelists emphasized the need for different decarbonization pathways across the country, they examined the viability of several methods already being deployed in the Pacific Northwest, including sustainable forest and agricultural management, biomass utilization for energy or carbon storage, preserving coastal ecosystems as a carbon sink, and opportunities for large-scale carbon removal and storage.

"Our natural and working lands are a cornerstone of our rural and tribal economies and an integral part of building healthy, climate resilient communities," Governor Kotek said. "They're also a powerful resource to help meet our state's ambitious climate goals, sequester carbon, and respond to a future of increasing uncertainty."

The fourth and final workshop of the Decarbonizing the West initiative was hosted by Governor Tina Kotek in Portland, Oregon. This workshop focused on natural and technological strategies for carbon reduction, utilization, and storage, including forest and on-farm management practices, coastal ecosystem resilience, and bioenergy with carbon capture and storage (BECCS).

Cross-Cutting and Regional Opportunities

Supportive markets, strong partnerships, and effective coordination among project developers, state, territorial, and federal agencies, and community stakeholders are essential for the successful implementation of carbon management projects. This section contains recommendations to support voluntary carbon markets and large regional carbon management projects.

Engage Communities Early and Often

Different communities can have varying perceptions of risk associated with carbon management projects. Proactive and intentional engagement performed by and on behalf of developers, aids in comprehensively characterizing these perceptions of risk and benefits and tailors engagement and education to community needs and preferences. Some of these community engagement approaches are codified as requirements for recipients of DOE funding opportunities.

Communities with long oil and gas histories are generally well acquainted with the benefits and impacts of oil and gas operations, but meaningful engagement is still necessary. Carbon management projects have similar benefits and impacts. Developers should be present in the communities and have reached out to potential surface and subsurface owners and community leaders before projects are publicly announced. The goals, science, timelines, and end products should be clearly explained. The more transparent the process, the more likely there will be public support.

Recommendations for Engaging Communities Early and Often:

- Federal agencies should work with project developers to execute community benefit plans that are flexible and informative to the affected communities.

Support Regional and Collaborative Decarbonization Efforts

The West offers significant opportunities to use hub models to implement projects that reduce capital and workforce needs, improve environmental quality, amplify community benefits, and deploy technologies in an efficient way.

Immediately following the announcement of Wyoming Governor Mark Gordon's WGA Chair Initiative, he signed a Memorandum of Understanding with Colorado Governor Jared Polis pledging to work together to advance the capabilities of direct air capture in their respective states.

Regional and collaborative approaches to carbon management can offer faster results at a greater scale by leveraging the resources, geologies, and policy environments of different states and territories.

Hub infrastructure can also provide natural avenues for enabling carbon utilization pathways and geologic storage at a large scale. Storage hubs or partnered storage efforts can pool emissions from different industrial sources and can be an effective strategy for simplifying well approvals and limiting project siting constraints. DOE CarbonSAFE program, once fully funded, allows for industrial emissions pooling, which has been effective at bringing smaller companies and project developers to the table and providing a storage pathway for carbon capture projects in early-stage development.

Initiatives such as DOE's Regional Direct Air Capture Hubs program help accelerate these regional development efforts by encouraging community-driven design. Support for DAC is not uniform across the western states. DAC hubs can attract project developers to new regions, provide carbon removal or mitigation services and benefits to address legacy emissions, and unlock new opportunities to co-locate storage sites. While DOE hub projects prioritize engineered solutions, natural solutions can also be integrated into this infrastructure development.

The IIJA allocated $3.5 billion to this effort, however, many of these projects will require additional support to elevate them from feasibility studies or laboratory-scale tests to being deployed at commercial scale.

The use of memoranda of understanding (MOU) or similar mechanisms can also be effective for developing partnerships, navigating permitting and resource constraints, and implementing regional solutions. In June 2023, Governors Mark Gordon and Jared Polis signed an MOU committing Wyoming and Colorado, respectively, to work together to advance DAC solutions. Leveraging the unique resources, assets, and experiences of each state can help states and project developers overcome critical challenges while providing new opportunities for economic development, improved environmental quality, and significant carbon reductions.

At the Boise workshop of the Decarbonizing the West initiative, representatives from JP Morgan Chase and CarbonCapture spoke with Wyoming Governor Mark Gordon about the potential pitfalls and opportunities to support broader carbon dioxide reduction activities through voluntary carbon markets.

Recommendations to support regional and collaborative decarbonization efforts:

- DOE should move more quickly to advance the projects selected and announced in the CarbonSAFE program, which has experienced historical delays.

Ensure Fair and Transparent Voluntary Carbon Markets

Voluntary carbon markets and the technologies that facilitate them have grown and improved significantly in the past decades. However, market expansion is hampered by concerns over carbon credit and system integrity. Standards may vary for different carbon projects and across different accrediting bodies, which can result in large variations in availability and quality of information needed for stakeholders to assess the integrity of projects and resulting credits. This lack of clear information can erode trust in not only specific credits or standards, but voluntary carbon markets more broadly.

Typically, it falls to the project developer to select a methodology for quantifying carbon removed; independent verifiers will then apply that methodology to determine the value of the resulting credits. Ensuring this verification process is transparent and that standards information is clear and easily accessible will help build trust in the quality of carbon credits and the integrity of voluntary carbon markets. It may also be helpful in attracting additional buyers to the carbon market.

Research and academic institutions, extension services, and government bodies can be valuable partners for project developers, standards bodies, and buyers in establishing and communicating transparent market standards and building market integrity.

Recommendations for ensuring fair and transparent voluntary carbon markets:

- Federal agencies should assist project developers, standards bodies, and buyers in establishing and communicating transparent market standards and building market integrity.

At the Gillette workshop of the Decarbonizing the West initiative, Wyoming Governor Mark Gordon spoke with Brad Crabtree, Assistant Secretary for the U.S. Department of Energy's Office of Fossil Energy and Carbon Management about the need to improve community engagement and more effectively communicate a project's community benefit when developing carbon projects.

Promote Baseline Standards for Monitoring, Reporting, and Verification of Carbon Removal Projects

As the global carbon marketplace develops and matures, markets and programs will continue to emerge, offering new opportunities to buy and sell carbon credits. The success of these programs, and the viability of the market more broadly, hinge on robust and transparent MRV, which requires certain standards be met to ensure that projects deliver the intended outcomes and reduce emissions at expected rates before payments are made. MRV is a critical accountability mechanism that builds trust and transparency in carbon markets and emerging CDR technologies.

Each decarbonization approach is measured against a baseline standard determined by standard-setting bodies, measuring emission reductions over time. As a result, each pathway may face unique challenges associated with MRV and it can be challenging to build market consensus for certain decarbonization approaches. Additionally, emerging or novel approaches, like enhanced rock weathering or mineralization, may require new methods of conducting MRV, resulting in delayed revenue streams for emergent technologies.

To ensure end-buyer confidence in the final product, product developers must implement and prove a technical MRV methodology to a nontechnical audience. To this end, third-party verifiers can play a role in ensuring that MRV data is publicly accessible, via a reputable and trustworthy platform, and presented in a clear and understandable way.

Baseline standards for MRV would provide additional transparency and instill trust in existing methodologies without locking out emerging science and technology. These baseline standards should be rigorous, but broadly applicable across different CDR pathways to ensure that CO_2 removal activities can be accurately assessed and measured across a broad range of CDR methods.

Independent accrediting bodies and registries have recently undertaken efforts to better coordinate their approaches to carbon credit certification. Aligning these standards can help streamline the crediting process and can lead to the verification of high-quality carbon credits, or credits that are additional, transparent, unique, and durable.

Recommendations for promoting baseline standards for monitoring, reporting, and verification:

- DOE, in coordination with other federal agencies, should provide guidance for minimum MRV standards.

At the Portland workshop of the Decarbonizing the West initiative, representatives from the Oregon Department of Forestry, Mast Reforestation, ACR, Finite Carbon, and L&C Carbon spoke about how reforming MRV requirements can increase the accessibility of carbon markets for small landowners.

Sponsor Acknowledgments

Participant Acknowledgements

WGA thanks all the speakers who contributed their time and expertise to the initiative's workshops and webinars.

Wyoming Workshop:

Gillette, Wyoming,
September 21, 2023

- The Honorable Mark Gordon, Governor of Wyoming
- The Honorable Brad Crabtree, Assistant Secretary for Fossil Energy and Carbon Management, U.S. Department of Energy
- Matt Fry, Senior Policy Manager, Carbon Management, Great Plains Institute
- Stephen Fusilier, Branch Chief, Rights-of-Way, Bureau of Land Management
- Tara Righetti, Professor of Law, University of Wyoming School of Energy Resources
- Todd Parfitt, Director, Wyoming Department of Environmental Quality
- Randall Luthi, Policy Director, Office of Wyoming Governor Mark Gordon
- Brice Freeman, Director of Carbon Capture, Membrane Technology and Research (MTR)
- Yutaro Hara, Assistant Manager, CCUS Section, Kawasaki Heavy Industries
- Ambal Jayaraman, Principal Engineer, TDA Research
- Howard Meyer, Senior Institute Engineer, GTI Energy
- Will Morris, Technical Director, Wyoming Integrated Test Center
- Jim Ford, Operations Manager, Wyoming Integrated Test Center
- Holly Krutka, Executive Director, University of Wyoming School of Energy Resources

WGA Winter Meeting:

Jackson Hole, Wyoming,
November 6, 2023

- Holly Krutka, Executive Director, University of Wyoming School of Energy Resources
- Charles Gorecki, Chief Executive Officer, University of North Dakota Energy and Environmental Research Center

Idaho Workshop:

Boise, Idaho,
December 12-13, 2023

- The Honorable Brad Little, Governor of Idaho
- The Honorable Mark Gordon, Governor of Wyoming
- Andre Brasil, Senior Director of Business Development, California BioEnergy
- Jesse Burson, Supply Development Lead, Renewable Natural Gas, Shell
- Rick Naerebout, Chief Executive Officer, Idaho Dairymen's Association
- John Olshefski, Ingevity, NeuFuel
- Kristen Boysen, Managing Director, Agricultural Drought and Climate Resilience Office, Colorado Department of Agriculture
- Myles Gray, Program Director, U.S. Biochar Initiative
- Bill Jaeger, Strategic Initiatives Officer, LOR Foundation
- Rachael Jamison, Vice President of Markets and Sustainability, American Wood Council
- Jennifer Okerlund, Director, Idaho Forest Products Commission
- Bill Parsons, Chief Operating Officer, WoodWorks
- Eric Dufek, Department Manager, Energy Storage and Electric Transportation, Idaho National Laboratory
- Ning Kang, Department Manager, Power and Energy Systems, Idaho National Laboratory
- Seth Snyder, Program Director, Energy, Environment Science, and Technology, Idaho National Laboratory
- Todd Combs, Associate Laboratory Director, Idaho National Laboratory
- Matthew DiBona, District Biologist, National Wild Turkey Federation
- Katharyn Duffy, Director of Science Operation, Vibrant Planet
- Jim Elbin, Division Administrator, Trust Lands, Idaho Department of Lands
- Matt Bright, Director of External Affairs, CarbonCapture
- Brian DiMarino, Head of Operational Sustainability, JP Morgan Chase
- Luke Hawbaker, Director of Business Development and Partnerships, Mast Reforestation
- Mary Mitsos, President and Chief Executive Officer, National Forest Foundation
- Jill Ozarski, Program Officer, Environment, Walton Family Foundation
- Jonathan Oppenheimer, Government Relations Director, Idaho Conservation League

Colorado Workshop:

Denver, Colorado, February 7-8, 2024

- The Honorable Jared Polis, Governor of Colorado
- The Honorable Mark Gordon, Governor of Wyoming
- Elias Cain, Project Manager, National Renewable Energy Laboratory
- Anil Prabhu, Chief of Carbon Management Branch, California Air Resources Board
- Max Scholten, Head of Commercialization, Heirloom Carbon
- Melissa Carey, Head of Climate, ESG, and Government Affairs, Holcim US
- Cully Cavness, Co-Founder, President, and Chief Operating Officer, Crusoe Energy
- Thomas Price, Energy Analyst, Office of Industrial Efficiency and Decarbonization, U.S. Department of Energy
- Angela Seligman, Senior Carbon Capture Policy Manager, Clean Air Task Force
- Kyle Clark-Sutton, Manager, Carbon Removal Policy, Rocky Mountain Institute
- Patricia Loria, Vice President of Business Development, CarbonCapture
- David Luebke, Technical Director, Direct Air Capture Center, National Energy Technology Laboratory
- Newsha Ajami, Chief Strategic Development Officer for Research, Lawrence Berkeley National Laboratory
- Matt Fry, Senior Policy Manager, Carbon Management, Great Plains Institute
- Kenn Kerr, Senior Vice President of Commercial Development, Global Thermostat
- Quinn Antus, Senior Program Manager, Carbon Management, Colorado Energy Office
- Dana Gava, Physical Scientist, UIC Class VI Implementation, U.S. Environmental Protection Agency
- Anna Littlefield, CCUS Program Manager, Payne Institute, Colorado School of Mines
- Joey Minervini, Public Affairs Manager, Americas, Global CCS Institute
- Kelli Roemer, Social Science Program Advisor, Office of Fossil Energy and Carbon Management, U.S. Department of Energy
- Savita Bowman, Senior Program Manager, ClearPath
- Kevin Connors, Assistant Director for Regulatory Compliance and Energy Policy, University of North Dakota Energy and Environmental Research Center
- Chris Swanston, Director, Office of Sustainability and Climate, U.S. Forest Service
- Anna Pavlova, Senior Vice President of Strategy, Market Development, and Sustainability, Carbon Quest
- Lily Barkau, Groundwater Section Manager, Wyoming Department of Environmental Quality
- Ashleigh Ross, Vice President and Head of Commercial Development and Policy, Carbon America
- Alicia Summers, Chief Development Officer, Frontier Carbon Solutions
- Jeff Kummer, Chief Executive Officer, Meriden Carbon

Oregon Workshop:

Portland, Oregon, March 11-12, 2024

- The Honorable Tina Kotek, Governor of Oregon
- David Ford, Principal, L&C Carbon
- Shaw Newman, Carbon Markets and Policy Specialist, Mast Reforestation
- Danny Norlander, Forest Climate, Carbon, and Health Analyst, Oregon Department of Forestry
- Andy Taylor, Senior Technical Manager of Forestry, ACR
- Brandon Vickery, Co-Chief Executive Officer, Finite Carbon
- Nora Brown, Head of Market Development and Policy, Charm Industrial
- Caspar Donnison, Energy Systems Researcher, Lawrence Livermore National Laboratory
- Lesley Jantarasami, Managing Director, Energy Program, Bipartisan Policy Center
- Joshuah Stolaroff, Chief Executive Officer, Mote Hydrogen
- Emily Connor, Program Manager, Carbon Conversion, U.S. Department of Energy Office of Fossil Energy and Carbon Management
- Chris Davis, Vice President for Public Policy and Carbon Products, CarbonCure
- Bill Drumheller, Senior Energy Policy Specialist, Washington State Department of Commerce
- David Heldebrant, Laboratory Fellow, Pacific Northwest National Laboratory
- Whitney Dorer, Climate Policy Community Engagement Coordinator, Oregon Department of Environmental Quality
- Caitlin Guthrie, Director of Forest Carbon Origination, Finite Carbon
- Jordan Wildish, Cap-and-Invest Offsets Lead, Washington State Department of Ecology
- Jana Gastellum, Executive Director, Oregon Environmental Council
- Rose Graves, Natural Climate Solutions Scientist, The Nature Conservancy
- Lisa Phipps, Coastal Management Program Manager, Oregon Department of Land Conservation and Development
- Liz Ruther, U.S. Conservation Program Officer, West Coast, Pew Charitable Trusts
- Elaine Blatt, Senior Policy and Program Analyst, Oregon Department of Environmental Quality

- Athena Petty, Senior Manager of Sustainability, New Seasons Market
- Nick Sirovatka, Regional Soil Health Specialist, USDA Natural Resources Conservation Service
- Paul Snyder, Executive Vice President of Stewardship, Tillamook County Creamery Association
- Matt Donegan, President, Donegan Advisors
- Meghan Gavin, Partner, Seattle and Olympia, Cascadia Law Group
- Anastasia O'Rourke, Senior Managing Director, Carbon Containment Lab

Webinar 1:

Liability for Long Term Carbon Storage, March 20, 2024

- Madeleine Lewis, Licensed Attorney and Policy Research Specialist, University of Wyoming School of Energy Resources
- Reice Haase, Deputy Director, North Dakota Industrial Commission

Webinar 2:

Permitting Carbon Transport Infrastructure, April 17, 2024

- Harry Warren, Senior Consultant, U.S. Department of Energy Loan Programs Office
- Scyller Borglum, Vice President, Underground Storage Markets, WSP USA

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- ACR
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- The Anshutz Corporation
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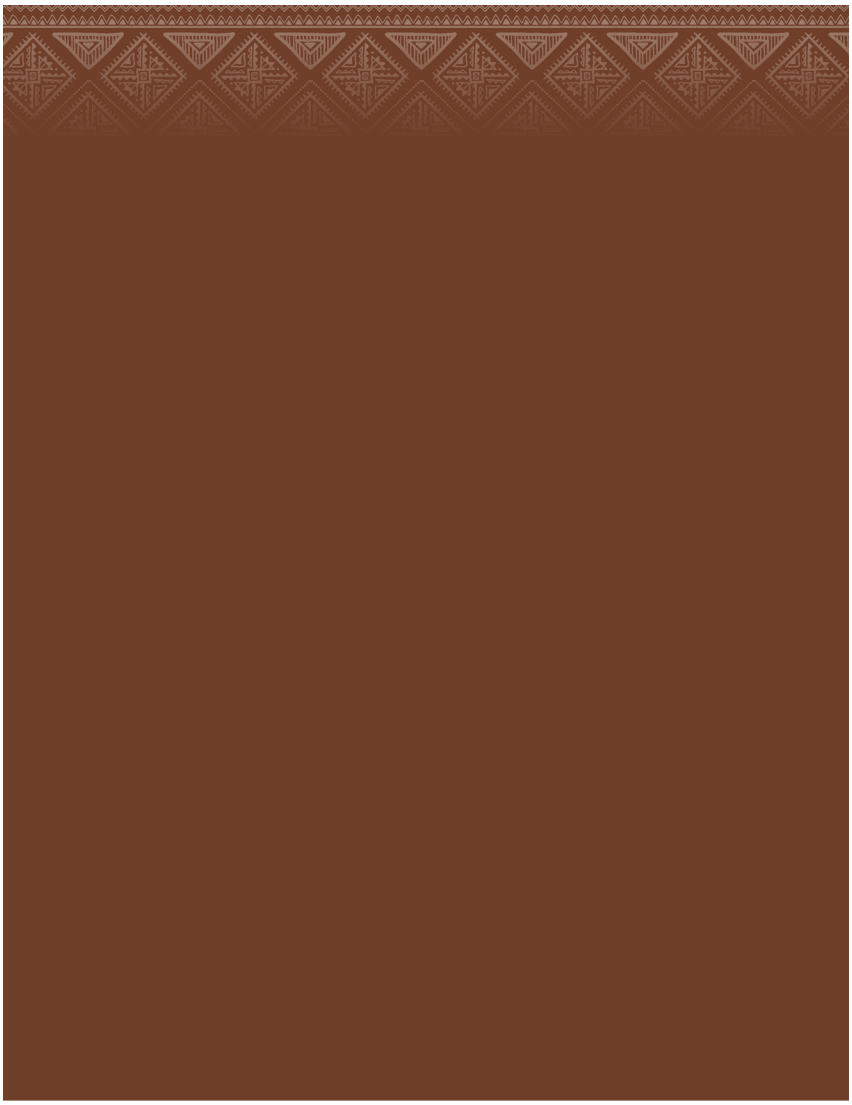
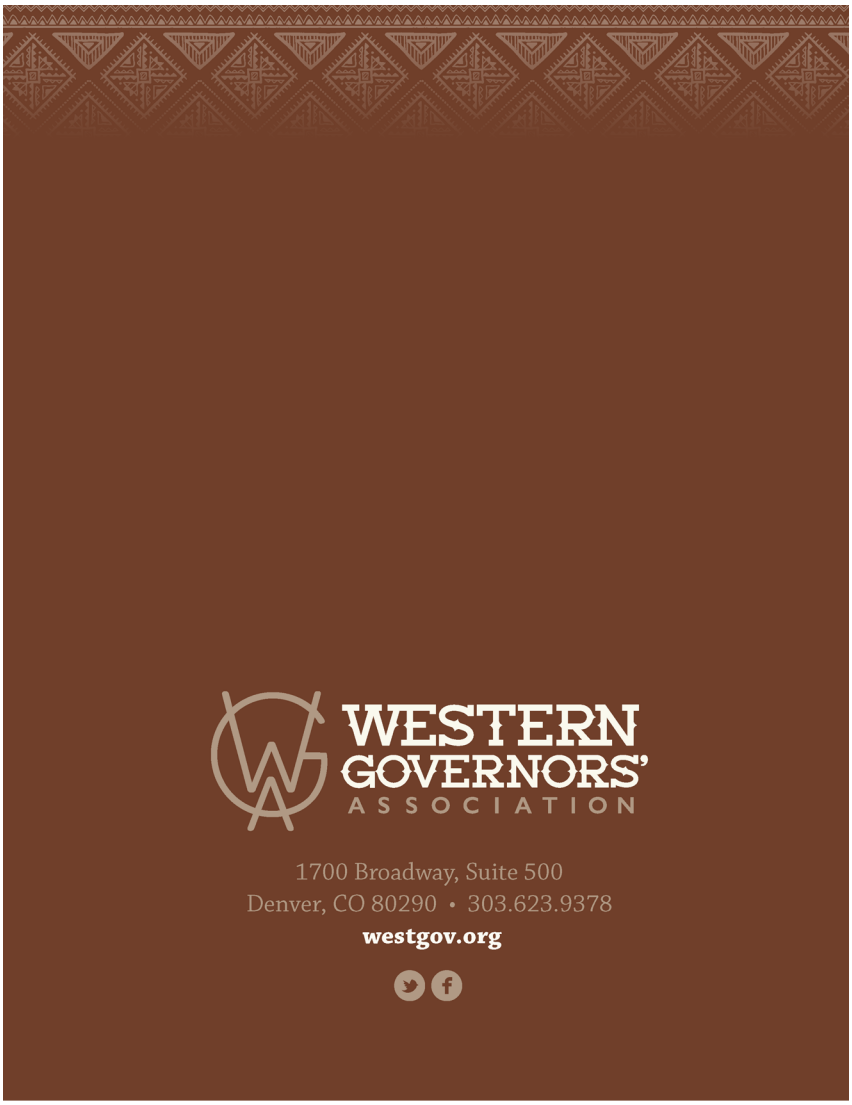
- Arrow Carbon
- Baker Hughes
- Bank of America
- Basin Electric Power Cooperative
- Bipartisan Policy Center
- Black Hills Energy
- Bluebird Backcountry
- Boise State University
- Boone and Crocket Club
- California Bioenergy
- Carbon America
- CarbonCapture
- Carbon Capture Coalition
- Carbon Containment Lab
- CarbonCure
- Carbon Quest
- Cascade Natural Gas
- Cascadia Law Group
- Center for Western Priorities
- Ceres, Inc.
- City of Boise
- Charm Industrial
- Chatburn Strategies
- Chevron New Energies
- Clean Air Task Force
- Clean Energy Action
- ClearPath
- Colorado Department of Law
- Colorado Department of Public Health and Environment
- Colorado Energy and Carbon Management Commission
- Colorado Community College System
- Colorado Oil and Gas Association
- Colorado School of Mines Payne Institute for Public Policy
- Colorado State Land Board
- Colorado State University
- Conservation Colorado
- Consulate General of Canada
- Canada West Foundation
- Correlate Energy
- Cowboy Clean Fuels
- Crusoe Energy
- Deloitte
- Do Good LLC
- Donegan Advisors
- Edison Electric Institute
- Enhanced Sequestration Geothermal Solutions
- Envu
- ESRI
- Evergreen Foundation
- Exxon Mobil
- Finite Carbon
- F.H. Stoltze Land & Lumber Co.
- Freestone Strategies
- Friends of the Lower Blue River

- Frontier Carbon Solutions
- Gillette College Foundation
- Glenrock Energy
- Global CCS Institute
- Global Thermostat
- Government of Alberta, Canada
- Great Plains Institute
- GTI Energy
- Heirloom Carbon
- HDR
- Holcim US
- Idaho Conservation League
- Idaho Dairymen's Association
- Idaho Department of Agriculture
- Idaho Department of Environmental Quality
- Idaho Forest Products Commission
- Ingevity
- Intel
- Interwest Energy Alliance
- Invenergy
- ION Clean Energy
- Ironworks International Union
- Jackson Hole Center for GlobalAffairs
- JP Morgan Chase
- Kawasaki Heavy Industries
- Kearns and West
- L&C Carbon
- LOR Foundation
- LowerCarbon Capital
- Mast Reforestation
- MDU Resources Group
- Membrane Technologies and Research
- Meriden Carbon
- Milestone Environmental Services
- Molson Coors Beverage Company
- Montana Environmental Information Center
- Mont Vista Capital
- Mote Hydrogen
- MW Energy Solutions
- National Forest Foundation
- National Wildlife Federation
- National Wild Turkey Federation
- Natural Resources Defense Council
- The Nature Conservancy
- NET Power
- New Seasons Market
- Northwest Gas Association
- Nuclear Energy Institute
- NW Natural
- Obsidian Renewables
- Occidental Petroleum
- Office of Congressman Mike Simpson
- Office of Congressman Russ Fulcher
- Office of Senator James Risch
- Office of Senator Mike Crapo
- Oil Mountain Energy
- Oregon Business Council
- Oregon Business for Climate
- Oregon Department of Agriculture
- Oregon Department of Energy
- Oregon Department of Geology and Mineral Industries
- Oregon Department of State Lands
- Oregon Environmental Council
- OregonServes: AmeriCorps StateCommission
- Oregon Parks and Recreation
- Oregon Watershed Enhancement Board
- Oxy - 1PointFive
- PacifiCorp
- Pew Charitable Trusts
- Portland General Electric
- Portland State University
- Rocky Mountain Institute
- Rocky Mountain Power
- Scott Public Policy
- Salas O'Brien
- Shell USA
- TDA Research
- Tillamook County CreameryAssociation
- Transitional Energy
- Tri-State Generation and Transmission Association
- United Association
- United Power
- University of Idaho
- University of Twente
- University of Wyoming
  - Enhanced Oil Recovery Institute
  - School of Energy Resources
  - Sustainable Rangelands Roundtable
- U.S. Biochar Initiative
- U.S. Geological Survey
- Utah State University
- Vallourec USA Corporation
- Vibrant Planet
- Walton Family Foundation
- Washington Department of Natural Resources
- Washington Geological Survey
- Wells Fargo
- Western Governors University
- WoodWorks
- WSP USA
- Wyoming Energy Authority
- Wyoming Office of State Lands and Investment
- Xcel Energy

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CARBON CAPTURE COALITION

Carbon Capture Coalition Statement for the Record

United States Senate Committee on Environment and Public Works

Committee Hearing: "Advancing Carbon Capture, Utilization and Sequestration Technologies and Ensuring Effective Implementation of the USE IT Act," February 12, 2025.

Introduction

The Carbon Capture Coalition (the Coalition) appreciates the opportunity to submit this statement for the record to the US Senate Environment and Public Works Committee for the February 12, 2025, hearing on advancing carbon management technologies and effective implementation of the Utilizing Significant Emissions with Innovative Technologies Act (USE IT Act).

Carbon management technologies, including capturing or removing carbon dioxide from industrial facilities, power plants, and ambient air, are an enabling technology platform for the production of cleaner energy and materials. Taken together, they are essential tools in a broader federal strategy to bolster American leadership in technology innovation and expand clean energy production while providing health and economic benefits to communities and regional economies in the form of air quality benefits and the preservation and creation of family-sustaining jobs. The nationwide adoption of carbon management technologies requires proper implementation of enacted laws, including the USE IT Act, the federal Section 45Q tax credit, and other measures to accelerate and incentivize the adoption of these technologies across sectors.

About Us

The Coalition is a nonpartisan collaboration of more than 100 companies, labor unions, and conservation and environmental policy organizations. Coalition members work together to lay the groundwork for the necessary portfolio of federal policies to enable nationwide, commercial-scale deployment of carbon management technologies. The full suite of carbon management technologies is crucial to driving down emissions across sectors, bolstering domestic energy and industrial production, and supporting workers with a broad range of skill sets. Carbon management includes carbon capture, removal, transport, reuse, and storage from industrial facilities, power plants, and ambient air.

Existing Domestic Framework of Carbon Management Policies

For more than a decade, the Coalition has worked with a broad group of bipartisan Members of Congress to realize a wide range of policy achievements, including:

- The bipartisan reform and expansion of the federal section 45Q tax credit; the foundational financing mechanism for carbon management projects, in the 2018 FUTURE Act.

- Historic increases in funding to retool and expand federal research, development, and demonstration, and deployment (RD&DD) of carbon management.
- Groundbreaking legislation to prioritize the buildout of CO_2 transport and storage infrastructure (SCALE Act).
- The significant enhancements to the 45Q tax credit in 2022 to make the program more accessible to project developers across power, industrial, and direct air capture (DAC) sectors.

In addition to these landmark pieces of legislation, the Coalition-endorsed USE IT Act, enacted in 2019, supports a range of carbon management technologies across a variety of applications and industries. Specifically, the law invests in research, development, and demonstration of direct air capture technology and reusing carbon captured from industrial facilities to produce innovative products. In addition, the USE IT Act fosters cooperative planning and permitting of CO_2 pipeline and storage infrastructure, through the establishment of two task forces focused on improving the performance of the permitting process for carbon management projects. These task forces will ultimately help to ensure regulatory frameworks enable efficient, orderly, and responsible deployment of the full suite of carbon management projects and related infrastructure.

This robust framework has helped generate unprecedented interest in domestic carbon management deployment, with an ever-growing list of announced projects in the last several years. In 2023 alone, 120 carbon capture, removal, reuse, and storage projects throughout the US were announced. As of now, there are 276 announced projects and counting, with a combined total capture capacity of nearly 200 million metric tons per year. Despite this impressive progress, we are still not on track to meet global carbon management deployment goals, which require 1 billion tons of carbon capture capacity deployed by 2030, or more than four times the current capture capacity.

Current Challenges to Carbon Management Project Deployment

While existing laws and regulations provide a strong foundation that has launched the industry toward commercial deployment, the sectors that make up the carbon management value chain face significant headwinds to maturing and deploying nationwide. Current challenges include an increasing gap between available financing and costs of capital, as well as delays and uncertainty in the permitting process for transport and storage infrastructure. Because of these obstacles, recently enacted supportive policies must mark the beginning, not the end, of necessary efforts to build the portfolio of available federal policies for carbon management technology deployment.

Challenges in Project Financing

Domestically, the 45Q tax credit remains the key federal policy mechanism to incentivize carbon management projects. Additionally, important investments made through the suite of bipartisan policies enacted over the last several years have provided additional drivers to demonstrate, reduce costs, and deploy these technologies across sectors.

Bipartisan-supported enhancements to the 45Q tax credit made in 2022, coupled with historic policy support included under the Infrastructure Investment and Jobs Act (IIJA), have resulted in almost $1.7 billion in federal and private investments being injected into diverse regions of the country over 10 states. However, further adjustments to the tax credit will be necessary to ensure investment certainty and business model flexibility and ensure these early investments translate into steel in the ground.

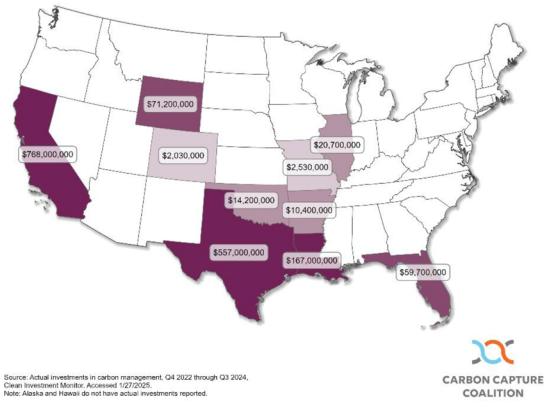

Figure 1: Federal and private domestic investments in carbon management.

Current economics for project deployment are challenging due to a combination of inflationary pressures on raw materials and components, labor, as well as higher interest rates for securing capital and the effect is particularly acute for those sectors that have higher costs to deploy carbon management technologies. These include coal and natural gas-fired power generation, diverse industrial sectors such as steel, cement, basic chemicals, and fertilizer, as well as direct air capture. Importantly, announced projects in these sectors make up more than half of the total domestic project announcements to date.

The gap between the value provided by 45Q and project deployment costs is widening. Inflation rates between 2020 and 2022 have already consumed more than half of the value increase of the 45Q tax credit for carbon capture retrofits in power and industry ($85 per ton for secure geologic storage). Make no mistake: this loss in value puts the majority of the more than 270 publicly announced carbon management projects in this country at risk of being canceled altogether. **To prevent further erosion of the credit value and sustain projects already in the development pipeline–as well as the critical benefits they provide to the American economy, growing energy supply, and environment–,45Q must be immediately adjusted for inflation, using 2021 as the base index year for the**

dollar figure. This would remain consistent with the intent of 2021 bipartisan marker bills to increase 45Q credit levels.

Finally, taxpayers who have elected 45Q must be afforded the ability to start and stop their election (a practice known as tolling) to match up with times the emitting source happens to be offline. Under current regulations, nationally declared federal emergencies provide the only pretense to pause the timer on 45Q should a point-source go offline. **Because there are many reasons outside of a taxpayer's control that a project may unexpectedly shut down, the Coalition supports revising 45Q to allow tolling at any point during the crediting period, if the facility ceases to operate due to a federally declared disaster or other circumstances beyond the operator's control**.

By enacting these recommendations, Congress will ensure that 45Q can reach its full potential and help to maximize the benefits of implementing legislation like the USE IT Act.

Challenges in Transport and Storage Project Permitting

Similar to the buildout of supportive infrastructure for increasing the supplies of reliable, affordable energy, carbon management project deployment has been hampered by permitting barriers that have hindered the efficient and responsible deployment of carbon management projects. Announced carbon capture, direct air capture and supportive CO_2 transport and storage infrastructure cannot deploy without being underpinned by effective and timely permitting processes. Recognizing that, the Coalition developed and published a set of permitting principles in 2023 to ensure that any federal legislation improving the federal permitting process aligns with carbon management project deployment timelines and incorporates robust community consultation.

Unfortunately, the USE IT Act has also been hindered by lagging implementation, most notably, the lack of reporting from the two Carbon Capture Utilization and Storage Permitting Task Forces, which were charged by Congress to:

> "Identify permitting and other challenges and successes that permitting authorities and project developers and operators face in permitting projects in an efficient, orderly, and responsible manner" and "Improve the performance of the permitting process and regional coordination for the purpose of promoting the efficient, orderly, and responsible development of carbon capture, utilization, and sequestration projects and carbon dioxide pipelines."

While these task forces are made up of some of the nation's most preeminent experts on carbon management technologies and permitting, we are unfortunately still awaiting publication of any recommendations on ways to enhance the available permitting framework. We therefore urge the Trump administration to reconvene the Task Forces and support their expeditious release of recommendations to Congress.

In addition to pending recommendations from the Task Forces, the Coalition has identified several actions to improve the current permitting framework for Class VI wells and state primary enforcement authority.

Permitting Class VI wells

The Environmental Protection Agency's (EPA) underground injection control (UIC) program oversees federal permitting of secure geologic storage through its Class II and Class VI well programs. Class VI wells are used to inject CO_2 into appropriate geologic formations solely for the purpose of permanently storing CO_2. The Class VI program rules address the permanent storage of CO_2 and ensure that wells are appropriately sited, constructed, tested, monitored, funded, and closed once CO_2 injection activities are completed. EPA can also grant primary enforcement authority (also known as primacy) to individual states, territories, or Tribal nations, which delegate authority to administer certain injection well classes under the UIC program in accordance with federal regulations. Importantly, states, territories, or Tribal Nations can be approved for this delegation of primacy only when their regulations meet or exceed the federal UIC requirements.

The queue of federal Class VI injection well permit applications under review at EPA is ever-growing. As of February 2025, that queue includes 56 projects with a total of 161 well applications across 14 states currently under review by the agency (these figures do not include those projects under review by states with primacy). While EPA has publicly stated its commitment to a 24-month application review process, around 16 percent of the projects under review are now past that mark. This affirms the need for timely and efficient review of Class VI well permit applications and state primacy applications, which remains a top priority for the Coalition. **As such, the Coalition recommends EPA commit to reviewing and providing final decisions on individual Class VI injection well applications within 18 months of those applications having been deemed "administratively complete."**

Moreover, we recommend revisiting the Carbon Dioxide Transportation Infrastructure Finance and Innovation (CIFIA) program authorized and appropriated as part of the Storing CO_2 and Lowering Emissions (SCALE) Act, to increase its appeal to applicants. CIFIA is a DOE Loan Programs Office (LPO) administered program containing $2.1 billion in lending authority for building large-scale interstate CO_2 transport systems and $500 million in grants, overseen by the Office of Fossil Energy and Carbon Management (FECM), to oversize interstate pipelines. Despite the inherent need for these pipelines in the broader buildout of the carbon management industry, we are unaware of any developer receiving funding under the loan program. **Assessing the program for ways to improve its appeal, especially given the lending authority for needed CO_2 trunk lines, is paramount for the CCUS Task Forces to discuss as part of their review of permitting practices and delays.**

Interstate CO_2 Pipelines

Robust infrastructure to safely transport and store captured CO_2 in secure geologic formations is an essential component of any broader energy and environment strategy. Carbon management projects, like many of their clean energy counterparts, are complex – and ensuring all pieces of a project come together is necessary to scale deployment of

these technologies across the economy. While the nation's current permitting regime has been in place for decades, as this industry continues to expand in the near-term, gaps in policy for permitting these projects, among others in the energy sector, have created delays and bottlenecks at critical junctures of project deployment. One example of this is with regard to the buildout of regional CO_2 transport infrastructure systems.

For reference, it is estimated that domestic CO_2 transport and storage infrastructure will need to expand to anywhere between 25,000 and 65,000 miles to enable the economywide deployment of carbon capture technologies and reduce emissions. For comparison, nearly 385,000 miles of operational pipelines in the US currently carry petroleum, natural gas, oil, and other products. Unlike natural gas pipelines, which have federal siting authority, the siting and permitting of CO_2 pipelines currently occurs on a state-by-state basis, subject to regulations put forth by states impacted by their construction. Ensuring the continued safety and reliability of CO_2 pipelines as this network expands is a top Coalition priority.

Carbon capture, removal, reuse, transport, and storage projects and associated infrastructure must be responsibly deployed at the pace and speed of growing investor and developer interest in these technologies. This, however, requires efficient and effective permitting grounded in robust environmental protections and community engagement. In its current state, the available framework is falling short, causing delays in the siting and construction of interstate CO_2 pipelines and the permitting of geologic storage wells. In some cases, these delays have led to wholesale cancellation of projects.

Establishing an optional pathway for federal siting authority for interstate CO_2 pipelines to provide similar parity for all linear infrastructure types, where appropriate, that face similar siting challenges should be prioritized to allow recent federal historic investments dedicated to carbon management infrastructure to enable efficient and responsible buildout of the necessary CO_2 pipeline network. Such parity would also enable better coordination, planning, and siting across federal agencies to lower impacts for wildlife, landowners, and local communities. **However, lines that are well served by the current state-by-state regulatory siting authority should be allowed to continue with that process.**

Conclusion

Carbon management technologies, including carbon capture, removal, reuse, transport, and storage, are crucial tools for balancing the increasing need for affordable, reliable energy that drives the American economy with the global imperative to reduce carbon emissions. Together, they are an enabling technology platform for the production of cleaner energy and materials and are important in the effort to continue growing our economy and providing Americans with family-sustaining jobs. Combined with responsible and timely permitting reforms, effectively implementing the existing portfolio of available policies, with additional changes to the available incentives, will provide certainty to investors in carbon management technologies and create a favorable environment for scaling projects.

The Carbon Capture Coalition appreciates the opportunity to comment on the important topics of today's hearing and the Committee's continued support for advancing federal policies to enable greater deployment of carbon capture, removal and reuse technologies and associated CO_2 transport and storage infrastructure. We look forward to working with the Committee in a bipartisan manner to identify the appropriate next steps to ensure these technologies can scale across the economy.

Should you have any questions about anything outlined in this statement, please contact Madelyn Morrison, Director of Government Affairs, Carbon Capture Coalition at mmorrison@carboncapturecoalition.org.

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