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Before the
Senate Environment and Public Works Committee

August 19, 2020
Field Hearing to examine "Energy and Environmental Innovation:
Wyoming's Leadership in Using and Storing Carbon Dioxide Emissions"

Great Plains Institute Testimony:
Federal Support for Carbon Capture Technologies Critical to Scaling the Carbon Capture Industry

Chairman Barrasso, Ranking Member Carper and Members of the Committee,

Thank you for convening this field hearing on the leadership of the state of Wyoming in the development of a domestic carbon capture industry. Holding this field hearing at the Wyoming Integrated Test Center is fitting, as Wyoming is a leading state in the development of commercial-scale carbon capture, utilization, removal and storage technologies. In a country as economically diverse and varied in resource potential as the United States, there must be multiple pathways to net-zero carbon emissions by midcentury if we are to meet our climate goals, and Wyoming has distinguished itself in charting a path toward climate stewardship that appropriately draws on the comparative advantages of a rural energy-producing and natural resource-rich state.

Additionally, by introducing and passing out of this committee the USE IT Act, the Environment and Public Works Committee has also shown tremendous leadership and interest in developing the next-generation of carbon capture technologies, including direct air capture (DAC), carbon utilization, and planning the deployment of infrastructure that will be necessary to capture, transport, and store carbon captured from industrial facilities, power plants and from ambient air. We recognize and thank Chairman Barrasso, Ranking Member Carper and the eight other members of the Committee from both political parties who have cosponsored the legislation.

About the Great Plains Institute

The Great Plains Institute (GPI) is a nonpartisan nonprofit with roots in the Upper Midwest and programmatic activities in carbon capture dating back to 2002. The goal of GPI's carbon management program is to accelerate economywide commercial deployment of carbon capture, transport, use, removal and geologic storage to take full economic advantage of our nation's energy resources, protect and create high-wage jobs, and meet midcentury goals for reducing carbon emissions.

Carbon capture can reduce emissions across multiple industries and is the only technology available to manage emissions from several industrial processes essential to modern economies. It can also be paired with bioenergy projects to produce energy with net zero or negative carbon dioxide (CO_2) emissions. GPI engages with a broad set of interests at the federal, regional and state levels to advance financial incentives and other policies that will drive investment in and deployment of carbon capture, CO_2 transport infrastructure and geologic storage projects.

Our work is national in scope, including focused work at the federal level and complementary state and regional initiatives spanning the Great Plains, Gulf Coast, Midwest and Mountain West regions. GPI coordinates the 16-state State Carbon Capture Work Group, originally co-convened by former Wyoming Governor Matt Mead and Montana Governor Steve Bullock, and the Regional Carbon Capture Deployment Initiative that brings together nearly 400 state officials and stakeholders across two dozen states. Additionally, the Great Plains Institute convenes the national Carbon Capture Coalition, which is comprised of more than 80 companies, unions and NGO building federal policy support for economy-wide deployment of carbon capture, transport, use, removal and storage.

This testimony will address:

- The ongoing federal role in the development and commercialization of carbon capture technologies;
- Wyoming's leadership in developing carbon capture technology;
- Carbon capture's role in meeting midcentury climate goals;
- Carbon capture's job creation potential; and
- Key areas the federal government must invest in to ensure commercial-scale deployment of carbon capture, including direct air capture, carbon utilization, and CO_2 transport infrastructure addressed in the three titles of the USE IT Act.

The Federal Role in Carbon Capture Deployment

The landmark bipartisan reform and expansion of the federal 45Q tax credit through passage of the FUTURE Act in 2018 has spurred tremendous interest from lawmakers, states, and stakeholders in commercializing carbon capture technologies. The Carbon Capture Coalition has spent over two years building consensus on the effective implementation of 45Q, including three comprehensive submissions of consensus model guidance and recommendations to Treasury and the IRS in November 2018, June 2019, and July 2020. IRS finalizing the proposed rule for 45Q will provide long overdue regulatory and investment certainty to unlock billions of dollars in private capital for carbon capture projects to complete planning, engineering, permitting and financing to begin construction by the end of 2023 and qualify for the credit.

Looking ahead, and building on the success of wind, solar and other low- and zero-carbon technologies, carbon capture will need a full portfolio of federal policies and parity of support to achieve economywide deployment. This includes tax credits and other incentives, federal funding for research, development and demonstration (RD&D), and federal financing in order to leverage private investment in carbon capture, transport and storage projects that will spur continued innovation and improved performance, thus driving down costs and attracting still more investment that further accelerates deployment.

It is well established that there are long lead times for advancing capital intensive energy technologies from concept to demonstration to commercialization, making it difficult to attract sufficient private investment to scale up these technologies in the marketplace, absent federal support.

The United States leads the world in the commercialization of carbon capture, and there is bipartisan support for capturing and utilizing CO_2 and its precursor carbon monoxide. Carbon oxides may be captured from diverse sources, including a broad range of industrial facilities, power plants and ambient air through DAC. Sustained federal investment in these technologies represents a genuine win-win for our nation's economy and environment, greatly reducing our nation's emissions, while benefitting energy-producing and industrial regions with the retention and creation of high-paying jobs and a sustainable tax base.

Reflecting growing momentum and political support, there have been numerous bipartisan Senate bills introduced in the 116th Congress that would further carbon capture deployment, whether through bolstering or creating new federal research and development programs or reducing the cost of attracting private capital to develop and build capture projects. They include the following:

- **The USE IT Act** (S. 383) supports RD&D for carbon utilization and DAC and facilitates collaboration on planning and permitting CO2 transport infrastructure;
- **The Carbon Capture Modernization Act** (S. 407) enables existing power plants to access available Section 48A tax credits for greater deployment of carbon capture in the power sector;
- **The Carbon Capture Improvement Act** (S. 1763) allows carbon capture projects to access tax-exempt private activity bonds;
- **Financing Our Energy Future Act** (S. 1841) makes carbon capture and utilization projects eligible for tax-advantaged master limited partnerships;
- **The EFFECT Act** (S. 1201) reauthorizes, updates and expands RD&D programs for carbon capture, utilization, removal and storage;
- **The LEADING Act** (S. 1685) establishes a RD&D program for carbon capture at natural gas energy facilities; and
- **The Clean Industrial Technology Act** (S. 2300) stands up an industrial decarbonization RD&D program, which includes carbon capture to address industrial emissions.

Additionally, several of these bills have been packaged into the American Energy Innovation Act, which, if passed, would represent the most consequential legislation for carbon capture since enactment of the FUTURE Act. The expansion of federal carbon capture RD&D programs will help drive down the costs and improve the performance of next generation clean energy and industrial technologies, thus providing more options in both the U.S. and globally to meet midcentury emissions reduction goals.

Finally, similar or companion legislation in the House has been introduced and, in several cases, reported out of committee on a bipartisan basis. Recently, direct pay and a two-year extension of the 45Q tax credit passed the full House as part of H.R. 2, the Moving Forward Act. Notably, far-reaching bipartisan RD&D amendments for carbon capture, utilization, removal and storage were also included in and passed as part of H.R. 2, providing a potentially promising basis for Senate negotiations with the House to enact provisions of the USE IT Act into law.

Carbon Capture's Role in Addressing Climate Change

Analysis by the International Energy Agency (IEA) has determined that deployment of carbon capture technology is critical to achieve midcentury global temperature targets. Nearly every global temperature scenario put forth by international organizations and agreements requires dramatically accelerated use of carbon capture to meet its goals. Underscoring carbon capture's central role in mitigating climate change, the United Nations Intergovernmental Panel on Climate Change (IPCC) found that carbon mitigation under the 2º Celsius scenario would cost 138 percent more if carbon capture were not included as an emissions reduction strategy.

Carbon capture has been successfully deployed at large scale in certain industrial sectors for decades and has entered commercial-scale operation in the power sector in recent years. Industrial CO_2 emissions account for about 33 percent of US stationary emissions, according to the US Environmental Protection Agency. Many industrial facilities in ethanol, gas processing, ammonia and hydrogen production offer immediate opportunities for relatively low-cost carbon capture due to the high purity and concentration of CO_2 emissions coming off their production processes.

The IEA estimates that the global carbon capture industry will need to scale-up to over 2,000 facilities capturing 2.8 gigatons of CO_2 per year to limit warming to 2°C. To meet the more ambitious 1.5°C scenario, the IPCC estimates that 10 gigatons of CO_2 must be captured annually. To reach this level of ambition, the Global CCS Institute estimates that more than 2,500 large-scale carbon capture facilities will need to come online by 2040. It is estimated that half of these facilities will be in power, the other half in industrial sectors. Today, there are 21 large-scale carbon capture projects operating world-wide, with another 30 in various stages of development. Globally, 21 large-scale facilities currently capture approximately 42 million metric tons of CO_2 per year. The U.S. has 13 commercial-scale carbon capture facilities operating today, with the capacity to capture on the order of 25 million tons of CO_2 annually.

Reaching this scale of CO_2 capture and storage will require an accelerated, economywide buildout of capture projects across sectors, including heavy industry (e.g. cement, steel, chemicals and other vital industrial processes); ethanol, fertilizer and hydrogen production; refining and natural gas processing; power generation and DAC from ambient air. Additionally, a commercial-scale carbon capture industry will require the buildout of transport infrastructure to move CO_2 from where it is captured to appropriate geologic storage sites. Not only would this constitute a significant investment in domestic energy, industry and manufacturing, it would preserve and expand a high-wage jobs base in many regions of the country, while decarbonizing economic sectors that are fundamental to modern life as we know it.

Wyoming is a Leader in Developing Carbon Capture Technology

Wyoming already ranks among the top states in the nation when it comes to carbon capture, transport and geologic storage, and it is even richer in potential. Wyoming is strategically positioned to become both a major source of CO_2 captured from industrial facilities and power plants, as well as a hub for the beneficial use and geologic storage of captured carbon. The state is one of the largest emerging hubs for CO_2 pipeline infrastructure and projects, serving not just Wyoming but linking to Colorado and Montana.

Ranked first among states in the production of coal and eighth in crude oil production, while also containing 23 facilities eligible for the reformed and expanded 45Q tax credit, Wyoming has

immense opportunity for the deployment of carbon capture technology and geologic storage through enhanced oil recovery (EOR) and in saline formations to lower carbon emissions and transform captured carbon into an economic resource.

As one of the first states to enact legislation on carbon capture, utilization and storage, Wyoming now has among the most comprehensive legislative frameworks for incentives and regulation of carbon capture and geologic storage. Uniquely among states, Wyoming also developed a CO_2 Pipeline Corridor Initiative to facilitate the development of statewide and regional infrastructure for the transport and management of CO_2. With a supportive tax structure, comprehensive legislation, and geologic potential, Wyoming is projected to continue as a leader in carbon capture policy development and project deployment.

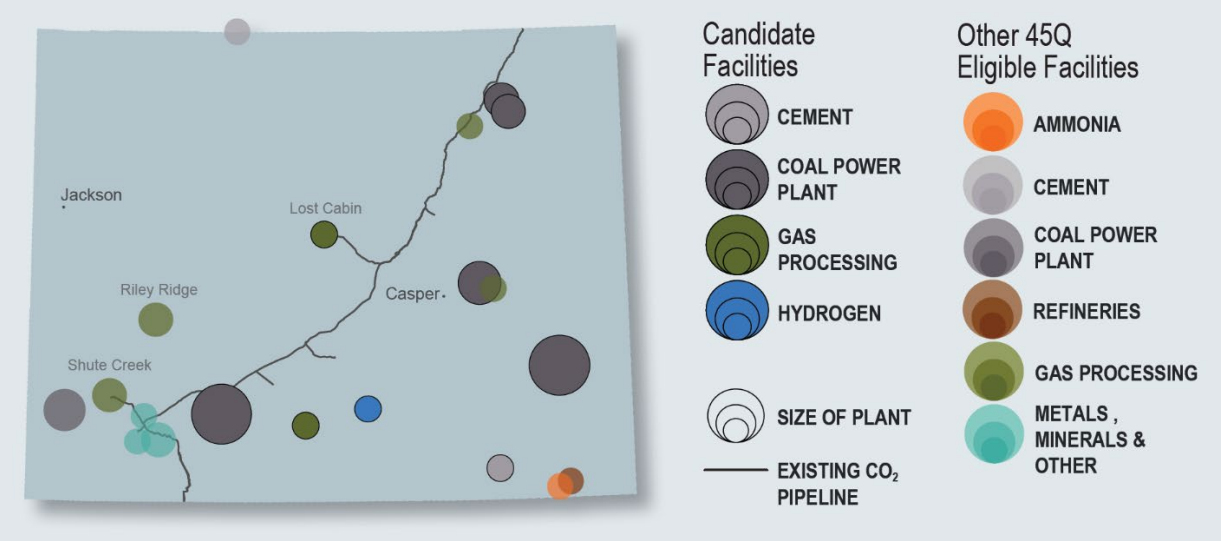

Figure 1: 45Q Eligible Facilities in Wyoming. Wyoming has many facilities large enough to qualify for the 45Q carbon capture tax credit, including coal power plants, gas processing facilities, and petroleum refineries. Facilities identified by the Regional Carbon Capture Deployment Initiative as potential early candidates for capture retrofit based on emissions, equipment, and estimated capture cost, are shown with outlines and darker colors. Source: Great Plains Institute 2019, EPA 2018.

Carbon Capture as a Jobs Creator

The current COVID-19 pandemic has wreaked havoc on much of the economy, and the power and industrial sectors are no different. The IEA estimates that “global energy demand will fall six percent in 2020 – the equivalent of losing the entire energy demand of India, the world’s third largest energy consumer.”

The IEA also estimates that global investment in energy technology is set to drop 20 percent in 2020, the largest ever one-year decrease, and thousands of jobs have been lost as energy projects have stalled. The current pandemic offers both the challenge and opportunity to rebuild and retool our energy sector better and cleaner than before. Carbon capture has a unique role to play in the broader economic recovery – both as a jobs creator and an emissions reduction tool.

Fostering carbon capture deployment at levels needed to meet midcentury climate goals will result in dramatic growth in employment provided by the carbon capture industry, including both project jobs (primarily construction) and operational jobs featuring a mix of skill levels. If commercially deployed globally to address emissions as part of a broad suite of zero- and low-carbon technologies, the Global CCS Institute has found that the carbon capture industry would employ between 70,000 and 100,000 construction workers and 30,000 to 40,000 facility operators in 2050, with additional employees to build and maintain a CO_2 transport and storage network. Additionally, carbon capture retrofits will decarbonize existing facilities, preventing their retirement and loss of associated high-wage jobs.

Carbon capture retrofits of industrial facilities and power plants support high-wage jobs in particular; indeed, they provide among the most desirable green jobs, given that employment associated with heavy industry (refining, chemicals, cement, steel, etc.) and electric power generation pays more than the average for states in which such facilities are located. In addition, new and innovative high-skill and high-wage industries will play a role in commercializing the carbon capture industry, including jobs associated with new negative emissions and carbon utilization technologies.

CARBON CAPTURE RETROFIT*		PROJECT JOBS	OPERATION JOBS
INDUSTRY	STEEL MILL	1,680 – 3,030	170 – 310
	REFINERY	440 – 760	40 – 70
	CEMENT PLANT	430 – 690	60 – 110
	HYDROGEN PLANT	175 – 300	20 – 30
	ETHANOL PLANT	30 – 50	5 – 10
POWER	COAL POWER PLANT	1,800 – 3,350	160 – 300
	NATURAL GAS COMBINED-CYCLE POWER PLANT	1,140 – 2,090	100 – 180
CO_2 TRANSPORT INFRASTRUCTURE	TRUNK LINE (20" DIAMETER PIPELINE, 200 MILES LONG)	1,250 – 2,190	8 – 20
	FEEDER LINE (12" DIAMETER PIPELINE, 50 MILES LONG)	250 – 370	2 – 5

*By facility type

Figure 2: Job Estimates by Facility Retrofit. Drawing on GPI's modeling of economically feasible capture projects (described later), the Rhodium Group has provided preliminary analysis of the jobs potential for a typical carbon capture facility across several industries. The range in jobs numbers reflect differences in project sizes in the GPI project database. Source: Rhodium Group, 2019.

The USE IT Act's Role in Building a Commercial-Scale Carbon Capture Industry

While the 45Q tax credit is foundational to spurring additional investment in carbon capture technology, passage of associated policies will provide important research and development dollars to drive down the costs associated with both existing and new technologies, as well as

helping to develop new technologies crucial to meeting midcentury climate goals and to preserving and creating high-wage industrial, manufacturing and energy production jobs in carbon-intensive sectors of our economy.

Enactment of the Senate-passed USE IT Act would support research, development and demonstration of DAC technology and beneficial uses of carbon captured from industrial, power and DAC plants that reduce emissions, as well as foster cooperative planning and permitting of pipeline infrastructure to transport CO_2 from where it is captured to where it can be safely and permanently stored or put to beneficial use. Passage of the USE IT Act and associated carbon capture legislation now before the 116th Congress would allow energy producing states like Wyoming to play a pivotal role in reducing emissions and sustaining energy production and high-wage jobs.

The USE IT Act contains three titles and remaining testimony will cover the importance of scaling these three technologies: direct air capture, carbon utilization and CO_2 transport infrastructure.

Direct Air Capture

While capturing emissions directly from industrial and power sources is critical to addressing climate change, negative emissions technologies (NETs), including DAC, will be required to manage atmospheric concentrations of CO_2. The IPCC estimates that, in addition to actively avoiding emissions, whether through renewables, energy efficiency or other zero-carbon technologies, there will be a need to remove anywhere between 100 to 1,000 gigatons of CO_2 by 2100, to limit warming to 1.5° C.

Deployed at the necessary scale, these NETs will remove approximately 10 gigatons of CO_2 annually by mid-century, and 20 gigatons of CO_2 by end of century, particularly to offset hard-to-decarbonize sectors, such as significant portions of industry and heavy-duty transportation. In addition to their necessary role in meeting the 1.5° C goal, in the likely scenario that we exceed our global carbon budget, any additional emissions "overshoot" would need to be offset by NETs. Deploying NET technologies at this scale will require massive federal and private investment, as well as international coordination. While DAC technology is commercially available at smaller scales and there are several projects in the development pipeline, new policies are needed to drive down the costs of deployment. According to research from the Rhodium Group, DAC will need to manage between 689 to 2,260 million tons of carbon annually to meet a 1.5° C target.

Additionally, if DAC deployment reaches the full scale needed to attain midcentury climate goals, it will create tremendous domestic employment and business opportunities. In analyzing the jobs and economic development created by DAC deployment, the Rhodium Group found that building just one average-sized facility[1] would create approximately 3,500 project jobs, with an additional 278 jobs created by ongoing plant maintenance. The associated jobs span a range of sectors, including industrial manufacturing, construction, engineering, and steel and cement manufacturing. Business opportunities from scaling DAC exist in equipment manufacturing, cement, steel, chemicals, electricity and natural gas. With a commercial-scale DAC industry, employment in steel and chemical sectors could be boosted 50 percent by large-scale DAC

[1] Assumes that a typical DAC plan captures one million tons of CO_2 per annum.

deployment alone, and the construction, engineering, and equipment manufacturing sectors could see 300,000 new jobs.

Carbon Utilization

Carbon utilization is the production of valuable products from carbon oxides (carbon monoxide-CO and carbon dioxide-CO_2) captured from gaseous waste streams, or from the atmosphere, that result in a reduction of greenhouse gas emissions as compared to an incumbent process or product. Carbon utilization may include the production of a wide variety of commodities or products sourced from waste gases or DAC and includes low and zero-carbon fuels, chemicals, plastics, advanced materials, industrial gases and fluids, building products as well as agricultural and food feedstocks.

Carbon utilization represents yet another area of public and private sector leadership in Wyoming, with the Integrated Test Center location for this hearing being a prominent example. The Integrated Test Center is pursuing carbon utilization innovation, to add economic and environmental value to captured carbon.

Increasingly, carbon utilization is seen as an important complement to large-scale carbon storage as it provides value-added markets for carbon capture operations and is an important component of a circular carbon economy. Taken together, the National Academies of Science has estimated that utilization pathways could take up to 1 gigaton of CO_2 per year. The growing carbon-to-value market could be worth an estimated $800 billion a year by 2030, with most value seen in high-volume products, including aggregates and fuels.

One prominent example of the opportunity inherent in carbon utilization is the US technology firm LanzaTech. Through a partnership with the world's largest steel producer, ArcelorMittal, the company is are constructing a commercial-scale facility in Belgium to use microbes to transform waste carbon monoxide emissions captured from steel production into 17.5 million gallons of ethanol annually. This ethanol can be converted to jet fuel or a wide range of chemicals and other products. The technology pathway LanzaTech is pursuing is just one example of carbon utilization where waste gases that would otherwise be combusted and released to the atmosphere as CO_2 are instead converted into valuable products.

MARKET SIZE: $ BILLION	2020	2025	2030
Concrete	60	200	400
Fuels	5	60	250
Aggregates	4	30	150
Algae Ag/Feed Products	3	10	120
Algae Fuels/Chemicals	2	4	200
Polymers	1	3	25
Commodity Chemicals	0	5	12

GHG MITIGATION: BILLIONS OF METRIC TONS OF CO_2	2020	2025	2030
Concrete	*	0.7	1.4
Fuels	*	*	2.1
Aggregates	*	0.7	3.6
Algae Ag/Feed Products	*	*	1.2
Algae Fuels/Chemicals	*	*	2
Polymers	*	*	*
Commodity Chemicals	*	*	*

* less than 0.5 billion tons CO_2

Figure 3: Market Size and GHG Mitigation Potential of Carbon Utilization Sectors. Source: *Carbon Utilization— A Vital And Effective Pathway For Decarbonization,* Center for Climate and Energy Solutions (C2ES), 2019.

A recent report from C2ES finds that high-volume products sourced from carbon utilization, including concrete and aggregates, as well as fuels, could drive both volumes of carbon utilization and market value. However, realizing this market will require build-out of CO_2 transport infrastructure, as well as breakthroughs in carbon utilization pathways enabled by federal RD&D. Finally, they will need to be tested and commercialized at places like Wyoming's Integrated Test Center.

CO_2 Transport Infrastructure

With the availability of a foundational federal incentive such as 45Q to help finance carbon capture deployment, interest and attention from policymakers and stakeholders is expanding to include CO_2 transport infrastructure. CO_2 transport infrastructure will play a critical role in enabling economywide deployment of large-scale carbon management. Here again, Wyoming stands out, with its national leadership on carbon capture reflected in the state's long-term, proactive approach to planning and preparing for the responsible buildout of CO_2 transport networks to meet both economic and emissions reduction goals. No other state has devoted so much attention to the infrastructure side of carbon management.

In 2012, the state launched the Wyoming Pipeline Corridor Initiative (WPCI) to identify approximately 2,000 miles of optimal pipeline corridors in 25 segments to provide CO_2 transport infrastructure within the state. These pipeline corridors will ultimately link industrial facilities and power plants with saline formations and oil fields best suited for permanent geologic storage. Coordinated state planning will also minimizing costs, uncertainty, and environmental impacts of infrastructure as well as the time, uncertainty and cost associated with permitting projects.

Initiated by former Governor Mead and further supported by Governor Gordon, Chairman Barrasso encouraged the Administration to prioritize CO_2 transport infrastructure and review of Wyoming's statewide effort, and the WPCI recently received a favorable decision on its environmental impact statement from the Bureau of Land Management. We also want to recognize our colleague Matt Fry, formerly on Governor Mead's staff and now with the Wyoming Game and Fish Department, whose dedication and perseverance over nearly a decade helped make the success of the WPCI a reality.

The WPCI has already served as a model for the work of other such initiatives. The State Carbon Capture Work Group, inspired by Wyoming's efforts, released a white paper in early 2017 on the development of national CO_2 transport networks that included recommendations for federal financing of such infrastructure. These recommendations informed the development of the INVEST CO_2 Act (H.R. 4905), introduced last year by Representative Bustos (D-IL). The Initiative also provided a basis for the provisions in Title III of the USE IT Act to facilitate collaborative CO_2 transport infrastructure planning among federal agencies, states, tribal governments, and industry, NGO and other key stakeholders.

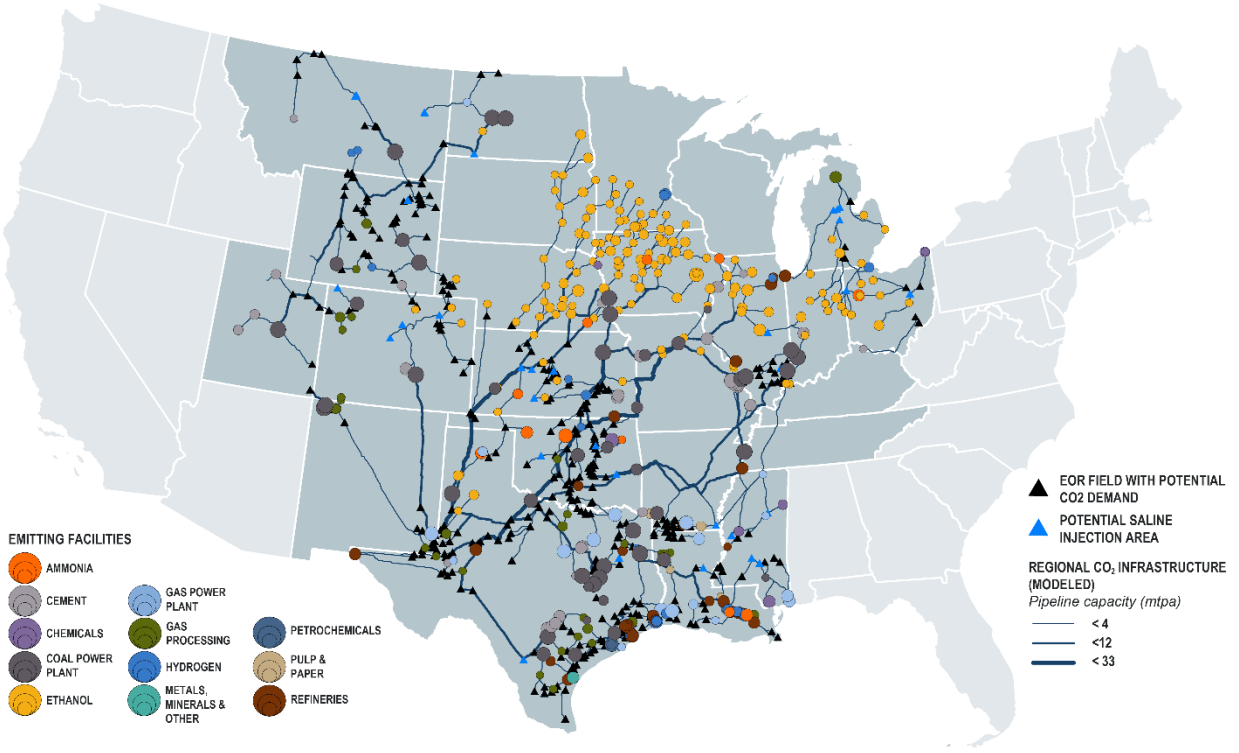

Figure 4: Near and Medium-Term Capture, Transport and Storage Deployment. Source: *Transport Infrastructure for Carbon Capture and Storage: Regional Infrastructure for Midcentury Decarbonization*, Great Plains Institute, 2020.

Often overlooked is the critical role that that the buildout out of CO_2 transport infrastructure must play if carbon capture is to fulfill its necessary contribution to meeting midcentury climate goals. A national modeling team coordinated by GPI, and featuring participation by the University of Wyoming's Enhanced Oil Recovery Institute, recently completed a two-year long modeling and analysis of regional-scale deployment of carbon capture, transport and geologic storage. This work underscores both the potential for, and essential importance of CO_2 transport infrastructure deployment, to enable large-scale carbon management.

45Q tax credit-eligible industrial and power plant sources of CO_2 and suitable geologic storage reservoirs across a 24-state study region, together with the results of a facility-by-facility analysis of carbon capture costs, were fed into Los Alamos National Laboratory's SimCCS model to identify optimized CO_2 transport networks capable of achieving economy-of-scale cost savings, while minimizing environmental and other impacts.

Modeling results show that near and medium-term deployment based on the 45Q tax credit, market demand for CO_2, coordinated infrastructure planning, and low cost financing results in the capture, transport and storage of 281 million metric tons per of CO_2 annually, or nearly one-third of a gigaton of CO_2 (See Figure 4). Midcentury deployment of even more robust CO_2 transport networks based upon further policy support and greater cost reductions result in annual capture, transport and storage of 669 million metric tons of CO_2 annually, or two-thirds of a gigaton (See Figure 5).

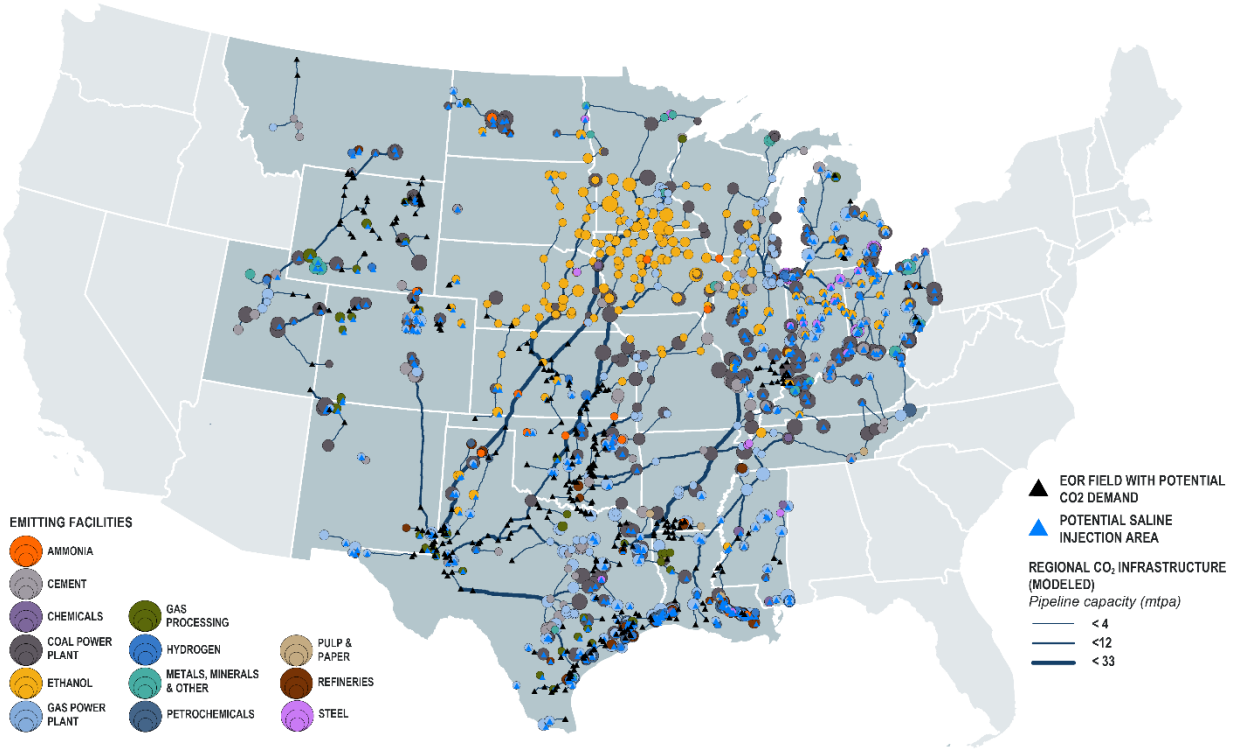

Figure 5: Midcentury Capture, Transport and Storage Deployment. Source: *Transport Infrastructure for Carbon Capture and Storage: Regional Infrastructure for Midcentury Decarbonization*, Great Plains Institute, 2020.

To put these results in perspective, U.S. annual CO_2 emissions are on the order of five gigatons. IEA's modeling of the 2º C target suggests that we must be achieving 20 percent of our annual emissions reductions by 2050 from carbon capture and storage. Given that the midcentury scenario modeled by GPI and colleagues shows roughly two-thirds of a gigaton of capture, transport and storage potential across 24 states, it is expected that expanding the current analysis to the rest of the country will reveal the **potential for at least a gigaton of annual carbon management nationwide by midcentury**. This level of carbon capture is in line with the IEA's modeling of the technology's expected contribution to achieving to the 2º C target by 2050.

Beyond the climate necessity, the economic benefits of regional CO_2 transport infrastructure deployment networks will be profound. Figure 6 below highlights the projected capital investment, project wages and annual operations and maintenance expenditures associated with both the near and medium-term and midcentury deployment scenarios. It should be noted that these projections do not include the enormous and beneficial economic and jobs implications of futureproofing existing domestic energy, industrial production and manufacturing for a low-carbon economy by deploying technology and infrastructure for decarbonization.

Scenario	CO_2 Stored	Miles of Transport Network	Capital Investment	Project Labor Investment	Annual O&M Spending
Near- and Medium-Term	**281** million metric tons	**29,710** miles	**$16.6** billion	**$14.3** billion	**$252** million
Midcentury	**669** million metric tons	**29,922** miles	**$19.3** billion	**$15.3** billion	**$254** million
Impact of Midcentury planning horizon	**x 2.38** more CO_2 stored	**+0.7%**	**+16.3%**	**+7.0%**	**+0.8%**

Figure 6: Economic and Employment Implications of Near/Medium-Term and Midcentury Deployment Scenarios. Source: *Transport Infrastructure for Carbon Capture and Storage: Regional Infrastructure for Midcentury Decarbonization*, Great Plains Institute, 2020.

To realize climate, economic and jobs benefits on this scale by midcentury, federal policy leadership on CO_2 transport infrastructure planning and deployment is urgently needed to complement 45Q and other federal policies on the capture and storage side of the equation. Passage of the USE IT Act's Title III is an important first step to enable federal agencies, states and stakeholders to begin working together on a regional multistate basis, building on the example of what is already occurring in Wyoming. In addition, federal support for financing CO_2 transport infrastructure capacity along the lines of the current INVEST CO_2 Act, especially large-volume, long-distance common carrier trunk lines, must be part of a federal infrastructure package in the next Congress.

Conclusion

In summary, economywide deployment of carbon capture, use and geologic storage is not optional if we are to decarbonize industry and achieve midcentury climate goals. Carbon capture technology provides a viable pathway to enable the decarbonization and continued operation of existing and new industrial facilities, while avoiding plant closures and the offshoring of jobs and livelihoods. The US is the world's leader in the capture, use and geologic storage of carbon emissions from industry, with nearly 50 years of successful commercial and operational experience on which to build. In addition, we now have the opportunity to build new industries and associated high-wage jobs with both DAC and carbon utilization technologies.

Building on the deeply bipartisan success of the 2018 FUTURE Act, Congress must enact a broad portfolio of federal incentives and other policies to commercialize carbon capture, transport, use, removal and geologic storage and further incentivize DAC and carbon utilization. We must implement lessons learned from our successful experiences with wind, solar and other low and zero-carbon technologies to implement a broader policy framework for carbon capture. Carbon capture technologies have a pivotal role in sustain US leadership in energy technology and helping to put our nation on a path toward midcentury decarbonization.

Thank you again for your leadership and for the opportunity to provide testimony for the record.

Sincerely,

Brad Crabtree
Vice President
Carbon Management
Great Plains Institute