FEDERAL POLICY BLUEPRINT

FEBRUARY 2021

CARBON CAPTURE COALITION

Membership

Participants

Accelergy
AFL-CIO
Air Liquide
Air Products
AK Steel
Alto Ingredients
American Carbon Registry
ArcelorMittal
Arch Resources
Archer Daniels Midland Co.
Baker Hughes
Bipartisan Policy Center
Calpine
Capital Power
Carbon180
Carbon America
Carbon Wrangler LLC
Center for Climate and Energy Solutions
Citizens for Responsible Energy Solutions Forum
Clean Air Task Force
Conestoga Energy Partners
Core Energy LLC
DTE Energy
EBR Development LLC
Elysian Ventures
EnergyBlue Project
Energy Innovation Reform Project
GE Gas Power
Glenrock Energy
Great River Energy
Greene Street Capital
Impact Natural Resources LLC
ION Engineering LLC
International Brotherhood of Boilermakers
International Brotherhood of Electrical Workers
Jackson Hole Center for Global Affairs
Jupiter Oxygen Corporation
Lake Charles Methanol
LanzaTech
Linde, Inc.
Mitsubishi Heavy Industries America, Inc.
National Farmers Union
National Wildlife Federation
NET Power LLC
New Energy Risk
New Steel International, Inc.
NRG Energy
Occidental
Peabody
Prairie State Generating Company
Praxair, Inc.
Shell
SMART Transportation Division (of the Sheet Metal, Air, Rail and Transportation Workers)
Summit Agricultural Group
Summit Power Group
Svante
The Nature Conservancy
Third Way
Thunderbolt Clean Energy LLC
United Mine Workers of America
United Steel Workers
Utility Workers Union of America
White Energy

Observers

Algae Biomass Organization
Biomass Power Association
Brown Brothers Energy & Environment, LLC
Carbon Engineering
Carbon Utilization Research Council
Chart Industries
ClearPath
Cornerpost CO_2 LLC
Enhanced Oil Recovery Institute, University of Wyoming
Environmental Defense Fund
Growth Energy
Institute of Clean Air Companies
Melzer Consulting
National Audubon Society
Portland Cement Association
Renewable Fuels Association
Republic Services
School of Energy Resources, University of Wyoming
Systems International | The ZEROS Project
Tellus Operating Group
Waste Management
World Resources Institute

FEDERAL POLICY BLUEPRINT

Table of Contents

CARBON CAPTURE COALITION

Preface

Members of the Carbon Capture Coalition (the Coalition) work together to achieve a common goal: economywide deployment of carbon capture, removal, transport, utilization, and storage. The mission of the Coalition is to reduce carbon emissions to meet midcentury climate goals, foster domestic energy and industrial production, and support a high-wage jobs base through widespread adoption of carbon capture technologies. The Coalition supports the mission by advancing a comprehensive agenda of federal policies and actions that will accelerate deployment of:

- Capture of carbon dioxide (CO_2) and carbon monoxide (CO) from power plants and industrial facilities;
- Carbon removal technologies, including direct air capture, bioenergy with carbon capture and storage and other advanced technologies that remove CO_2 already in the atmosphere;
- Transport infrastructure to carry CO_2 from where it is captured to where it can be geologically stored or put to beneficial use;
- Utilization of captured CO_2 and CO to produce low-carbon fuels, chemicals, materials, and other useful products;
- Storage of CO_2 in secure geologic reservoirs, such as saline geologic formations and oil and gas fields.

The 2021 consensus *Federal Policy Blueprint* builds upon the Coalition's original policy blueprint released during the 116th Congress. It articulates a comprehensive and ambitious federal policy agenda to help achieve the goal of economywide carbon capture deployment and reflects the consensus federal policy priorities of the Coalition. It is not intended to represent a complete compilation of all policies that are relevant and important to the broader carbon management agenda of carbon capture, removal, transport, utilization, and storage.

"Carbon capture" is used to reference the entire suite of carbon management tools: capture, removal, transport, utilization, and storage.

This Blueprint focuses on federal policy priorities. It does not address state-level policies, which have an important role to play in complementing federal policies to support commercial carbon capture deployment.

Introduction

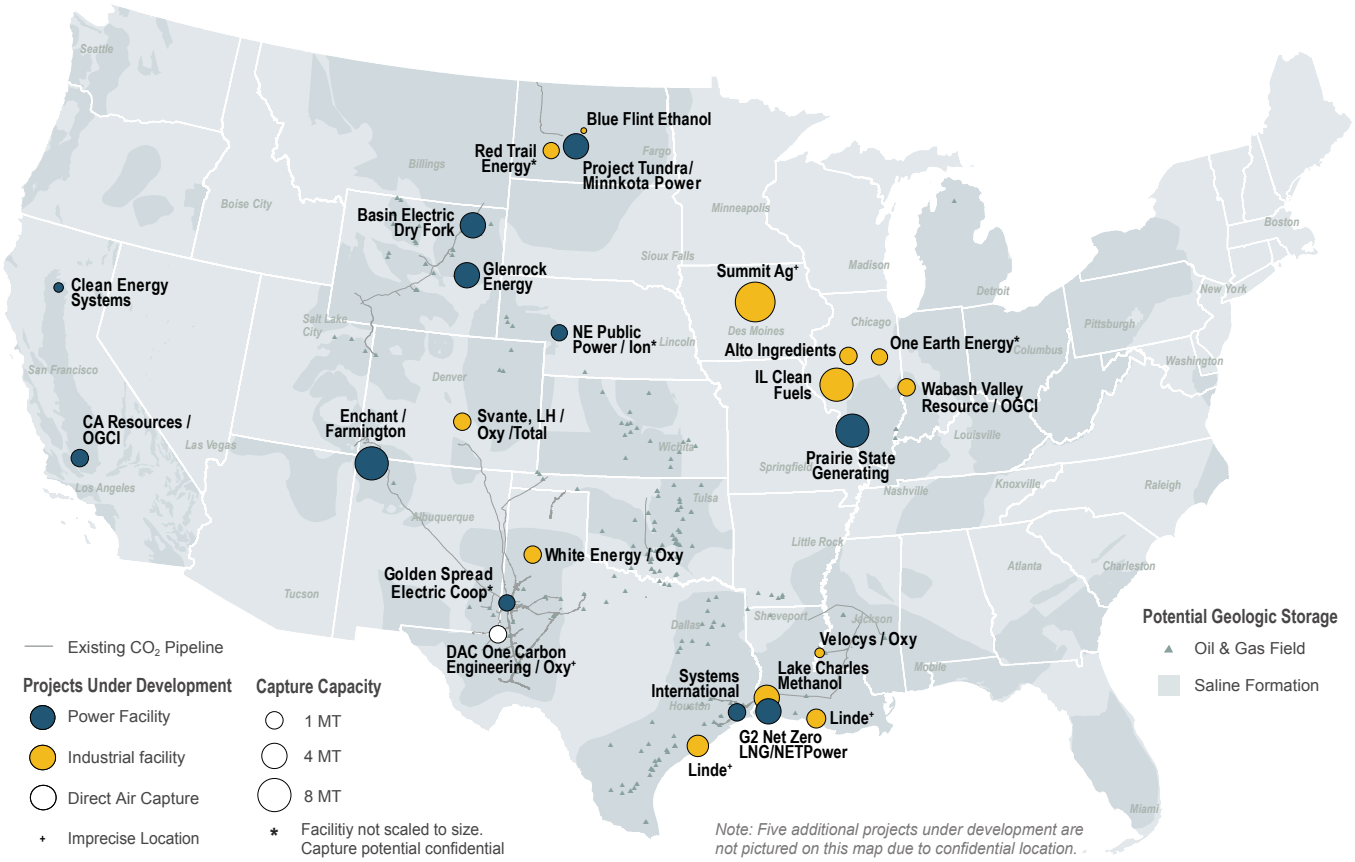
The United States leads the world in the commercialization of carbon capture, removal, transport, utilization and storage (or carbon capture), and there is broad bipartisan support for capturing and utilizing CO_2 and CO. The U.S. has 13 commercial-scale carbon capture facilities, with the capacity to capture about 25 million tons of CO_2 annually, representing approximately half of the 26 commercial-scale carbon capture projects worldwide.

To meet midcentury emissions reduction goals, preserve and create high-wage jobs and maintain U.S. technology leadership, a broad suite of enabling policies will be required to accelerate commercial deployment of carbon capture projects.

Large-scale deployment of carbon capture is essential if we are to achieve the economywide decarbonization necessary to meet midcentury climate goals. To limit warming to 2°C, the IEA estimates that the global carbon management industry will need to scale up to well over 2,000 facilities capturing and storing 2.8 gigatons (billion metric tons) of CO_2 per year. Deployment of carbon capture also provides a viable pathway for the decarbonization and continued operation of key industrial, manufacturing and energy facilities, thereby avoiding plant closures and the offshoring of jobs and livelihoods.

In the three years since Congress revamped the federal 45Q tax credit, project developers and investors have announced over 30 carbon capture projects. They span multiple industry sectors, electric power, transportation fuels, and direct air capture technologies. These approximately 30 publicly announced carbon capture projects represent an essential early down payment on long-term deployment to meet midcentury climate goals. If these projects all proceed to commercial operation, it will represent roughly a tripling of operating carbon capture projects in the U.S. Additionally, many more projects under development have not yet been publicly announced.

Figure 1: Publicly announced carbon capture projects in the United States that are currently under development



These announced projects span industry, power and direct air capture and will store CO_2 in saline formations or in oil and gas fields.

The Federal Role in Commercializing Carbon Capture

The landmark bipartisan reform and expansion of the 45Q tax credit through passage of the FUTURE Act in 2018, coupled with groundbreaking provisions in year-end energy legislation passed as part of the Consolidated Appropriations Act, 2021 (FY 2021 Omnibus), is foundational for commercial-scale deployment of carbon capture technologies. The 2021 Omnibus featured an urgently-needed two-year extension of the 45Q tax credit and robust authorizations for federal research, development and demonstration (RD&D) programs aimed at scaling up carbon capture, removal, utilization, and storage; the legislation also included reforms to the Department of Energy (DOE) loan program office, enabling DOE to draw on $8 billion in currently available funds to provide loans and loan guarantees to carbon capture projects. Additionally, the Internal Revenue Service (IRS) finalizing the 45Q rulemaking in January 2021 after a three-year delay,[1] together with the 45Q extension, provides long overdue regulatory and investment certainty to unlock billions of dollars in private capital for carbon capture projects, which can now complete the planning, engineering, permitting and financing required to begin construction by the end of 2025 in order to qualify for the credit.

While these legislative accomplishments are significant, they represent only an initial step toward

1 Since the enactment of the reformed and expanded 45Q tax credit in 2018, the Coalition spent over two years both urging the U.S. Department of the Treasury and the IRS to finalize 45Q guidance and a rulemaking as well as building consensus among its membership companies, unions and NGOs on the effective implementation of 45Q. This resulted in the Coalition submitting consensus-based, comprehensive model guidance and recommendations to Treasury and the IRS in November 2018, June 2019 and July 2020.

fully enabling economywide commercialization of carbon capture, removal and utilization technologies and the development and buildout of associated CO_2 transport and storage infrastructure. If carbon capture is to fulfill its necessary role in achieving net-zero emissions by midcentury, we must scale federal investments and policy ambition accordingly.

A full federal portfolio of supportive policies includes enhancements to 45Q, other tax credits and incentives, greatly expanded funding for RD&D, and financing and grants for CO_2 transport and storage infrastructure. Already, there has been tremendous progress in the previous two Congresses, in both the number of bills introduced and bipartisan, bicameral co-sponsors that have expanded the policy landscape for advancing carbon capture, removal, transport, utilization, and storage. Taken together, these legislative efforts have the potential to establish a comprehensive federal policy portfolio to facilitate and leverage private investment in carbon capture projects. This expanded federal carbon capture policy framework will, in turn, spur continued innovation, increased scale, and improved performance, while driving down costs and attracting still more investment that further accelerates deployment—just as federal policy has effectively helped foster the development, commercialization and ultimate scale-up of other low- and zero-carbon technologies, such as wind and solar.

The Administration and 117th Congress – A Critical Window for Carbon Capture

The administration and 117th Congress have a crucial near-term opportunity to build upon the significant bipartisan legislative accomplishments and growing momentum of the previous two sessions of Congress to advance a comprehensive and ambitious policy portfolio to realize the full climate, economic recovery and jobs potential of carbon capture, removal, transport, utilization and storage technologies. Broader legislative packages focused on economic recovery, infrastructure and climate legislation being developed for consideration provide a window for action that carbon capture cannot afford to miss.

If large-scale carbon management is to fulfill its needed contribution to meet midcentury climate goals, progress over the next decade is critical to scale carbon capture technologies within the timeframe required to achieve net-zero emissions by 2050 and negative emissions thereafter. Meaningfully scaling the carbon management industry by 2050 requires significant action in the near-term within industrial, energy, and manufacturing sectors. In parallel, the buildout of interconnected and responsibly-sited CO_2 transport and storage infrastructure must be

Figure 2: 45Q Tax Credit Structure and Eligibility Requirements

Annual Carbon Capture Thresholds		
25,000 – 500,000 metric tons of CO_2/CO For carbon utilization projects to convert CO or CO_2 into useful products (e.g., fuels, chemicals, products)	**At least 100,000 metric tons of CO_2/CO** Industrial facilities (e.g., ethanol, steel, cement, and petrochemicals), direct air capture facilities and facilities using CO_2 for enhanced oil recovery (EOR)	**At least 500,000 metric tons of CO_2/CO** Electric generating units (i.e., coal and natural gas-fired powered plants)
45Q Tax Credit Amounts		
$35 per ton For secure geologic storage of CO_2 through enhanced oil recovery	**$35 per ton** For carbon utilization projects to convert CO or CO_2 into useful products (e.g., fuels, chemicals, products)	**$50 per ton** For secure geologic storage of CO_2 in saline geologic formations

Timing: Projects must begin construction before January 1, 2026 and may claim the credit for up to 12 years after being placed in service.
Eligibility: Carbon capture and direct air capture projects that either capture and utilize or geologically store carbon oxides are eligible to claim the tax credit.

"Scaling the carbon management industry by 2050 requires significant action in the near-term within industrial, energy, and manufacturing sectors. In parallel, the buildout of interconnected and responsibly-sited CO_2 transport and storage infrastructure must be well underway by 2030."

well underway by 2030, gathering CO_2 captured from multiple facilities and delivering it to appropriate geologic storage sites serving as regional hubs.

Carbon capture, direct air capture, carbon utilization, and storage projects must be deployed quickly to reach a critical mass by 2030. Doing so will establish new benchmarks in technical maturity, ease of construction, affordability, and effective and timely permitting processes. Meeting these benchmarks will enable the industrial, power, and CO_2 transport and storage sectors to make the massive carbon capture investments necessary for achieving net-zero emissions economywide by 2050. If we fail to commit to a broader federal policy portfolio now to enable significant carbon capture deployment by 2030, the U.S. and other countries risk being left without essential options needed to avoid the worst impacts of climate change.

Therefore, it is vitally important that legislation in this Congress include key Coalition recommendations, including enhancements to 45Q and other existing financial incentives, low-cost financing and grants for CO_2 transport and storage infrastructure, and significantly expanded RD&D funding. Taken together, these policies would leverage private investment in near- and medium-term deployment of carbon capture, removal, transport, utilization, and storage projects.

Carbon Capture's Role in Addressing Climate Change

Both the United Nation's Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA) have concluded that economywide and dramatically accelerated commercial deployment of carbon capture is critical for achieving global temperature targets.

In modeling scenarios to limit warming below 2°C, the IEA concludes that 15 percent of all emissions reductions to meet net zero by 2070 must come from carbon capture, with the largest relative emissions reduction contributions coming from carbon capture at industrial facilities. A faster transition to net zero increases the need for carbon capture. Moving the net-zero goalposts from 2070 to 2050 would require 50 percent more carbon capture deployment.

The IEA estimates that the global carbon management industry will need to scale up to well over 2,000 facilities, capturing 2.8 gigatons (billion metric tons) of CO_2 per year to limit warming to 2°C. For the more ambitious 1.5°C scenario, under conditions where further emissions reduction measures are taken, the IPCC estimates that on average, between 8 to 15 gigatons of annual emissions reductions will come from carbon capture technologies, more than half of which must come from carbon removal.

"The IEA estimates that the global carbon management industry will need to scale up to well over 2,000 facilities, capturing 2.8 gigatons of CO_2 per year to limit warming to 2°C."

The Global CCS Institute estimates that more than 2,500 large-scale carbon capture facilities will need to come online by 2040 to achieve the 1.5°C goal; half of these facilities are expected to be in power generation, the other half in industrial sectors. Post-2050, direct air capture and other negative emissions technologies will play an increasing role in offsetting any remaining anthropogenic emissions in

particularly hard-to-abate sectors such as aviation, as well as in reducing the concentration of CO_2 remaining in the atmosphere.

Carbon Capture as a Jobs Creator

Deployment of carbon capture, removal, transport, utilization, and storage technologies will retain and grow domestic high-wage industrial, energy, and manufacturing jobs. Carbon capture projects at industrial facilities and power plants provide some of the most desirable clean energy and industrial jobs since employment associated with heavy industry (refining, chemicals, cement, steel, etc.) and power plants pay higher than average local wages, while preserving important facilities and infrastructure.

In addition, new and innovative high-skilled and high-wage industries will play a role in commercializing carbon capture and carbon removal, including jobs associated with new negative emissions and carbon utilization technologies. Carbon capture retrofits will reduce emissions from existing facilities, preventing their retirement and loss of associated high-wage jobs.

According to a recent Rhodium Group analysis commissioned by the Great Plains Institute, carbon capture deployment at industrial facilities and power plants and buildout of associated CO_2 transport infrastructure in 21 states across the Midwest, Great Plains, Gulf Coast and Rockies regions can support an annual average of up to 68,000 project jobs and 35,800 ongoing operational jobs over a 15-year period, while capturing and managing 592 million metric tons of CO_2 per year.

A typical direct air capture plant capturing one million metric tons of CO_2 per year can generate roughly 3,500 jobs across the various sectors in the supply chain. The construction, engineering and equipment manufacturing sectors combined could see at least 300,000 new jobs associated with full scale direct air capture deployment, according to another Rhodium Group analysis.

"Carbon capture deployment at industrial facilities and power plants and buildout of associated CO_2 transport infrastructure in 21 states across the Midwest, Great Plains, Gulf Coast and Rockies regions can support an annual average of up to 68,000 project jobs and 35,800 ongoing operational jobs over a 15-year period, while capturing and managing 592 million metric tons of CO_2 per year."

Figure 3: Job Estimates by Facility Retrofit

	Project Jobs	Operation Jobs
Carbon Capture Retrofit - 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
Carbon Capture Retrofit - 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

Building upon modeling of economically feasible capture projects from the Great Plains Institute, the Rhodium Group has provided analysis of the jobs potential of typical carbon capture retrofits at facilities across several industries. The range in jobs numbers reflects differences in project sizes in the Great Plains Institute project database.

Carbon Capture Benefits to Affected Communities

In addition to realizing the essential reductions in carbon emissions from widespread adoption of carbon capture technologies, there is a need to ensure that benefits from deployment of the suite of carbon management technologies flow to affected communities and workers.

The communities that are most vulnerable to climate change also typically suffer the greatest impact from criteria air and other pollutants; carbon capture has the potential to play a role in addressing these concerns. Carbon capture retrofits in many instances may significantly reduce conventional pollutant emissions for several reasons.

First, prior to CO_2 separation and capture, flue gas must undergo pretreatment to remove criteria air pollutants, including sulfur oxides, particulate matter, and nitrogen dioxide, to protect the capture solvent. Additionally, utilization of pre-combustion industrial gases removes criteria pollutants as part of the utilization process. Finally, installation of carbon capture may result in facilities having to meet more current and usually stricter emissions standards. However, the specific impact of individual carbon capture retrofits on conventional pollutants will vary depending on the emissions and carbon capture technologies deployed at individual cement, refining, iron and steel, and power plants.

Because carbon capture retrofits are capital intensive, there is little risk of old, inefficient, and polluting facilities extending their lives by adding carbon capture. Younger and relatively more efficient plants with significant remaining economic life pose the most serious challenge to climate change; without capture, they will emit CO_2 unabated, potentially for decades.

While carbon capture will likely provide air quality benefits, further analysis is needed to quantify air quality impacts from carbon capture retrofits at different types of facilities in different industries and develop appropriate measures to ensure and optimize benefits.

Looking Ahead: Reaching Economywide Deployment of Carbon Capture

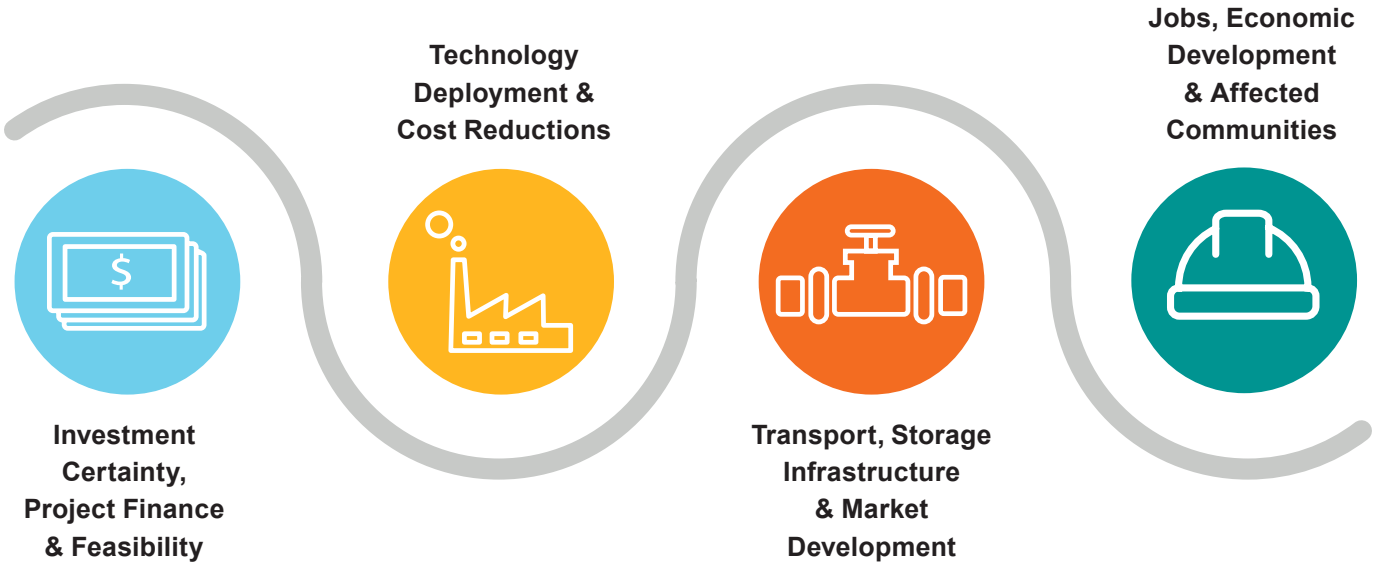
With the cornerstone policy of the 45Q tax credit in place, the Coalition now advocates for a comprehensive federal policy agenda needed to commercialize carbon capture, removal, transport, utilization, and storage technologies. This Blueprint outlines the broader federal policy agenda needed to achieve this policy foundation and ensure carbon capture's necessary contribution in achieving net-zero emissions by 2050.

The Carbon Capture Coalition's strategic vision for future policy action is to:

- **Enhance the 45Q tax credit** to ensure the investment certainty and business model flexibility intended by Congress, as well as ensure effective implementation and oversight of the tax credit;
- **Incorporate CO_2 transport and storage infrastructure financing** into broader national infrastructure policy to enable deployment of large-scale transport and storage of CO_2;
- **Retool and expand federal RD&D funding** for less commercially mature and next generation carbon capture, removal, transport, utilization, and storage technologies and practices (including fully funding the robust RD&D provisions enacted in 2020);
- **Provide additional federal tax credits and other deployment incentives** to further complement, expand and build upon 45Q in financing carbon capture projects, including direct air capture and carbon utilization projects;
- **Ensure benefits from the deployment of carbon capture projects flow to affected communities and workers** through coordinated federal actions.

The remainder of this *Federal Policy Blueprint* outlines in more detail the consensus policy agenda of the Carbon Capture Coalition and will guide our efforts to engage federal policymakers in seeking widespread adoption and deployment of carbon capture, removal and utilization technologies and associated development of CO_2 transport and storage infrastructure.

Figure 4: Economywide Deployment of Carbon Capture



Investment Certainty, Project Finance & Feasibility

Enhancement of the 45Q tax credit, in addition to an expanded portfolio of complementary policies, is crucial to providing investment certainty, additional incentive value and the flexibility needed to leverage greater private investment in carbon capture projects, including direct air capture and utilization projects. These steps will increase the financial feasibility of projects, particularly those projects that involve capturing CO_2 from more dilute sources, including certain industrial processes such as the manufacture of steel and cement, power generation and from ambient air through direct air capture.

Financing projects involving these sources with higher capture costs is critical to achieving the full climate, economic and jobs benefits of carbon capture and removal. Key additional investment certainty and project financing provisions include a direct pay mechanism and multiyear extension of the commence construction window for the 45Q tax credit, along with a range of complementary policies that will lower the cost of debt and equity, reduce commodity risk and expand markets for low-carbon electricity, fuels, and products produced through carbon capture, direct air capture, and carbon utilization. Ultimately, the scale of deployment required by 2030 will necessitate accelerating project development. Additional policies may need to be developed to address the pace of project deployment, whether to add certainty to construction schedules, reduce the risks of cost overruns, or provide backstops for technology performance guarantees.

Maximizing the Impact of 45Q on Project Deployment

Enact a Direct Pay Mechanism for 45Q

A direct pay mechanism for 45Q is the most important next step Congress and the administration can take to enable economywide deployment of carbon capture technologies to meet midcentury climate goals, as well as to provide a powerful spur for economic activity and job creation at a time when both are urgently needed for our nation's recovery from the COVID-19 pandemic. Importantly, direct pay for 45Q can be implemented at a low budgetary score.

The complexity and inefficiency of tax equity transactions impose increased costs and burdens on project developers. Tax equity is a suboptimal means of financing carbon capture technologies, even under normal market circumstances, because tax equity investors demand elevated returns that erode the value of the tax credit to the project, especially for carbon capture, direct air capture and other less commercially mature technologies.

Investment Certainty, Project Finance & Feasibility Policies

- Maximizing the impact of 45Q on project deployment
- Providing further enhancements to 45Q to fill remaining cost gaps
- Enhancing and expanding other existing federal incentives to enable financing
- Ensuring 45Q guidance developed by Treasury is properly implemented and seek clarification on guidance where necessary
- Facilitating CO_2 transport infrastructure planning, siting and permitting
- Dramatically increase commercial-scale saline geologic storage of CO_2 on private and federal lands
- Providing predictable markets for products from carbon capture & utilization

According to carbon capture project developers, the terms of tax equity investment typically consume around 20 percent or greater of the value of the tax credit. This means that the effective value of 45Q tax credits flowing to tax equity-financed projects is roughly 20 percent less than the cost of those same tax credits to the federal government. For example, while Congress intended to provide an incentive of $50 per metric ton for the capture and storage of CO_2 in saline geologic formations, at typical tax equity investment rates, a project developer realizes only $40 of that value from the tax credit, with the remaining $10 of the federal incentive lost to the financial transaction.

By contrast, direct pay for 45Q would provide the intended incentive value much more directly, efficiently, and effectively. Direct pay would not only unlock broader financial markets and leverage greater private capital for investment in projects; for every dollar expended by the federal government through the 45Q incentive, direct pay would deliver greater value for the American taxpayer by yielding more deployment of carbon capture, removal, and utilization technologies—and thus greater climate, jobs and economic benefits.

Multiyear Extension of the 45Q Commence-Construction Window

Further extension of the 45Q tax credit is needed to achieve the full emissions reduction potential of the credit. While the two-year 45Q extension in the recently passed FY 2021 Omnibus provides welcome near-term stability and helps project developers move forward with the 30-plus publicly announced carbon capture projects already in various stages of project development and financing, this action alone will not give investment certainty over a sufficient time period to allow the needed expansion of carbon capture deployment.

More complex and capital-intensive carbon capture projects can have lead times of five years or more before beginning construction, especially those projects pursuing CO_2 storage in saline geologic formations due to longer permitting timelines, or those deploying technology in certain industrial sectors with little or no experience with commercial-scale carbon capture to date. This means that some potential projects starting today already risk missing the newly extended commence-construction deadline at the end of 2025.

A significant multiyear extension of the 45Q commence construction window remains necessary to provide the long-term certainty for the private investment in commercial deployment that will be essential to scaling up carbon capture technologies by midcentury, just as the federal wind production tax credit and solar investment tax credits (ITCs) have anchored long-term private investment in those technologies since 1992 and 2005, respectively.

Elimination of Thresholds in the 45Q Statute

The current thresholds in statute are a legacy of the original 45Q program from over a decade ago. They serve no obvious public policy purpose and have undermined the broader objectives of the incentive by limiting the number and range of industrial facilities, projects and technologies that can participate. In the FUTURE Act of 2018, Congress lowered the annual capture threshold for eligible industrial facilities from 500,000 metric tons to 100,000 metric tons and created a new annual threshold for carbon utilization projects of a minimum of 25,000 and a maximum of 500,000 tons, but the original 500,000-ton threshold for electric generating units remained unchanged.

Figure 5: Power and Industrial facilities that do not meet or narrowly exceed current 45Q thresholds by up to 25 percent.

Sector	Current Threshold (metric tons of CO_2 per year)	Number of Facilities Under Threshold	Total CO_2 Emissions of Facilities Under Threshold (metric tons of CO_2 per year)	Number of Facilities Narrowly Above Threshold	Total CO_2 Emissions of Facilities Narrowly Above Threshold (metric tons of CO_2 per year)
Coal Power Plant	At least 500,000	65	13,532,968	11	6,173,161
Gas Power Plant	At least 500,000	658	81,362,442	34	19,039,608
Industrial	At least 100,000	3,964	106,090,987	180	20,067,726

Data source: Environmental Protection Agency, Facility Level Information on Greenhouse Gases Tool, 2018.

Since the reform and expansion of 45Q, it has become clear that these thresholds stifle innovation, severely limit the number of facilities and industries able to participate and reduce the overall emissions reduction potential of the 45Q program.

Thresholds are already deterring projects at industrial facilities and in some power generation applications. Additionally, these thresholds are impeding the potential growth of the emerging carbon utilization marketplace, which includes new and innovative technologies and processes to produce low- and zero-carbon fuels, building materials, chemicals, and other advanced materials and products sourced from captured CO_2 and CO. Many of these carbon utilization technologies are not immediately able to scale to the 25,000 metric ton threshold, effectively precluding their early-stage commercial demonstration and locking them out of the 45Q program altogether.

Furthermore, project developers are finding that even if a facility does narrowly exceed the threshold, as outlined in figure 5, they still may not be able to secure financing for the carbon capture projects. This is due to the risk posed by potential operational or market disruptions such as the COVID-19 pandemic, which may cause the facility to fall below the threshold in a future year and not be able to claim the tax credit. For these reasons, Congress should remove these barriers to innovation and project development by eliminating all thresholds in the 45Q statute.

Further Enhancements to 45Q to Fill Remaining Cost Gaps

The reform and expansion of 45Q remains a signature bipartisan accomplishment, and the policy will drive a significant level of project deployment, especially in industrial sectors with lower costs of carbon capture, such as ethanol, gas processing, fertilizer and hydrogen production. However, as companies and investors have initiated project development in earnest in response to 45Q, they have encountered barriers to utilizing the tax credit and increasingly realize that enhancements to the program are needed beyond direct pay, multiyear extension, and elimination of thresholds to fill remaining cost gaps that prevent projects from achieving commercial feasibility and securing private financing.

Differentiated Credit Values for Higher-Cost Technologies

The largest sources of carbon emissions in industrial production and power generation also feature lower concentrations of CO_2, thus increasing the per-ton costs of capture. This includes carbon-intensive industrial sectors such as steel, cement, basic chemicals and refining, as well as coal, natural gas and biomass power generation. In addition, direct air capture that separates CO_2 from ambient air, the most dilute source of CO_2, has the highest per-ton costs of capture. While widescale adoption of carbon capture technologies in these sectors is essential to meet midcentury emissions

reductions, very little deployment has occurred due to greater costs and commercial risk; in fact, cement, natural gas and biomass power generation, and direct air capture do not yet have any large-scale commercial projects placed in service anywhere in the world. Therefore, it is vitally important that policymakers enhance 45Q to provide for differentiated credit values that recognize and accommodate the very different costs of capturing and managing carbon emissions from different industrial and power plant flue gas streams and through direct air capture to adequately incentivize private investment in these sectors that are critical to decarbonization.

Establish an Alternative Electricity Production Tax Credit Option for Natural Gas Power Generation with Carbon Capture, Utilization and Storage

Since combustion of natural gas results in roughly half the CO_2 emissions of coal combustion, a natural gas power plant equipped with carbon capture will generate only about half the 45Q credits on a per ton basis of an equivalent coal power plant, thus creating a fundamental disincentive to deploy carbon capture on natural gas power. Since the 45Q program as presently structured will not sufficiently incentivize carbon capture deployment in natural gas power generation, which will be crucial to achieving net-zero emissions in the power sector, a production tax credit alternative should be provided at the project developer's option that would be allocated on the basis of each megawatt hour generated and claimed in lieu of the 45Q tax credit. Current 45Q regulatory requirements for the demonstration of secure geologic storage and for emissions reductions achieved through carbon utilization would still apply.

Lengthen the 45Q Credit Payment Window from 12 to 20 Years in Combination with Direct Pay

Carbon capture facilities, including direct air capture, industrial and power facilities, are designed to operate for over twenty years. 45Q currently credits projects for storing CO_2 for up to a 12-year period. Lengthening and aligning the credit payment window more closely to the expected lifetime of the carbon capture facility is one way to fill cost gaps in the existing 45Q credit and make project financing more feasible. The current 12-year period to claim credits under 45Q means that carbon capture projects have a lower return, averaged over the lifetime of the facility. This is especially challenging for projects that store captured CO_2 in saline geologic formations. Since such projects receive no revenue from the sale of CO_2, saline geologic storage imposes an ongoing net cost after the 12-year credit payment window ends. Therefore, saline storage is less likely to be developed, and unlikely to remain in operation, without revenue certainty over the lifetime of the capture projects that such storage serves. Finally, extending the period to claim credits would ideally be accompanied by a direct pay provision. Tax equity financing for some investors is limited to a ten-year timeframe, thereby diminishing the value of tax credits received in later years in financing projects, unless project developers have the option of direct pay.

Enhance and Expand Complementary Federal Incentives to Enable Financing of Carbon Capture Projects

Other existing federal financial incentives beyond the 45Q tax credit either exclude carbon capture projects or require technical modifications to allow projects to qualify. Expanding the suite of financing mechanisms available to carbon capture, direct air capture and utilization projects will make additional private capital available on more favorable terms, thus increasing future deployment and emissions reduction potential. Congress should expand eligibility, make technical corrections and/or enhance existing federal incentives, including:

Reform Existing Section 48A and 48B Investment Tax Credits

Design flaws in the current 48A ITC program have made it impossible for companies to access existing incentives to retrofit currently operating coal-fired power plants with carbon capture technology. Enacting proposed reforms to 48A to modify plant heat rate requirements for compatibility with operating carbon capture equipment and providing for direct pay would unlock approximately $2 billion in currently available funding for retrofits. Additionally, technical fixes to the existing 48B ITC would enable carbon

capture projects involving industrial gasification to access existing credits. Necessary changes include reallocating unused credits awarded to projects that failed to proceed, amending closing agreements for current projects to extend placed in service requirements to ten years, including a direct pay provision and clarifying that, similar to the 48A program, projects claiming 48B ITCs are also eligible to claim the 45Q tax credit.

Provide for a Reformed and Expanded Section 48 Investment Tax Credit for Carbon Capture, Utilization and Direct Air Capture

In addition to reforming the 48A and 48B ITCs for existing projects, Congress should reform and expand the Section 48 ITC program for new carbon capture, carbon utilization and direct air capture projects equal to 30 percent of the value of installed carbon capture equipment, as defined under the 45Q program, and placed in service within ten years. An expanded ITC would enable and accelerate deployment of carbon capture from more expensive and hard-to-abate sectors, and it would be open to all projects eligible for 45Q, including current 48A- and 48B-eligible projects that choose to opt into the reformed program. Projects would comply with IRS requirements under 45Q for monitoring, reporting and verification of secure geologic storage and for lifecycle analysis of emissions reductions from carbon utilization. Finally, projects claiming the reformed Section 48 ITC would also be eligible for direct pay and for 45Q credits to help broaden the range of commercially feasible projects, thereby leveraging private-sector investment and expanding deployment.

Make Carbon Capture and Direct Air Capture Projects Eligible for Tax-Exempt Private Activity Bonds

Carbon capture projects are currently ineligible for tax-exempt private activity bonds (PABs), a common, well-accepted mechanism for financing large-scale private infrastructure projects that have public benefits, including large-scale air pollution control investments in the 1970s and 1980s at privately-owned power plants. Compared to conventional bank financing, tax-exempt PABs reduce annual debt payments, both by lowering interest rates and extending the repayment period. Making carbon capture eligible for PABs would reduce financing costs, encouraging the development of more carbon capture and direct air capture projects.

Prevent the Disallowance of 45Q under the BEAT Tax

Important potential tax equity investors in carbon capture projects may be subject to disallowance of 45Q tax credits under the Base Erosion and Anti-Abuse Tax (BEAT), which was revised in the tax reform legislation of 2017 and lowers the threshold that triggers taxation of multinational companies. Business tax credits such as 45Q can be applied to offset up to 80 percent of a company's BEAT obligation. However, this provision applies only through 2025, and the Coalition supports this additional permanent fix, which investors claiming the wind production tax credit and solar ITC already enjoy.

Make Carbon Capture Projects Eligible for Master Limited Partnerships

Carbon capture projects, along with other low- and zero-carbon energy projects, are currently ineligible for Master Limited Partnerships (MLPs), which are a business structure that allows for raising equity on public markets, while providing the tax benefits of a partnership. Carbon capture projects should be allowed to qualify for MLP status to raise equity on more favorable terms.

Technology Deployment & Cost Reductions

In the same way that other low- and zero-carbon energy technologies were largely developed and commercialized through public-private partnerships, such as wind and solar, the federal government has played a key role in the development of some of the first carbon capture and storage projects, when the cost and commercial risk of deploying these technologies at commercial scale remained prohibitive for private industry to shoulder alone.

There are long lead times in advancing capital-intensive technologies from concept to demonstration to commercialization, which makes federal investments during the next decade critical to scaling

Technology Deployment & Cost Reduction Policies

- Scaling new RD&D programs for carbon capture, removal, utilization, and storage to FY 2021 Omnibus authorization levels

up carbon capture technologies. While DOE funding has played a crucial role in the success of recent large-scale carbon capture and storage projects in the U.S., carbon capture overall has suffered a significant lack of federal investment compared to historic levels of support for other clean energy technologies. As one example, the American Recovery and Reinvestment Act of 2009 included $90 billion for clean energy technologies, only 4 percent of which (approximately $3.5 billion) was allocated to carbon capture technology.

The federal government still has a significant role to play in funding less commercially mature and next generation carbon capture technologies across sectors. The U.S. will need to make increased RD&D investments for these technologies to see meaningful commercial deployment in the marketplace. Similarly, federal RD&D programs need to prioritize the development of large-scale commercial saline geologic storage sites to serve as regional hubs anchoring the development of a carbon management industry. Continued expansion, retooling and prioritizing of federal investments in less commercially mature and transformational carbon capture, removal, utilization, and storage technologies and processes will be a critical component of driving down costs to accelerate economywide commercial deployment.

The FY 2021 Omnibus features robust authorization levels for carbon capture RD&D. Fully appropriating the authorized funding levels would result in an over 400 percent increase to carbon capture budgets. While these are historic increases, these authorization levels mark a course correction towards building an even more ambitious program of federal RD&D investment in carbon management that will be needed to reach net-zero emissions economywide by 2050. Therefore, it is crucial that the administration and 117th Congress fully fund these newly authorized programs, whether through the appropriations process or as part of a broader COVID-19 economic recovery package.

In particular, ensuring that funds are fully appropriated for large-scale pilot projects, commercial-scale demonstrations and front-end engineering and design (FEED) studies for carbon capture projects can drive near-term jobs creation and economic activity, while spurring additional project development over the next several years.

Industrial Emissions

Beyond the programs detailed in figure 6, the FY 2021 Omnibus contains important cross-cutting programs for industrial emissions reductions. In terms of emissions, the industrial sector is responsible for approximately one-third of both global and domestic emissions; more than half of these occur in just three sectors: steel, cement, and basic chemicals. Within these sectors, over half of the emissions are process emissions, meaning they are inherent to chemical or physical processes, such as the creation of clinker for cement or steel from iron ore, that cannot be abated without carbon capture.

These sectors face unique decarbonization challenges. They are heterogeneous, with capital-intensive and long-lived facilities. Moreover, heavy industry is highly trade-exposed, meaning that individual companies must compete in high-volume, low-margin global commodities markets. Thus, any costs borne from deployment of carbon abatement technologies will be difficult for them to bear individually and remain profitable.

While carbon capture is not the complete solution to addressing industrial emissions, they represent an essential component of the broader portfolio of scalable emissions reduction options available to industry for decarbonizing the manufacture of products necessary to modern life, including building materials, fuels and basic chemicals.

Figure 6: Energy Act of 2020 (FY 2021 Omnibus) Carbon Capture Programs

Program Areas	Total Authorized Funding (over 5 years)
Carbon Capture Technology Program for the development of transformational technologies that will significantly improve the efficiency, effectiveness, cost, emission reductions and environmental performance of coal and natural gas use, including in manufacturing and industrial facilities. This program includes significant authorizations for RD&D, large-scale pilot projects, commercial demonstration projects and FEED studies.	**$4.71 billion in total funding:** • $910 million for R&D • $1 billion for large-scale pilot projects • $2.6 billion for commercial-scale demonstration projects • $200 million for FEED studies
Carbon Capture Test Centers to advance RD&D of carbon capture technologies.	$125 million
Carbon Storage Validation and Testing program that will coordinate federal agencies' work on assessing suitable CO_2 storage locations and developing demonstration and commercial storage sites.	$800 million
Carbon Utilization program to scale up markets and identify technologies to convert captured carbon to valuable products and commodities.	~$283 million
Direct Air Capture Test Centers grant program for the operation of direct air capture test centers to advance RD&D of direct air capture and storage technologies.	~$447 million
Reforms to the DOE Loan Program to better allow carbon capture projects to access approximately $8 billion in remaining funding. Additionally, authorizations are provided for administrative expenses.	$160 million (for administrative expenses) $25 million in FY 2021 (for fees for existing projects)

The Energy Act of 2020 (contained within the FY 2021 Omnibus) establishes and significantly expands several important areas of focus for the DOE, from early-stage research to commercial-scale deployment of carbon capture, removal, utilization, and geologic storage programs.

Transport and Storage Infrastructure & Market Development

To deploy carbon capture at levels sufficient to meet midcentury climate goals, we must responsibly scale up an interconnected, nationwide network for transporting CO_2 captured from multiple industrial facilities, power plants and direct air capture plants to locations around the country where it can be put to beneficial use or safely and permanently stored in appropriate geologic formations. This buildout is multifaceted and requires policy mechanisms for CO_2 transport, geologic storage and carbon utilization, as well as actions related to permitting of saline geologic storage.

Interconnected, responsibly sited transport systems that collect CO_2 from multiple capture sources and deliver it to shared large-scale commercial saline geologic storage sites, or regional "carbon hubs," are the infrastructure backbone needed for economywide deployment of carbon capture at the necessary scale. The development of commercial saline geologic storage sites will be critical to meeting net-zero emissions goals. While industry has decades of commercial experience safely storing CO_2 geologically at large scale, only one dedicated saline geologic storage project exists in the U.S. today. Nevertheless, over half of the current 30-plus announced carbon capture projects in development have declared their intent to store CO_2 in dedicated saline geologic storage sites. Therefore, timely federal permitting of saline geologic storage will be key to bringing both carbon capture projects in the development pipeline and future projects to fruition.

Transport and Storage Infrastructure & Market Development Policies

- Facilitating CO_2 transport infrastructure planning, siting and permitting
- Dramatically increasing commercial scale saline storage of CO_2 on private and federal lands
- Fostering the buildout of CO_2 pipeline infrastructure networks with additional federal policies
- Providing predictable markets for products from carbon capture & utilization

The Federal Role in the Buildout of CO_2 Transport and Storage

The administration and Congress should prioritize inclusion of CO_2 transport and storage infrastructure as a necessary component of any broader infrastructure legislation, given its essential role in helping to achieve net-zero emissions economywide. Similar to the buildout of other forms of infrastructure to support deployment of low- and zero-carbon technologies over the next 30 years, scaling a national CO_2 transport and storage system will be key to meeting midcentury emissions reduction goals. The need for enabling government policy support for CO_2 transport and storage infrastructure is being increasingly recognized and acted upon by governments around the world, with significant projects and investments committed or completed in Canada, Norway, the European Union, United Kingdom, and Australia in the past two years. The U.S. does not currently have any equivalent policy and is at risk of falling behind in this area.

The Carbon Capture Coalition has endorsed the bipartisan Storing CO_2 and Lowering Emissions Act (SCALE Act), first introduced in the 116th Congress by Representatives Veasey (D-TX), McKinley (R-WV), Bustos (D-IL) and Stauber (R-MN). Building on Representative Bustos' Investing in Energy Systems for the Transport of CO_2 Act (INVEST CO_2 Act), passage of the SCALE Act would represent a step change in the federal government's approach to fostering economywide deployment of carbon capture, removal, transport, utilization, and storage.

Similar to the development of other infrastructure systems such as water, electricity transmission, and telecommunications, the SCALE Act would position the federal government to partner with private capital to invest in both regional and national CO_2 transport and storage infrastructure networks. These networks must be sufficiently sized to achieve economies of scale and efficiently move CO_2 captured from industry, power generation and direct air capture to suitable large-scale commercial saline geologic storage hubs, where it can then be safely and permanently stored.

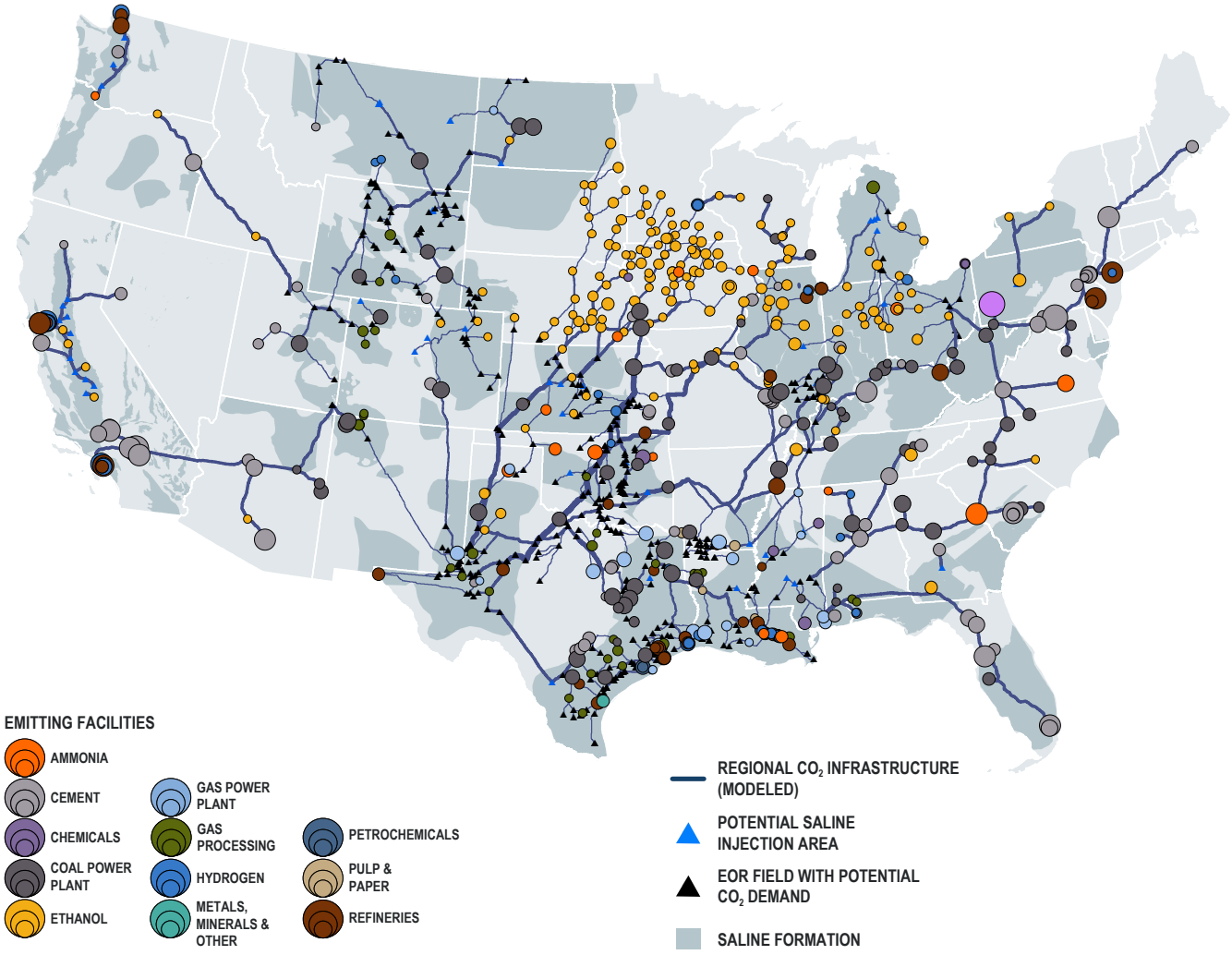
The SCALE Act would provide low-interest loans and grants to cover a portion of the cost of common carrier CO_2 transport infrastructure development to partner with and enable private-sector investment. Additionally, the SCALE Act would expand the DOE CarbonSAFE program, which provides cost share for the development of saline geologic storage sites, with particular priority on larger-scale commercial projects to serve as regional storage hubs. The bill also increases funding for the Environmental Protection Agency (EPA) to support the permitting of saline geologic storage, as well as provide resources to states that seek primacy from EPA and establish their own equally rigorous permitting programs.

Timely Permitting for Saline Geologic Storage

In addition to ensuring the development and financing of CO_2 transport and storage systems, timely federal permitting of saline geologic storage will be key to bringing carbon capture projects in the development pipeline to fruition. Carbon capture projects that seek to inject CO_2 for the sole purpose of long-term saline geologic storage are subject to the EPA's Class VI well rule, which is part of the agency's Underground Injection Control Program.

Given the increase in project development in response to the 45Q tax credit, it is crucial that federal funding for these programs at EPA increase to meet the anticipated influx of Class VI well applications and the growing number of states seeking primacy to administer these programs.

Figure 7: Optimized CO_2 Transport and Storage Network



Optimized CO_2 transport and storage network deployment modeling from the Great Plains Institute finds that, under 45Q, a shared, interconnected CO_2 transport and storage system could capture, transport and store 300 million metric tons of CO_2 per year by 2035 from industrial facilities and power plants.

Currently, securing an EPA Class VI permit for saline geologic storage can take several years. Even with the two-year extension of 45Q bringing the commence construction window to the end of 2025, the timeframes required for saline geologic storage permitting may put carbon capture projects at greater risk of missing the deadline to qualify for 45Q, especially when considering the additional time required to undertake planning, complete FEED studies, secure financing and accomplish other necessary components of project development. Therefore, increased funding is critical to ensuring that EPA and states have adequate staffing and resources to conduct the necessary reviews in a timely fashion.

Congress and the administration can boost EPA and state resources to manage both the increased number of Class VI well permits and state primacy applications. They can also ensure better coordination and engagement at the federal level on the extensive planning that is involved in granting a Class VI permit to projects.

Coalition priorities for federal actions to ensure the timely permitting of saline geologic storage resources include:

- Increase EPA funding for permitting Class VI wells for saline geologic storage, and grants for states to administer their own Class VI permitting programs;

- Proactively implement key provisions of the Utilizing Significant Emissions with Innovative Technologies (USE IT Act) and the Energy Act of 2020 that were enacted as part of the 2021 Omnibus bill. Implementing these measures will encourage federal, state, tribal and stakeholder coordination and collaboration on permitting and responsible siting of CO_2 transport and storage infrastructure and carbon capture projects;
- Direct federal agencies to identify and characterize suitable geological storage locations on federal lands and to facilitate the permitting of CO_2 storage sites on federal lands.

Carbon Utilization & Market Development

The Coalition has identified as a priority the development of federal policies related to federal and private procurement of low-, zero- and even carbon-negative electricity, liquid fuels and products produced through carbon capture, removal, utilization, and storage. Members of the Coalition recognize the important role that federal procurement policy has played in providing demand-side support for other low- and zero-carbon technologies, complementing the role of tax credits and other financial incentives on the supply side to help drive private investment in commercial technology deployment. The Coalition will be developing specific policy recommendations in the 117th Congress.

Carbon utilization entails the beneficial use of CO_2 or CO captured from gaseous waste streams in the manufacture of a valuable product that results in a net reduction of greenhouse gas emissions as compared to an incumbent process or product. Carbon utilization may involve the production of a wide variety of commodities or products sourced from waste gases or direct air capture, including low- and zero-carbon fuels, chemicals, plastics, advanced materials, industrial gases and fluids, building products and even feedstocks for animal feed and food. Using the IRS definition of commercial markets, a wide variety of products sourced from qualified carbon oxides should be eligible to receive credit under 45Q. The Coalition maintains that the marketplace for eligible commodities and products produced from carbon utilization should not be constrained, so long as the production and use of captured CO_2 or CO offsets anthropogenic CO_2 emissions on an established lifecycle basis.

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 constitutes an important component of a circular carbon economy. Taken together, the National Academies of Science has estimated that globally, 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 annually by 2030.

High-volume products sourced from carbon utilization, including concrete, aggregates and fuels could drive both significant carbon utilization and market value. However, realizing this market will require a range of market development policies such as federal procurement, buildout of CO_2 transport infrastructure, and breakthroughs in carbon utilization technologies and processes enabled by federal RD&D.

The federal government can take steps to incentivize commercial production of products sourced from carbon capture, including developing standards and disclosures regarding the embodied carbon content of carbon recycled products. As corporations and other entities begin to look towards procurement of electricity, liquid fuels and products sourced from carbon capture processes, the federal government can play a central role in developing standards for what is needed to track, account for and verify carbon reductions from the manufacture of such products.

In addition to developing standards and disclosures for embodied carbon, the administration and Congress can harness the purchasing power of

"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 constitutes an important component of a circular carbon economy."

the federal government to establish markets for electricity, liquid fuels and products sourced from carbon capture, as it has done with other low- and zero-emissions energy and products. Congress and the administration can develop federal procurement policies for valuable products captured from carbon across agencies. Language that allows for the procurement of captured carbon products under U.S. Department of Agriculture procurement policies can serve as an initial model for further exploration.

Reducing Project Development Risk through Contract for Differences

A contract for differences (CfD) is a mechanism to reduce the risk of commodity market volatility for developers and investors willing to undertake early-stage commercial demonstration projects involving carbon capture, direct air capture and carbon utilization. CfDs can be used in a variety of industries to create investment certainty to deploy projects that would otherwise be uneconomic under current market conditions.

Under a CfD, a developer would enter into a contract with the federal government that provides a fixed "strike price" for a commodity produced in association with the carbon capture project (e.g., electricity, emissions reductions from direct air capture, fuels, steel, cement, chemicals, etc.). If the price of the commodity in question falls below the strike price stipulated in the contract, the government would pay the difference, protecting the project developer from a loss.

Conversely, if the market price rises above the strike price, a project developer would pay the difference, which would then be returned to the U.S. Treasury, thus preventing a windfall gain to the developer. Structured in this way, a CfD cost-effectively provides for long-term investment certainty and reduces the cost of capital, while optimizing the market risks and opportunities for both project developers and the federal government that are associated with scaling carbon capture, direct air capture and carbon utilization technologies.

Jobs, Economic Development & Affected Communities

The jobs associated with installing carbon capture retrofits or constructing direct air capture facilities, as well as associated CO_2 transport, utilization and storage projects, lend themselves to labor forces and skillsets in oil and gas, mining, and key industrial and manufacturing sectors. Deployment of carbon capture also provides a viable pathway for the decarbonization and continued operation of industrial, manufacturing and energy facilities, thereby avoiding plant closures and the offshoring of jobs and livelihoods.

These jobs can bring significant equity benefits to communities and regions, through high-wage jobs that have been a traditional pathway to the middle class for many American families. However, the skilled, high-paying jobs that carbon capture and CO_2 transport infrastructure projects help retain and create may not be readily available to disadvantaged communities living in close proximity to industrial, power or direct air capture plants, and whose residents may not have access to the education, training and skills required for such employment.

Carbon capture retrofits require facilities to be outfitted with capture technologies such as amine scrubbers to remove CO_2 from exhaust gas and compressors to make the CO_2 transport-ready; specific technologies deployed are dependent upon the type of plant and vary across industries and facilities. In addition to the jobs associated with carbon capture projects, there

Jobs, Economic Development & Affected Communities Policies

- Leveraging existing federal apprenticeship and workforce training programs in affected communities
- Quantifying potential benefits and impacts of carbon capture retrofits at industrial and power facilities on local criteria air and other pollutants

are jobs associated with the equipment, materials (e.g., cement and steel), engineering, and labor required to install the capture technology, as well as ongoing jobs to operate and maintain the retrofits.

According to Rhodium Group analysis, carbon capture deployment at industrial facilities and power plants and deployment of associated CO_2 transport infrastructure in 21 states across the Midwest, Great Plains, Gulf Coast and Rockies regions can support an annual average of up to 68,000 project jobs and 35,800 ongoing operational jobs over a 15-year period and capture 592 million metric tons of CO_2 per year. Along with the development of CO_2 transport infrastructure, this would generate up to $212.9 billion in private investment.

The communities that are most vulnerable to climate change also typically suffer the greatest impacts from criteria air and other pollutants from nearby industrial and power facilities; carbon capture has the potential to play a role in addressing these concerns. Carbon capture is a flexible control technology that works on a wide range of industrial facilities and power plants, and in many instances carbon capture retrofits significantly reduce conventional pollutant emissions for several reasons.

First, prior to CO_2 separation and capture, flue gas must undergo pretreatment to remove criteria air pollutants, including sulfur oxides, particulate matter, and nitrogen dioxide, to protect the capture solvent. Additionally, beneficial utilization of pre-combustion industrial gases removes criteria pollutants as part of the utilization process. Finally, installation of carbon capture may result in facilities having to meet more current and usually stricter emissions standards.

Because carbon capture retrofits are capital intensive, there is little risk of old, inefficient, and polluting facilities extending their lives by adding carbon capture. Younger, relatively more efficient, long-lived plants pose the most significant challenge to climate change; without capture, they will emit CO_2 unabated, potentially for decades. However, more detailed analysis is needed to quantify potential air quality benefits from carbon capture retrofits.

The administration can take two immediate steps to leverage existing federal resources to prioritize near-term actions to better assist and understand issues faced by affected communities:

1. The administration can leverage existing federal apprenticeship and workforce training programs to expand support for jobs training undertaken in partnership with community colleges, trade unions and other local institutions in affected communities.

2. The administration can direct EPA and DOE to coordinate an interagency study to assess and quantify potential benefits and risks to local criteria air and other pollutants from carbon capture retrofits at industrial and power facilities across different technologies and industry sectors.

Additionally, the Coalition will be putting forward further policy recommendations in this area during the 117th Congress.

Conclusion

The Coalition's *Federal Policy Blueprint* underscores the federal actions and investments needed for economywide deployment of carbon capture, removal, transport, utilization, and geologic storage. Large-scale deployment of carbon capture is essential, if we are to achieve midcentury climate goals as modeled by the IEA and IPCC. In addition to meeting emissions reduction targets, the jobs associated with large-scale carbon management can bring significant equity benefits to communities and regions by providing the kinds of employment that have traditionally afforded a pathway to the middle class for many American families. Additional job training, environmental policy adoption and other measures must be implemented to ensure that reductions in carbon emissions are accompanied by economic, public health and other benefits at the community level.

Building out a comprehensive and robust federal carbon capture policy agenda can help the U.S. sustain its position as a global leader in the commercialization and deployment of these energy and industrial technologies and associated infrastructure. A federal portfolio of supportive policies includes enhancements to the 45Q tax credit and other tax credits and incentives, expanded funding for RD&D, and financing and grants for the buildout of CO_2 transport and storage infrastructure. This expanded policy framework will spur continued technology innovation, increased scale, and improved performance, thus driving down

costs and enabling commercial deployment—all while ensuring that American workers and communities benefit from carbon capture deployment and are not left behind on the path to a net-zero economy by 2050.

Momentum is building in the U.S., as evidenced by recent groundbreaking bipartisan policy developments and the over 30 carbon capture, direct air capture and geologic storage projects publicly announced since the enactment of the 45Q tax credit. Moving forward, we must continue to scale federal investments and policy ambition for carbon capture to deliver on its full climate, energy and jobs potential.

"Building out a comprehensive and robust federal carbon capture policy agenda can help the U.S. sustain its position as a global leader in the commercialization and deployment of these energy and industrial technologies and associated infrastructure."

CARBON CAPTURE COALITION

The Carbon Capture Coalition is a nonpartisan collaboration of over 80 industry, energy, and technology companies; energy and industrial labor unions; and conservation, environmental, and energy policy organizations building federal policy support for economywide deployment of carbon capture, removal, transport, utilization and storage.

To view the Coalition's federal policy blueprint, please visit www.carboncapturecoalition.org.

The Great Plains Institute convenes the Carbon Capture Coalition.

CARBON CAPTURE
COALITION

carboncapturecoalition.org