WESTERN GOVERNORS' ASSOCIATION

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.

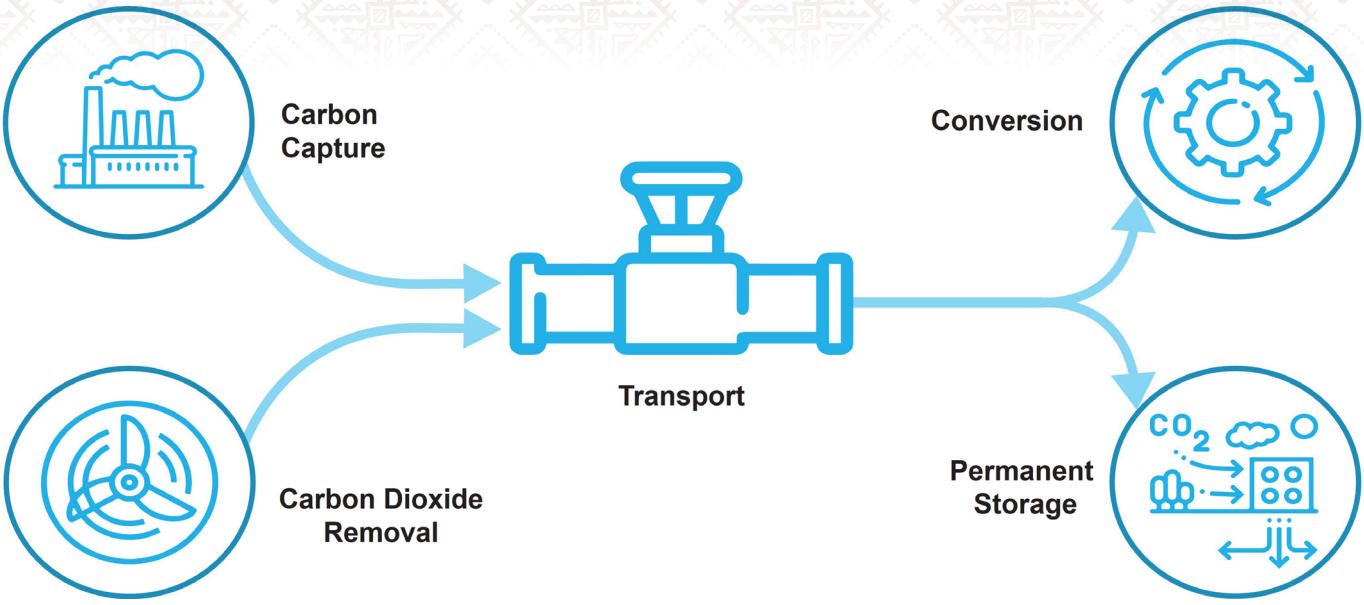
Carbon capture, utilization, and storage (CCUS) and other point source carbon reduction strategies prevent carbon emissions and thus play a necessary role in decarbonization. Carbon dioxide removal (CDR) is a broad term encompassing approaches that remove CO_2 directly from the atmosphere through engineered 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.

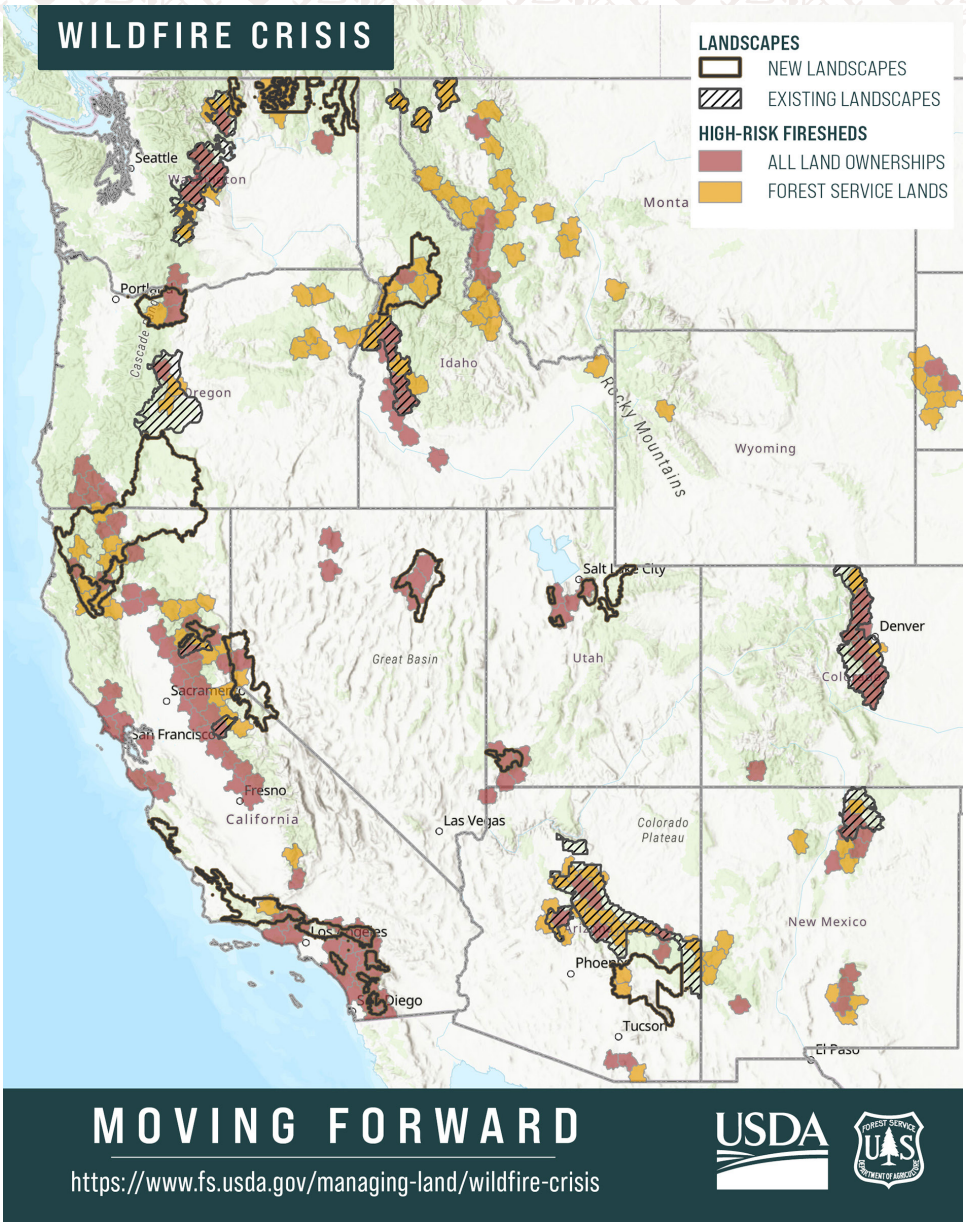
"We have to figure out how to get a durable marketplace," Governor Gordon told the crowd assembled in Boise. "The fact of the matter is that tax policy is dependent on administrations, so it isn't that durable. Marketplaces are, so trying to make this more of a discussion about the dynamics of how this 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,

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.

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.

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.

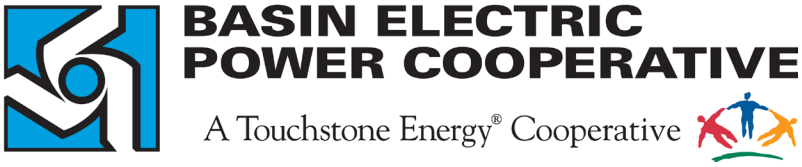
Independent accrediting bodies and registries have recently undertaken efforts to better coordinate their approaches to carbon credit certification. Aligning these standards can help streamline the crediting process and can lead to the verification of high-quality carbon credits, or credits that are additional, transparent, unique, and durable.

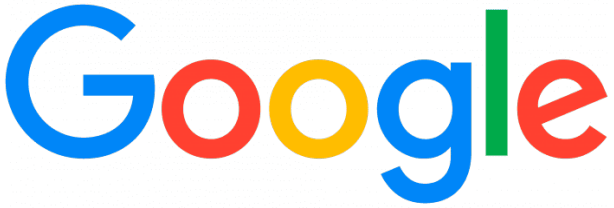
Recommendations for promoting baseline standards for monitoring, reporting, and verification:

- 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

We would also like to thank all of the groups and organizations that participated in workshops, webinars, and initiative surveys over the past year:

- ACR
- Akana
- Alaska Support Industry Alliance
- Amazon
- Amazon Web Services
- American Fuels and Petrochemical Manufacturers
- American Wood Council
- Ann Walker Consulting
- The Anshutz Corporation
- Apricus Energy Partners
- 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

WESTERN GOVERNORS' ASSOCIATION

1700 Broadway, Suite 500
Denver, CO 80290 • 303.623.9378

westgov.org