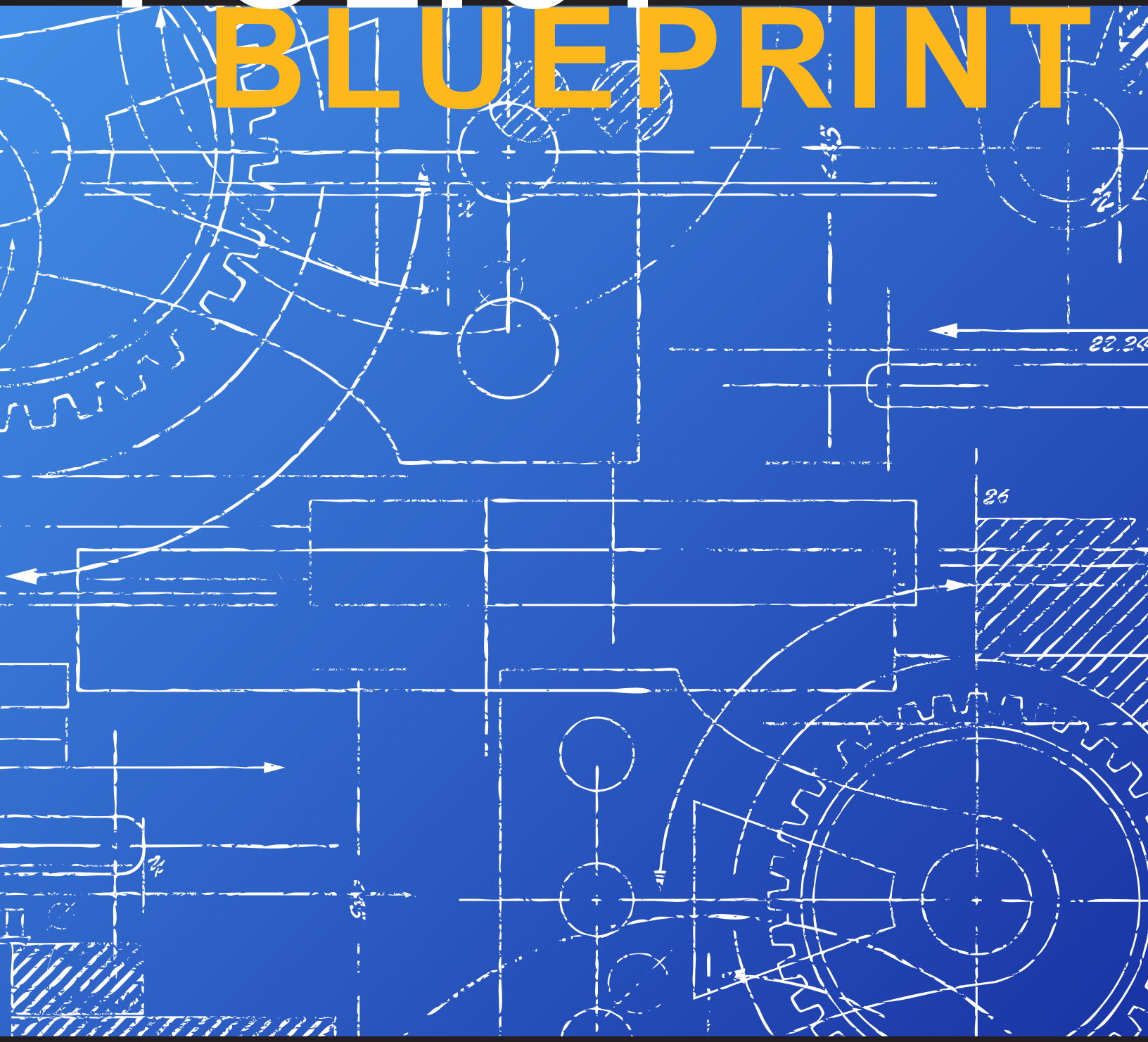
MAY 2019

FEDERAL POLICY BLUEPRINT



CARBON CAPTURE COALITION

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This document reflects the consensus federal policy priorities of the industry, labor and NGO participants in the Carbon Capture Coalition. It is not intended to represent a complete compilation of policies of relevance and importance to carbon capture, utilization, removal and storage. As the issues and Coalition discussions evolve over time, we will periodically update this policy blueprint with additional ideas and priorities as the situation merits.

The policy 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.

Throughout this policy blueprint, carbon capture when referenced generically is meant to include the entire value chain of carbon capture, transport, utilization, removal and storage.

FEDERAL POLICY BLUEPRINT

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CARBON CAPTURE COALITION

Preface

The Carbon Capture Coalition is a nonpartisan partnership of over 60 energy, industrial, and technology companies, labor unions, and conservation, environmental, clean energy and agricultural organizations that supports commercial adoption of carbon capture technology. The Coalition was created to help realize carbon capture's full potential as a national strategy for reducing carbon emissions, supporting domestic energy and industrial production and protecting and creating high-wage jobs. The Coalition's diverse participants work together to achieve a common goal: economywide deployment of carbon capture from industrial facilities, power plants and ambient air through financial incentives and other policies that drive private investment, innovation and cost reductions in carbon capture and utilization technology and pipeline transport.

The Coalition's mission is to advance policies and actions that will accelerate deployment of:

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

Coalition participants have developed this consensus policy blueprint to articulate a comprehensive and ambitious federal policy agenda that can help achieve the goal of economywide carbon capture deployment.

The Coalition is built on the diversity and collaboration of its members. It serves them through:

- **Education**. Sharing information on policies, technologies, and practices that drive commercial deployment of carbon capture.
- **Convening Power.** Briefings, webinars, and member-led, action-oriented work groups.
- **Joint Advocacy.** Development of policy recommendations and strategic engagement of policymakers, the media, and the broader public.

Carbon Capture is...

Proven. CO_2 has been safely captured, transported, injected, and stored for enhanced oil recovery (EOR) in the U.S. since the early 1970s, while Norway has stored CO_2 from North Sea natural gas production since 1996.

Affordable. CO_2 is a valuable commodity when purchased for EOR and other beneficial uses. The capture and storage of CO_2 is, on a per-ton basis, cost-competitive with other low- and zero-carbon emissions options.

Versatile. Carbon Capture is an economy wide solution for reducing emissions. It can create value from carbon through new technologies that transform CO_2 and CO into low-carbon fuels, building materials, and other products.

Essential. Carbon capture is necessary and will reduce the overall cost of reaching 2050 carbon emissions targets, according to the International Energy Agency. Widespread deployment will enable the U.S. to meet these goals, while sustaining the nation's energy production, industrial base, and high-skilled jobs in the communities that depend on them.

Introduction

Carbon capture was first deployed at commercial scale in 1972, when CO_2 was captured from natural gas processing and used for enhanced oil recovery (CO_2-EOR) in West Texas. In a largely unheralded example of American innovation, U.S. industry has led the world over nearly a half century in successfully demonstrating large-scale carbon capture across a range of industries, including natural gas processing, fertilizer production, gasification, ethanol fermentation, refinery hydrogen production and coal-fired power generation. Carbon capture capacity has grown to nearly 25 million metric tons across U.S. industries annually, equivalent to nearly 5.3 million cars.[1]

To date, captured CO_2 has been primarily used in EOR, producing additional domestic oil from existing, already-developed fields, while geologically storing the CO_2 safely and permanently in the process. Expanding carbon capture at industrial facilities and power plants will enable further CO_2-EOR, but also other forms of geologic storage and the beneficial use of CO_2 and CO as a feedstock. New carbon utilization technologies and business models are emerging rapidly to make economic use of captured CO_2 and CO, attracting entrepreneurs and investors who are building a new carbon economy founded on the production of low-carbon fuels, chemicals, advanced materials and useful products, while transforming waste emissions into value and opportunity.

While geologic storage in oil and gas fields is more common, industry knows how to store CO_2 safely and effectively in saline reservoirs at large scale, having demonstrated such storage in the U.S. and overseas. Archer Daniels Midland operates a successful project today in Decatur, IL that stores over a million tons of CO_2 from ethanol production annually in a deep saline formation. However, significant expansion of CO_2 storage in saline formations will require additional investments in research, development, demonstration and commercial deployment.

North America, primarily the U.S., is projected to hold a major share in the global carbon capture and storage market through 2023 due to the widespread presence of a large number of carbon capture projects in the region. The U.S. alone accounts for 16 of the 22 operational large-scale carbon capture and storage projects operating in the world today.[2]

Carbon capture provides multiple benefits. Carbon capture:

- Achieves significant CO_2 emissions reductions from oil, natural gas, coal, and ethanol and from key industrial processes;
- Supports domestic energy and industrial production, while strengthening America's national security and reducing trade deficits by further lessening our reliance on imported crude;
- Protects and creates good-paying and highly-skilled energy, industrial, manufacturing, construction and services jobs across the value chain from carbon capture to pipeline transport to utilization and storage; and
- Spurs innovation and investment in developing new uses of captured carbon, transforming it into an economic resource.

Modeling by the International Energy Agency (IEA) and Intergovernmental Panel on Climate Change (IPCC) demonstrates the critical role that carbon capture technology can play in meeting global climate goals. In its analysis of scenarios for limiting warming to 2° Celsius, the IEA found that carbon capture contributes nearly 15 percent of cumulative emissions reductions by midcentury and 20 percent annually by 2050, with nearly half those reductions from industrial processes central to modern life—many of which lack other available carbon mitigation options.

1 Global CCS Institute Intelligent Database - https://co2re.co/

2 Visit the Global CCS Institute Facilities Database for specific project information: https://co2re.co/FacilityData

"The private sector is stepping up investments in demonstrating new technologies and building on the recent success of large-scale carbon capture projects around the world—from ADM's project at an ethanol plant in Illinois to a project at a steel mill in the United Arab Emirates to the retrofit of a coal-fired power plant near in Texas."

For its part, the IPCC's modeling shows that meeting the 2° C goal without carbon capture increases overall costs by nearly 140 percent. Furthermore, recent IPCC analysis of the 1.5° C scenario underscores the important role carbon capture and removal can play as part of a portfolio of needed technologies in meeting that more ambitious decarbonization goal.

The good news is that the United States remains the global leader in carbon capture and storage, having successfully demonstrated the technology at commercial scale in multiple industries over the past half century. We must do more to maintain that leadership.

The Expanded 45Q Tax Credit

The United States is the global leader in carbon capture. To maintain that leadership and achieve economywide deployment of these important technologies, a broad suite of policies will be required to broaden and accelerate commercial deployment of carbon capture, utilization, removal and storage projects.

The reformed and expanded 45Q tax credit provides a solid foundation for the emerging US industry; however, additional policies are needed – just as a broad portfolio of federal policies has already helped scale up other low and zero carbon technologies.

To achieve economywide deployment of carbon capture, a critical mass of commercial-scale capture projects must be developed in key industrial sectors and power generation between now and 2030 to enable the scaling of the technology needed by midcentury to reach decarbonization goals. In parallel, robust CO_2 pipeline infrastructure networks must be built out across different regions of the country, expanding on the roughly 5,000 miles of CO_2 pipelines in the U.S. Today.

Last year's passage of the FUTURE Act to reform and strengthen the federal Section 45Q tax credit for carbon capture, storage and use was a remarkable bipartisan accomplishment, but significant additional policy support is needed if we are to incentivize investment sufficient to drive commercial deployment on the scale that IEA and IPCC analyses indicate is required.

Fortunately, the private sector is stepping up investments in demonstrating new technologies and building on the recent success of large-scale carbon capture projects around the world—from ADM's previously mentioned project at an ethanol plant in Illinois to a project at a steel mill in the United Arab Emirates to the retrofit of a coal-fired power plant near in Texas. The Oil and Gas Climate Initiative, which comprises 13 of the world's largest oil and gas companies, has raised $1.3 billion to invest in climate mitigation technologies, with a large focus on carbon capture. Also, a consortium of companies has financed NET Power's $150 million power plant in Texas to demonstrate at 50 Megawatt (MW) scale a new power cycle that could represent a substantial cost reduction for carbon capture in natural gas power generation.

The expanded federal carbon capture policy agenda described in the following pages would, if implemented, serve to leverage this track record of successful deployment and growing private sector interest in developing and investing in carbon capture, transport, utilization, removal and storage projects.

The 45Q Tax Credit: A Foundation for Commercial Deployment

The Carbon Capture Coalition achieved its top federal legislative priority in February 2018 with passage of landmark legislation in Congress to reform and expand the U.S. Federal Section 45Q tax credit for CO_2 storage. The reform of the 45Q incentive was enacted as part of the broader Bipartisan Budget Act of 2018.

This legislation, known as the FUTURE Act, was introduced by Senators Heidi Heitkamp (D-ND), Shelley Moore Capito (R-WV), Sheldon Whitehouse (D-RI) and John Barrasso (R-WY). It was cosponsored by one-fourth of the U.S. Senate, including 18 Democrats, six Republicans and one Independent. A companion bill, the Carbon Capture Act, was introduced in the House by Congressman Mike Conaway (R-TX) and cosponsored by 50 members, including 35 Republicans and 15 Democrats.

The bipartisan support for both bills was unprecedented for legislation of its kind, spanning the political spectrum and all regions of the country and underscoring the breadth of support for carbon capture.

Key provisions of the reformed 45Q tax credit include:

- Increases the credit value incrementally over ten years from $10 to $35 per metric ton of CO_2 stored geologically through enhanced oil recovery and from $20 to $50 per ton for saline and other forms of geologic storage;
- Provides $35 per metric ton of CO_2 emissions reduced through the beneficial use of captured CO_2 for purposes beyond EOR;
- Authorizes the program for carbon capture projects that commence construction within six years of enactment, and projects meeting that timeframe can claim the credit for 12 years after being placed in service;
- Reduces the minimum eligibility threshold for qualified facilities from 500,000 metric tons of CO_2 captured annually to 100,000 tons for industrial facilities, expanding participation to additional industry sectors by making smaller industrial facilities eligible to claim the credit (retains the 500,000-ton eligibility threshold for electric generating units);
- Establishes a threshold of 25,000 metric tons for CO_2 captured and put to beneficial uses other than EOR;
- Awards the credit to the owner of the carbon capture equipment and allows transfer of the credit to other entities responsible for managing the CO_2 to provide greater flexibility for companies with different business models to utilize the tax credit effectively, including cooperatives and municipal utilities;
- Allows projects involving carbon monoxide capture and direct air capture to qualify for the credit; and
- Increases financial certainty for investors in carbon capture projects by eliminating the previous cap on credits, which the original 45Q credit was about to reach.

"The Carbon Capture Coalition achieved its top federal legislative priority in February 2018 with passage of landmark legislation in Congress to reform and expand the U.S. Federal Section 45Q tax credit for CO_2 storage."

The Need for a Portfolio Approach: Building on 45Q to Spur Innovation and Cost Reductions

The reformed 45Q tax credit is arguably the most robust and comprehensive carbon capture and utilization deployment incentive in the world today and provides a foundational policy on which to build. The FUTURE Act significantly increases the value of the tax credit and restructures it to enhance monetization to finance projects. Applicable to all man-made or anthropogenic sources of CO_2, the credit also accommodates the capture and use of both CO_2 and CO, extends eligibility to include direct air capture and other forms of carbon utilization beyond EOR, and expands the opportunity for carbon capture deployment to a wider array of industrial facilities.

Moving forward, we know from the successful role federal and state policies have played in helping to scale up wind, solar and other low and zero-carbon energy technologies in the marketplace, carbon capture will also need a comprehensive suite of policy tools and incentives to achieve economywide deployment in the next decade. Carbon capture projects are capital intensive and require long lead times to develop, permit, finance and construct. In addition, capture technologies have only recently begun to be deployed at large commercial scale in power generation and certain key industry sectors such as steel production. Thus, project developers and investors in carbon capture projects face increased costs, uncertainty and technology and commercial risk. Further enhancements to the 45Q credit, together with additional incentives and policies to complement 45Q, will be needed to drive investment in carbon capture projects at a scale sufficient to spur the innovation and cost reductions required to accelerate deployment.

With the federal policy foundation in place through 45Q, the Coalition continues to advocate for additional policy mechanisms and incentives that will build out the full policy structure needed to realize the full potential of carbon capture. This blueprint outlines the broader federal policy agenda needed to achieve that.

"Carbon capture will need a comprehensive suite of policy tools and incentives to achieve economywide deployment in the next decade."

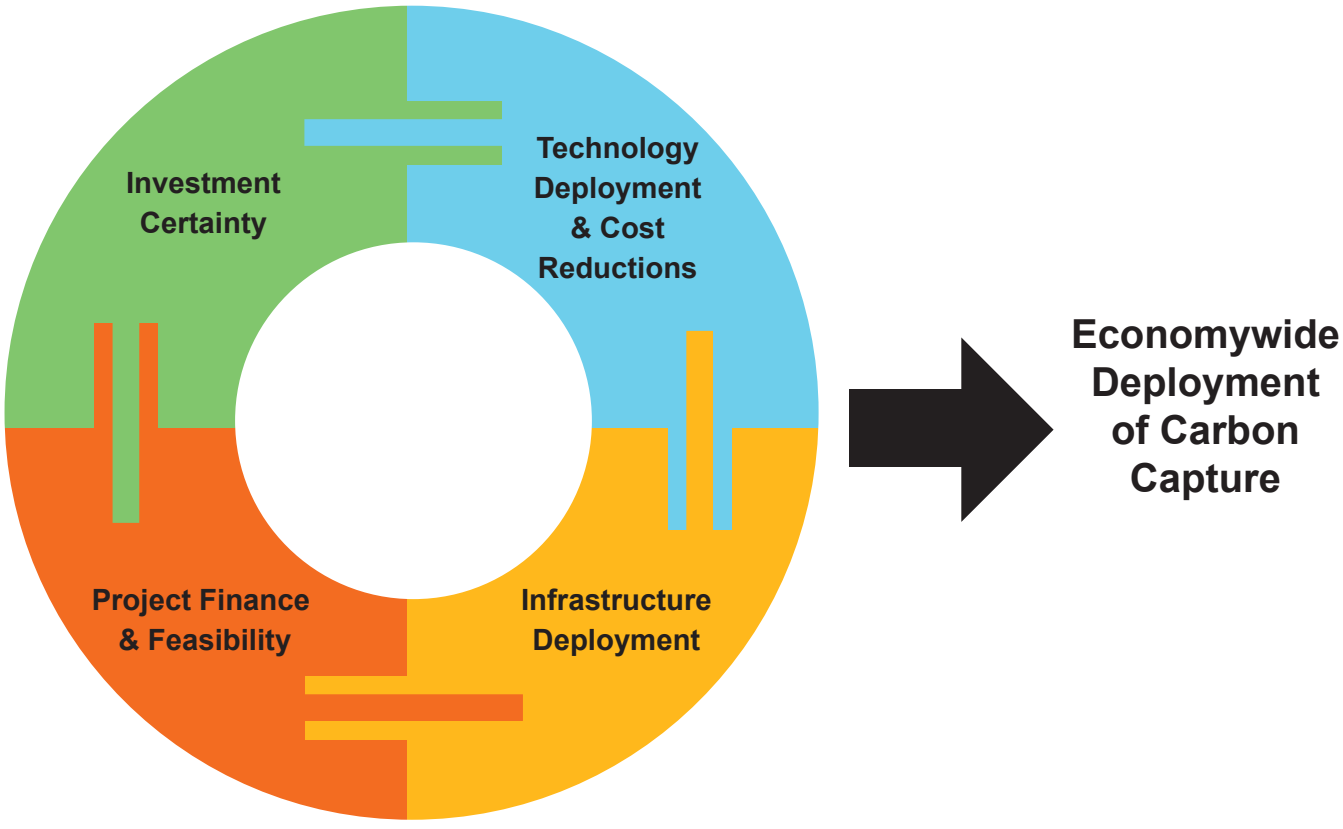
Looking Ahead: Reaching Economywide Deployment of Carbon Capture

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

- Ensure effective implementation of 45Q by the U.S. Treasury to provide the investment certainty and business model flexibility intended by Congress;
- Provide additional federal incentives to complement, expand and build upon 45Q in financing carbon capture, utilization, removal and storage projects;
- Incorporate carbon capture, transport, utilization, removal and storage into broader national infrastructure policy; and
- Expand, retool and prioritize federal funding for research, development, demonstration and deployment (RDD&D) of the next generation of carbon capture, utilization, removal and geologic storage technologies and practices.

Reform of the 45Q tax credit is a significant accomplishment and provides a foundation for the full portfolio of policies needed to scale commercial deployment of carbon capture, similar to what has benefitted other low and zero-carbon technologies. To that end, the Coalition has developed this policy blueprint to guide our efforts in seeking widespread adoption and deployment of carbon capture and related technologies. Economywide deployment of carbon capture will require policy and administrative action in the following areas:

- Investment Certainty;
- Technology Deployment & Cost Reductions;
- Project Finance & Feasibility; and
- Infrastructure Deployment.



Investment Certainty

Effective implementation of the 45Q tax credit is crucial to providing the financial certainty and flexibility needed to leverage the intended private investment in projects to achieve the full carbon emissions reduction, energy and industrial production, and job creation benefits of the policy. Federal agencies have a critical role to play through guidance and regulatory policy.

Investment Certainty Policy Priorities

- **Ensuring Timely and Effective Development of 45Q Guidance by Treasury**
- **Providing Additional Equivalent Pathways for Demonstrating Secure Geologic Storage through CO_2-EOR**
- **Facilitating CO_2 Pipeline Infrastructure Planning, Siting and Permitting**

ENSURING TIMELY AND EFFECTIVE DEVELOPMENT OF 45Q GUIDANCE BY TREASURY

In November 2018, the Carbon Capture Coalition submitted a cover letter, model guidance and supplementary narrative on geologic storage to the U.S. Department of the Treasury to inform the development of guidance for project developers and investors. The Coalition reached consensus on the model guidance, which addresses several implementation issues of critical importance to the development and financing of carbon capture projects, including credit transferability, contractual assurance, credit recapture, and the beginning of construction.

Despite over 15 months passing since enactment of the FUTURE Act, Treasury has only issued a request for public comment, but it has not yet provided information, clarification, or revised guidance to taxpayers seeking to utilize the tax credit. To qualify for the 45Q tax credit under the current congressional authorization, a carbon capture project must begin construction by the end of 2023. Therefore, it is crucial that Treasury proceed promptly to issue guidance for the revamped 45Q tax credit that provides the flexibility and financial certainty for carbon capture project developers and investors before the short six-year commence construction window closes. The Coalition is urging Congress to provide an additional two years of authorization for 45Q and the beginning construction window to compensate for Treasury delays in finalizing guidance.

The Coalition is also developing additional guidance recommendations relating to:

- Implementation of the statutory requirement of lifecycle greenhouse gas analysis for projects claiming the 45Q tax credit for emissions reductions achieved through beneficial utilization of CO_2 captured from power plants and industrial facilities;
- Extending allowed time for continuous construction (after beginning construction) for a period longer than currently provided for wind and solar projects, given the longer project development timeframes required for carbon capture projects;
- Defining a power plant to allow distributed generation for primarily non-grid applications to qualify for lower industrial 45Q thresholds; and
- Allowing for aggregation of individual facilities below statutory 45Q thresholds for annual CO_2 capture into a single project that reaches the threshold.

PROVIDING ADDITIONAL EQUIVALENT PATHWAYS FOR DEMONSTRATING SECURE GEOLOGIC STORAGE THROUGH CO_2-EOR

Carbon Capture Coalition participants believe it benefits all parties to have an informed and factual discussion of the current federal regulatory framework for taxpayers to demonstrate secure geologic storage of carbon dioxide (CO_2) through enhanced oil recovery (EOR), for the purposes of claiming the 45Q tax credit. Coalition participants also recognize that some parties are currently seeking changes to the existing regulatory framework.

In November 2018, the Coalition published an overview for accounting of carbon storage through EOR aimed at providing accurate information and clarifying misperceptions regarding the current landscape of federal regulations governing secure geologic storage of CO_2 through EOR projects that use anthropogenic CO_2.

Since that time, the International Organization for Standardization (ISO) has finalized ISO 27916 relating to carbon dioxide capture, transportation and geological storage in the context of CO_2-EOR. The Coalition is exploring the compatibility and potential application of the ISO 27916 standard as part of an equivalent methodology for demonstration of secure geologic storage through CO_2-EOR for the purposes of qualifying for the 45Q tax credit.

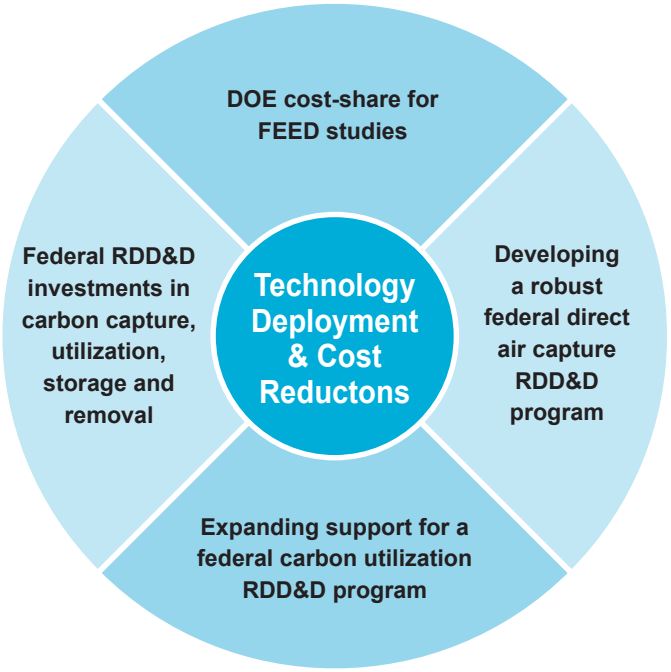
FACILITATING CO_2 PIPELINE INFRASTRUCTURE PLANNING, SITING AND PERMITTING

If carbon capture, utilization, removal and storage is to scale economywide, the U.S. will have to extend roughly 5,000 miles of existing CO_2 pipeline networks and build new trunk pipelines in regions not currently served by such infrastructure in order to transport CO_2 from where it is captured to where it can be used or geologically stored. The Coalition supports responsible development of CO_2 pipeline networks to enable large-scale reductions in carbon emissions, while minimizing environmental and other impacts through best practices in planning and siting.

Toward that end, the Carbon Capture Coalition supports the USE IT Act, which has been recently reintroduced in the House and Senate with bipartisan support (S.383 and H.R. 1166). Title III of the USE IT Act aims to foster collaboration among federal, state, tribal and non-governmental interests to facilitate planning and deployment of needed pipeline infrastructure to transport CO_2 for ultimate storage or beneficial use.

Technology Deployment & Cost Reductions

Just as federal RDD&D has successfully helped scale up deployment of wind, solar and other energy technologies, expanding, retooling and prioritizing federal investments in transformational carbon capture, utilization, storage and removal technologies will be a critical component of driving down costs to accelerate economywide commercial deployment.



Aggressive and sustained federal RDD&D support must play a key role in helping the private sector to bring down costs and commercialize carbon capture technologies across a range of energy resources, sectors and industrial processes, including direct air capture. There are long lead times for advancing energy technologies from concept to demonstration to commercialization, and carbon capture projects are especially capital intensive and subject to technology and commercial risk. These factors increase financial risk and make it difficult without federal support to attract enough private investment to scale up these technologies in the marketplace.

In addition to carbon capture, tremendous innovation is occurring in the development and commercialization of new and beneficial uses of CO_2 and CO that expand the market and opportunity to monetize captured carbon beyond CO_2-EOR. CO_2 and CO are already being used in the lab and in early commercial settings to, among other things, manufacture plastics, chemicals and advanced materials, strengthen concrete and produce jet fuel, with untold new beneficial uses to be realized through additional federal support. Expanded federal RDD&D in this arena will leverage private investment to improve the cost and performance of emerging carbon utilization technologies, so that they can compete in the broader marketplace.

ENSURING ROBUST FEDERAL APPROPRIATIONS FOR CARBON CAPTURE, UTILIZATION, REMOVAL AND STORAGE

The Coalition has written to congressional appropriators to request that in FY 2020, the U.S. Department of Energy (DOE) Fossil Energy's Carbon Capture and Carbon Storage programs be funded at least at $208,767,000, a $10,000,000 increase over last year. Prominent members of Congress from both political parties have also begun calling for ramped-up federal investments in energy innovation, and the Coalition will prepare a more ambitious and comprehensive FY 2021 request for federal RDD&D.

Technology Deployment & Cost Reductions

POLICY PRIORITIES

- **Ensuring Robust Federal Appropriations for Carbon Capture, Utilization, Removal and Storage**
- **Retooling & Expanding Federal RDD&D Programs**
  - USE IT Act
  - DOE Fossil Energy Program Reauthorization
  - Developing a Robust Federal Direct Air Capture RDD&D Program
  - Expanding Support for a Federal Carbon Utilization RDD&D Program
- **DOE Cost Share for Front-End Engineering & Design (FEED) Studies**

Federal funding for carbon capture, utilization, removal and storage RDD&D should in no way be limited to supporting only basic research, and federal resources should prioritize the development and testing of technologies at lab, pilot, demonstration and commercial scales. Demonstration projects are especially critical, and new, emerging technologies would greatly benefit from targeted federal support. Historically, Congress has recognized that this is an appropriate role for DOE, and the Coalition believes that funding should be explicitly available for demonstration and commercial-scale work.

The Coalition encourages the federal government to prioritize specific, targeted research, development and demonstration of carbon capture technologies from diverse sources, including from coal and natural gas power plants, industrial facilities and ambient air through direct air capture. The Coalition also supports additional funding for implementation of demonstration projects under the Carbon Storage Program to be linked with commercial power and industrial carbon capture projects where possible.

Congress has previously provided appropriations to support the development of large-scale transformational pilot carbon capture projects. The transformational technologies under development represent an entirely new way to convert energy that will enable a step-change in performance, efficiency, and cost of electricity as compared to today's state-of-the-art technologies. The Coalition recommends that the large-scale transformational pilot program receive the funding necessary to advance these technologies.

The Coalition strongly supports the DOE Office of Fossil Energy's (FE) RDD&D programs in carbon capture, utilization, removal and storage technologies, and it urges Congress to build on this existing work. The recent National Academies of Sciences (NAS) report, "Negative Emissions Technologies and Reliable Sequestration: A Research Agenda," lays out an ambitious roadmap. As Congress considers legislation to reauthorize FE, the Coalition believes FY 2020 can be a time to begin building towards this roadmap.

RETOOLING AND EXPANDING FEDERAL RDD&D PROGRAMS

In addition to appropriations recommendations, the Carbon Capture Coalition is working with Congress to develop and support legislation to retool and expand federal RDD&D programs to respond to the scale of the challenges and opportunities associated with carbon capture, utilization, removal and storage.

The USE IT Act

Endorsed by the Coalition, the USE IT Act represents a near-term opportunity for bipartisan progress. In addition to the pipeline planning, siting and permitting provisions already described, Titles I and II of the USE IT Act would accomplish an important first step in standing up a federal program and funding to support research, development and demonstration of direct air capture and carbon utilization technologies, respectively.

DOE Fossil Energy Program Reauthorization

The Coalition has provided input into the bipartisan Enhancing Fossil Fuel Energy Carbon Technology (EFFECT) Act (S. 1201), which was recently introduced in the Senate to update and strengthen the DOE Office of Fossil Energy's RDD&D objectives and programs for carbon capture, utilization, removal and storage. The legislation would authorize four new programs to develop transformational technologies, including research and development, large-scale pilot projects, demonstration projects, and front-end engineering and design.

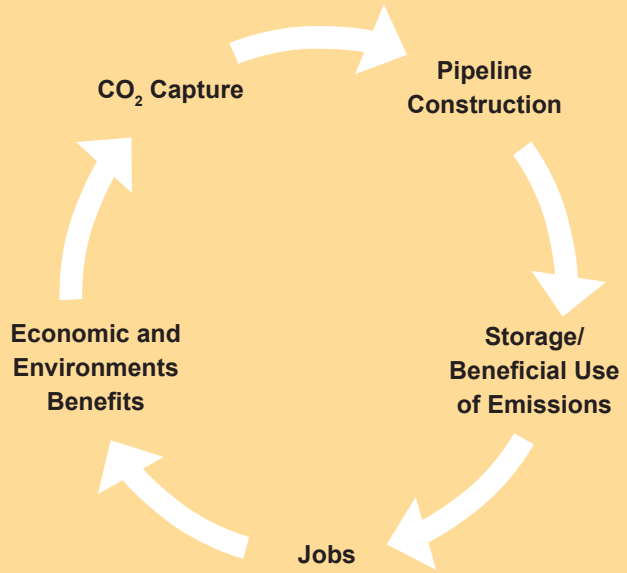
The Coalition is also working with members of Congress to reintroduce similar bipartisan legislation in the U.S. House, entitled the Fossil Energy Research & Development Act.

Developing a Robust Federal Direct Air Capture RDD&D Program

To date, DOE has invested just under $9 million total in direct air capture technologies. The above-referenced National Academies of Sciences report provides a roadmap for federal RDD&D outlining funding levels in the tens to low hundreds of millions of dollars annually for direct air capture. While recently introduced and anticipated legislation in Congress to reauthorize the

Carbon Capture Circular Economy

Carbon capture, utilization, removal and storage is one example of a circular economy. By adopting the right policies and leveraging market forces, the federal government can create economic, jobs and environmental benefits through the monetization of industrial emissions.



DOE Office of Fossil Energy does provide for first-ever dedicated carbon removal programs, levels of funding fall far short of those recommended in the NAS report. The Carbon Capture Coalition will work with Congress to develop recommendations for legislation that establishes objectives and levels of funding sufficient to advance a robust federal RDD&D program and helps companies and entrepreneurs in the field of direct air capture to overcome technical and financing challenges to broader commercial deployment.

Expanding Support for a Federal Carbon Utilization RDD&D Program

The National Energy Technology Laboratory and Bioenergy Technologies Office at DOE are currently supporting carbon utilization RDD&D with limited available funding. U.S. Department of Agriculture is authorized in the 2018 Farm Bill to support carbon utilization in the agricultural economy; however, funding has yet to be appropriated for this activity. The private sector is positioned to bring tremendous innovation to carbon utilization and monetize carbon in an array of profitable products that deliver substantial reductions in carbon emissions. Long-term federal support for RDD&D will mobilize private capital in the near-term for carbon utilization demonstration and commercial deployment. The Carbon Capture Coalition will work with Congress to develop recommendations for legislation that establishes objectives and levels of funding sufficient to advance a robust federal RDD&D program that helps companies and entrepreneurs in the field of carbon utilization to overcome technical and financing challenges to broader commercial deployment.

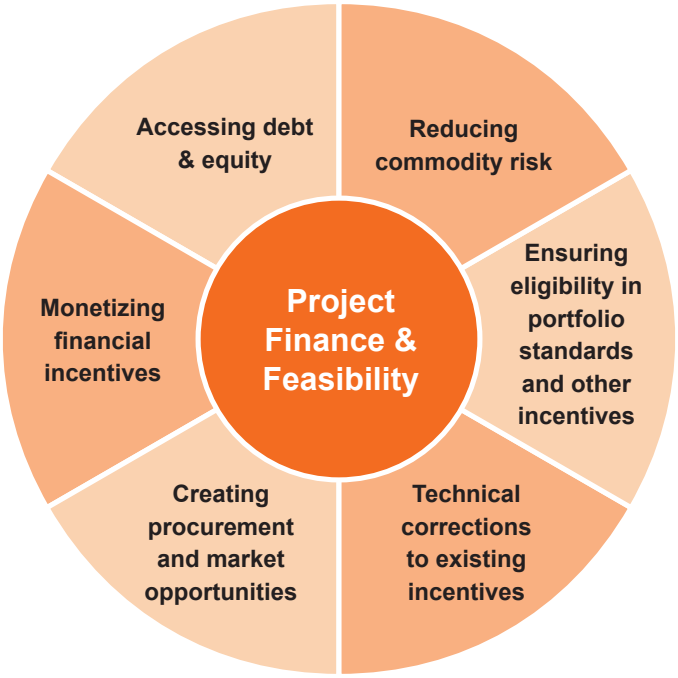
DOE COST SHARE FOR FRONT-END ENGINEERING & DESIGN (FEED) STUDIES

Front End Engineering Design (FEED) studies play a significant role in de-risking early commercial demonstration projects. Typically, a robust FEED study constitutes 10 percent of the total capital cost of a project, and it can help significantly reduce technology performance risk and cost over-runs. Therefore, regardless of the type of incentive for commercial demonstration projects, FEED study incentives should be a cost-share grant, structured so that the project developer covers 10 to 20 percent of the cost.

In order to support a robust commercial demonstration process, in which technologies are taken from first-of-a-kind (FOAK) to Nth-of-a-kind (NOAK), there should be sufficient funding to cover FEED studies for approximately 15 to 25 projects. This program should be undertaken in coordination with a commercial demonstration program, such that FEED cost-share grants are awarded to incentive recipients for the commercial demonstration program.

Project Finance & Feasibility

The newly reformed and expanded Section 45Q tax credit provides an important incentive in its own right for project developers and investors that will enable carbon capture and utilization projects in multiple industries to achieve financial feasibility, especially projects involving lower-cost, higher-purity industrial sources of CO_2. 45Q can also serve as the centerpiece of the kind of broader portfolio of federal incentives and policies that has proven effective in accelerating the commercial deployment of wind, solar and other energy technologies.



An expanded portfolio of policies will ultimately be necessary to achieve economywide deployment by making more projects economic, particularly those involving higher-cost carbon capture from power generation and industrial processes such as the manufacture of steel and cement. This expanded portfolio includes improvements to 45Q and other tax incentives that enhance monetization, technical corrections to 45Q and other federal incentives that broaden eligibility and access, and complementary policies that contribute to overall financial feasibility by lowering the cost of debt and equity, reducing commodity risk and expanding markets for low-carbon electricity, fuels and products produced through carbon capture.

ENHANCING MONETIZATION OF 45Q AND OTHER TAX CREDITS

The ability of project developers and investors to monetize the full value of the reformed and expanded 45Q and other tax credits is paramount to project finance and feasibility, and Coalition recommends that Congress adopt the following policies.

Project Finance & Feasibility

POLICY PRIORITIES

- **Monetizing Financial Incentives**
  - Preventing the Disallowance of 45Q under the BEAT Tax
  - Expanding 45Q Transferability
  - Providing a Revenue-Neutral Refundable Option for 45Q
  - Establishing a 45Q Bonding mechanism
- **Technical Corrections to Expand Eligibility and Access**
  - Eliminating the 25,000-Ton Threshold in 45Q for Carbon Utilization Projects
  - Fixing the 48A Tax Credit to Enable Carbon Capture Retrofits of Existing Power Plants
- **Federal Policies to Complement 45Q**
  - Making Carbon Capture Projects Eligible for Tax-Exempt Private Activity Bonds (PABs)
  - Providing for Eligibility of Carbon Capture Projects for Master Limited Partnerships (MLPs)
  - Reforming the DOE Loan Program
- **Providing Predictable Markets for Carbon Capture & Utilization**
  - Developing Federal Procurement Policies
  - Reducing Commodity Risk through Contract-for-Differences (CfDs)
  - Incentiving Commercial Production
  - Ensuring Eligibility for Carbon Capture in Electricity Portfolio Standards
- **Commercializing Transformational Carbon Capture Technologies**
  - Providing an Enhanced Investment Tax Credit (ITC)

Preventing the Disallowance of 45Q under the BEAT Tax

The Coalition recommends that Congress amend the Internal Revenue Code to prevent disallowance of 45Q under the Base Erosion and Anti-Abuse Tax (BEAT), treatment already afforded investors claiming the Production Tax Credit for wind energy and the Investment Tax Credit for solar energy. Important potential tax equity investors in carbon capture projects may be subject to BEAT, which was revised in major tax reform legislation in 2017 to lower the threshold that triggers application of the new tax to 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 an additional fix that would extend through the duration of the 45Q tax credit.

Expanded Transferability

Congress should provide additional flexibility to the existing transfer provision in the 45Q statute by including additional taxpayers who are involved in the carbon capture transaction to be allowable as transferees. Additional flexibility will make it easier for investors in carbon capture equipment to transfer the credit to taxpayers with tax liability, creating a larger market for monetizing 45Q tax credits and, thus, a larger pool of eligible investors in projects.

A new credit transfer provision for 45Q could be modeled on the existing transfer provision found in Section 45J(e) of the Advanced Nuclear Tax Credit, which serves as a precedent for a more flexible transfer standard for 45Q. Potential transferees for such tax credits may include persons who have an ownership interest in the carbon capture facility; provided equipment or services in the construction of such a facility; provided transportation of CO_2 from the facility or transmission or distribution of electricity from such facility; purchased electricity or products from such a facility; or provides financing for the qualified facility or carbon capture equipment.

Providing a Revenue-Neutral Refundable Option

The Coalition recommends that Congress provide a revenue-neutral refundable option for the 45Q tax credit. Such an option would allow project developers the choice to convert the 45Q tax credit into a cash grant, which would create certainty for project developers concerning the monetization and value of the tax credit. Carbon capture projects have high capital costs, and many carbon capture project developers and financiers may have federal tax credits that they are unable to use or that must be carried over to later years. Such a policy should be structured to be revenue neutral for the federal government by allowing a project developer to take the credit as cash for a limited number of years, instead of claiming the tax credit for the full 12 years allowed under the current statute.

Establishing a Bonding Mechanism

Congress should consider a proposal to establish "American Energy Bonds" that would allow project developers and energy companies to more efficiently monetize federal tax credits, including 45Q, to encourage additional private investment in our nation's energy infrastructure. Under the proposal, energy companies would be allowed to make interest payments in the form of tax credits, provided they invest the proceeds of the bonds in qualified American energy infrastructure projects, including carbon capture and utilization. Once assigned to the bondholder, the energy company would no longer be eligible to claim the credit, which would go to the bondholder. Importantly, this structure would not create a new tax credit or expand any pre-existing credits.

TECHNICAL CORRECTIONS TO EXPAND ELIGIBILITY AND ACCESS

Technical corrections are also needed to ensure that carbon capture and utilization projects are eligible for and have access to available federal incentives.

Eliminating the 25,000-Ton Threshold in 45Q for Carbon Utilization Projects

The Coalition recommends that Congress eliminate the 25,000-ton annual minimum CO_2 capture threshold for carbon utilization projects seeking to claim the 45Q tax credit. In the FUTURE Act, Congress added carbon utilization to 45Q to incentivize the development and

deployment of new applications for using captured carbon beyond its traditional use in CO_2-EOR, and a minimum threshold of 25,000 metric tons of annual CO_2 capture and a maximum threshold of 500,000 tons were established to determine eligibility. Since passage of the legislation last year, it has become clear, based on technical input from technology companies, that most projects in the nascent carbon utilization field will simply not be able to reach the 25,000-ton threshold. This creates the risk that new 45Q program will fail to accomplish the intended goal of catalyzing the demonstration and deployment of new carbon utilization technologies in the commercial marketplace.

Fixing the 48A Tax Credit to Enable Carbon Capture Retrofits of Existing Power Plants

The Coalition endorses proposed reforms to the existing 48A Advanced Coal Tax Credit contained in the bipartisan Carbon Capture Modernization Act introduced recently in the Senate and House (S. 407 and H.R. 1796). The Act corrects design flaws in the 48A program that have made it impossible for companies to access existing incentives to retrofit currently operating coal-fired power plants with carbon capture technology. Fixes in the legislation include removing efficiency requirements that are incompatible with carbon capture (while still achieving far greater emission reductions than from efficiency improvements alone), lowering the percentage CO_2 capture requirement for existing units to improve project economics, lowering the size threshold for eligible projects and directing the Treasury Department to offer additional application rounds to reallocate available 48A credits. In addition to specific provisions in the legislation, the Coalition recommends that Congress reduce the threshold for eligible projects to 50 MW.

In 2018, coal-fired electricity generation accounted for 30 percent of global CO_2 emissions. A majority of that generation is found today in Asia's young and growing coal fleet, where average power plants are only 12 years old and will require carbon capture retrofit solutions to meet midcentury emissions reduction goals. Innovation knows no borders, and it is vital that the U.S. continue to lead the way in commercial deployment of technologies to manage carbon emissions from existing power plants. Enacting these proposed reforms to the federal 48A tax credit would free up an estimated $1.7 to $2 billion in available funding for tax credits, allowing U.S. power companies to pursue multiple additional carbon capture projects and build on the success of NRG Energy's world class Petra Nova project at a power plant near Houston.

FEDERAL POLICIES TO COMPLEMENT 45Q

Additional federal incentives and other policies can be combined with the 45Q tax credit to help more carbon capture and utilization projects reach financial feasibility than with just the 45Q tax credit alone. The following policies would complement 45Q by providing greater access to low-cost debt and equity, reducing commodity risk, and providing market, offtake and cost recovery opportunities for low-carbon electricity, fuels and products produced through carbon capture and utilization.

Making Carbon Capture Projects Eligible for Tax-Exempt Private Activity Bonds (PABs)

The Carbon Capture Coalition endorsed the bipartisan Carbon Capture Improvement Act introduced in the Senate and House last Congress, which would make carbon capture projects eligible for PABs, thereby allowing project developers access to tax-exempt debt to finance their projects and thus lowering their capital costs. PABs are a common, well-accepted financing technique used to finance airports, seaports, mass transit, water pollution control, hazardous waste disposal, and solid waste facilities (including sulfur scrubbers in coal power plants). However, carbon capture equipment cannot now be financed with PABs. Roughly two-thirds of the cost of capturing a ton of CO_2 is repayment to investors and lenders who funded the carbon capture plant. PABs reduce annual debt payments by both lowering interest rates and extending the repayment period. Federally authorized access to PABs is a permanent incentive, not subject to the on-again, off-again nature of federal tax credits.

Reintroduction of the Carbon Capture Improvement Act is anticipated this year.

Providing for Eligibility of Carbon Capture Projects for Master Limited Partnerships (MLPs)

The Coalition supported the bipartisan MLP Parity Act when it was introduced in the Senate and House last Congress. The Act would make a broad range of clean energy technologies eligible for the MLP structure, including carbon capture. MLPs combine the tax benefits of a partnership with a corporation's ability to raise capital in public markets. Eligibility for MLPs would allow carbon capture projects to reduce the cost of equity, providing access to capital on more favorable terms. MLP financing has backed more than $500 billion worth of U.S. oil and gas pipelines and some coal-related infrastructure. Typically, annual funds raised in the tax equity partnership market through tax credits has been $5 to $10 billion. By contrast, typical annual issuances in the MLP market have been in the $50 billion a year range. Like PABs, eligibility for MLPs would provide a permanent federal incentive, unlike tax credits.

The MLP Parity Act is expected to be reintroduced this year.

Reforming the DOE Loan Program

Federal loan guarantees can become an important tool for financing carbon capture projects. Under the DOE Loan Program, $8.5 billion in loan guarantees is available under the Advanced Fossil Energy Projects solicitation, yet only one carbon capture project has received a conditional loan guarantee. The Carbon Capture Coalition recommends key reforms to the program to make it more effective, including lowering the overall level of fees, clarifying the calculation of credit subsidy fees, and lifting restrictions on loan guarantees for projects receiving federal grants. The Coalition supports the preservation of the Loan Program Office and recommends that Congress take a closer look at improving the program's effectiveness, particularly for carbon capture projects. Specifically, the Coalition advocates that credit subsidy be appropriated for carbon capture projects under the advanced fossil energy solicitation that have received conditional commitments and that Congress explore ways to reduce other costs of the Program, such as facility fees, DOE consultant fees, and application fees that are detrimental to project developers and have deterred them from even participating in the program.

PROVIDING PREDICTABLE MARKETS AND COST RECOVERY FOR CARBON CAPTURE AND UTILIZATION

Developing Federal Procurement Policies for Carbon Capture and Utilization

Federal procurement can be a powerful driver for the financing of projects by providing project developers and investors with certain and predictable markets and offtake opportunities for low-carbon electricity, fuels and products from carbon capture and utilization, much as wind, solar and other energy technologies have historically benefited from targeted federal procurement policies. The Carbon Capture Coalition will develop legislative recommendations to Congress for procurement policies aimed at creating such markets for carbon capture (including direct air capture) and utilization. The Coalition will provide recommendations for new legislation, as well as for amendments to existing statutes such as the National Defense Authorization Act.

Reducing Commodity Risk through Contract-for-Differences (CfDs)

Commodity prices are inherently volatile, and developers face challenges in financing carbon capture projects because investors offer capital on less favorable terms to compensate for commodity price risk. Establishing a CfD program through the U.S. DOE would reduce that risk, allowing project developers access to lower-cost financing. Under such a program, a developer would enter into a contract with DOE that provides a fixed "strike price" for the commodity associated with the carbon capture project (e.g. electricity, fuels, steel, cement, chemicals, etc.). If the price of the commodity in question falls below the strike price, the DOE would pay the difference between the strike price and the reference market price stipulated in the contract. Conversely, if the reference market price rises above the strike price, a project developer would pay DOE the difference, which would then be returned to the

U.S. Treasury. The CfD approach would protect a developer and investors willing to undertake riskier early stage commercial demonstration of a capture technology from the impact of a falling commodity price, while also preventing windfall returns at taxpayer expense, should the price of that commodity increase above the contracted strike price.

In 2016, the Energy Policy Modernization Act in the Senate was amended with bipartisan support to task DOE with reporting to Congress on the costs and benefits of DOE implementing a CfD program. The broader legislation did not ultimately pass, and the Carbon Capture Coalition will encourage further congressional consideration of this policy.

Incentivizing Commercial Production of Low and Zero-Carbon Fuels from Captured Carbon

Captured carbon oxides from a flue stack, ambient air or from other locations in industrial processes can be used to make low carbon and zero carbon transportation fuels. Many of these fuels can be used within the existing liquid fueling infrastructure and with conventional vehicles without modifications. Fuels capable of being produced today using captured carbon oxides include ethanol, diesel fuel, jet fuel, gasoline and others, and they have the potential to provide an important commercial market for carbon captured from industrial, power plant and direct air capture projects. The Coalition will be exploring legislative recommendations to Congress for policies to incentivize commercial demonstration of carbon oxides-to-fuels technologies.

Ensuring Eligibility for Carbon Capture in Electricity Portfolio Standards

Electricity portfolio standards have played an important role in incentivizing private investment in the deployment of wind, solar and other renewable power generation projects in general. In particular, regulated utilities have used statutory obligations at the state level requiring that a certain percentage of electricity be derived from renewable sources to justify approval from state regulators to add renewable generation to their portfolios. In return, utilities have received cost recovery from ratepayers for those investments. Recently, several states have increased the stringency of such portfolio requirements, while also expanding eligibility more broadly to encompass other low and zero-carbon generation technologies, including carbon capture. This kind of broader low-carbon portfolio standard policy is receiving increasing attention among members of Congress as part of a larger discussion of options for achieving broader decarbonization goals.

The Carbon Capture Coalition does not take a position on such a federal low-carbon or zero-carbon electricity portfolio standard. However, if federal policymakers were to choose to implement such a policy, Coalition participants believe it is critically important that any legislation establish clear eligibility and effectively incentivize the robust participation of carbon capture, utilization, removal and storage, along with other generation technologies, to accomplish the intended emissions reduction objectives cost-effectively.

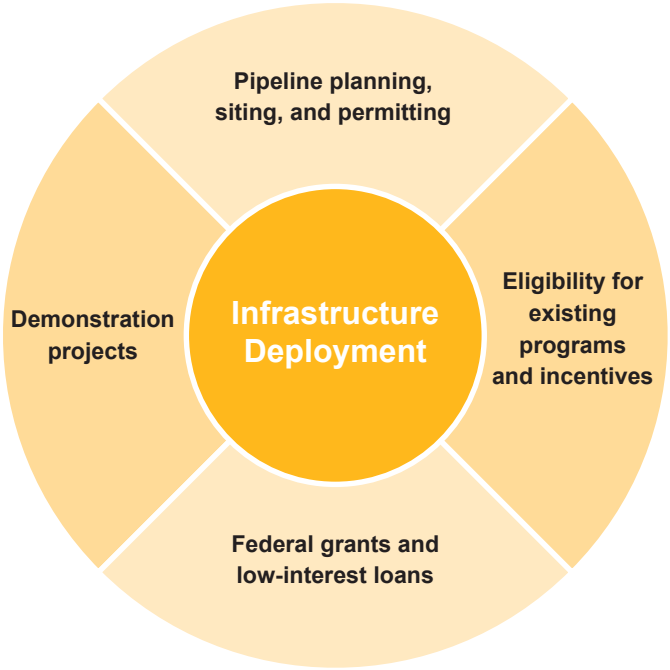
COMMERCIALIZING TRANSFORMATIONAL CARBON CAPTURE TECHNOLOGIES

Providing an Enhanced Investment Tax Credit (ITC)

A promising set of next-generation carbon capture technologies have application for coal and gas power generation and different industrial sectors, and they hold the potential for significantly reduced costs and improved performance. Expanding and enhancing the existing 48A and 48B ITC programs (the previously described 48A tax credit addresses power plants, while 48B is for industrial facilities) would, in combination with 45Q, help accelerate the commercialization of these transformational technologies in the marketplace. A revamped 48A and 48B program would leave the current tax credit amount at 30 percent. Eligible projects would include carbon capture on coal, natural gas and industrial sources, focus on transformational innovations that reduce costs in the areas of efficiency, capital costs, and durability, and include state-of-the-art design and construction strategies. Projects deemed eligible for an enhanced ITC should also have the option of financing their projects with American Energy Bonds described elsewhere in the policy blueprint.

Infrastructure Deployment

Since 1972, approximately 5,000 miles of CO_2 pipelines have been built in a dozen U.S. states and operated safely and reliably without any significant environmental accident or human fatality. Now, to achieve the full potential of carbon capture as a national strategy for reducing carbon emissions, enhancing energy independence and protecting and creating high-wage jobs, we must responsibly scale up this infrastructure to create a nationwide network for transporting CO_2 captured from industrial facilities, power plants and ambient air to locations around the country where it can be put to beneficial use or safely and permanently stored in geologic formations. This buildout will include capacity expansions and extensions of existing pipeline networks, as well as the construction of long-distance, large-volume interstate trunk lines to serve states and regions that currently lack CO_2 transport infrastructure.



Despite significant and successful private investments in CO_2 pipelines by the energy industry over the past half century, a truly scale-efficient, long-distance, and interconnected national CO_2 transport system sufficient to meet broader policy objectives will not be developed without federal involvement in helping to finance new pipeline capacity.

Infrastructure Deployment

POLICY PRIORITIES

- **Federal Financing of Extra Pipeline Capacity to Achieve Economies of Scale**
  - Access to Federal Low and Zero-Interest Loans
  - Enact Legislation for Common Carrier CO_2 Pipeline Infrastructure
- **Additional Federal Policies to Foster the Buildout of CO_2 Pipeline Infrastructure Networks**
  - Facilitating Planning, Siting and Permitting of CO_2 Pipeline Infrastructure
  - Providing Eligibility for Tax-Exempt Private Activity Bonds and Master Limited Partnerships

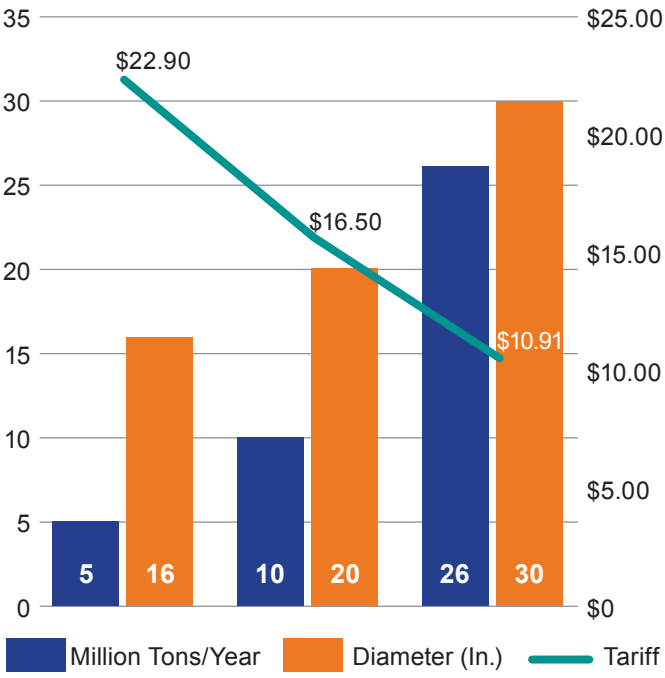
FEDERAL FINANCING OF EXTRA PIPELINE CAPACITY TO ACHIEVE ECONOMIES OF SCALE

Federal policy can help ensure the development of pipeline capacity adequate to meet the needs of initial carbon capture, utilization, removal and storage projects, accommodate future growth in the industry over time and reduce the cost to all private participants in the system, including smaller industrial facilities such as ethanol plants that will need to share common pipeline infrastructure to make carbon capture viable. The economy of scale savings from supersizing pipelines makes this possible. By doubling the diameter of a pipeline, capacity quadruples, thus lowering the tariff that must be charged for transport. Since most pipeline construction costs are fixed, increasing pipeline diameter to expand capacity substantially adds a relatively small amount to total project costs.

However, private capital will not accommodate this incremental cost to supersize pipelines and assume the associated risk of financing this extra uncontracted capacity until additional tariff-paying shippers come on line. Investors and developers of privately-owned pipelines require shippers to sign contracts in advance to finance such capacity expansion.

Federal policy can help the private sector overcome this classic chicken-and-egg problem in the marketplace by supplementing private capital to help to

Bigger Volume & Diameter Means Lower Tariff



finance a large increment of expanded capacity at low additional cost, thereby achieving economies of scale and reducing the overall costs of the system. And the American public reaps the benefits of reducing carbon emissions, sustaining our nation's domestic energy and industrial production and jobs base, and increasing economic activity and tax revenues that result.

The Carbon Capture Coalition recommends that Congress enact legislation for common carrier pipeline infrastructure to transport anthropogenic CO_2 that includes the following key elements:

- Low and zero-interest federal loans to supplement private capital in financing pipeline projects;
- Federal grants to cover the incremental cost of supersizing pipelines to provide for extra capacity and realize economies of scale; and
- Federally-supported flagship demonstration projects in key regions of the country, featuring large-volume, long-distance interstate trunk lines linking multiple industrial facilities and power plants that supply CO_2 to multiple utilization and geologic storage sites.

While not a federal legislative action, a statement from Congress making clear the importance of defining CO_2 pipelines as part of the "pollution control equipment" needed for widespread deployment of carbon capture would be a helpful signal to state and local governments.

ADDITIONAL FEDERAL POLICIES TO FOSTER THE BUILDOUT OF CO_2 PIPELINE INFRASTRUCTURE NETWORKS

The Carbon Capture Coalition supports the following additional federal policies to help foster the buildout of existing and new CO_2 pipeline infrastructure networks:

Facilitating Planning, Siting and Permitting of CO_2 Pipeline Infrastructure

Congressional passage of the USE IT Act (described in sections above) would play an important role in facilitating the planning, siting and permitting of CO_2 pipeline infrastructure.

Providing Eligibility for Tax-Exempt Private Activity Bonds and Master Limited Partnerships

As described in a previous section of the blueprint, the Coalition supported the Carbon Capture Improvement Act and Master Limited Partnership Parity Act introduced in the last Congress to make carbon capture projects eligible for PABs and MLPs, respectively. PABs would allow carbon capture projects access to tax-exempt debt to help finance their projects (including CO_2 pipelines), thus lowering their capital costs. Allowing carbon capture projects to be MLPs would reduce the cost of equity and provide access to capital on more favorable terms. While CO_2 pipelines are currently eligible for MLPs, the lack of eligibility for carbon capture projects creates uncertainty for project developers and investors.

Conclusion

This policy blueprint makes clear that expansion of federal policies and investments in carbon capture, utilization, removal and storage and in CO_2 pipeline infrastructure is needed to bring down emissions, protect and create high-wage jobs and promote economic opportunities in the management and beneficial use of carbon. A comprehensive and robust federal policy agenda can help the U.S. sustain its position as a global leader in the commercialization and deployment of these crucial energy and industrial technologies and infrastructure.

The economywide deployment of carbon capture and related technologies represents a critical component of any U.S. or global strategy to decarbonize power generation and other key industry sectors by midcentury. Modeling of decarbonization by the IEA and IPCC has long made clear that meeting climate goals, and doing so affordably, will require robust investments and broad deployment in carbon capture and related technologies.

The Coalition's policy blueprint underscores the foundational importance of bipartisan passage of the reformed and extended 45Q tax credit in 2018. Complementary policies and incentives that provide investment certainty, spur technology deployment and provide cost reductions, enhance project finance and feasibility and encourage infrastructure deployment will be needed to ensure that carbon capture, storage, utilization and removal achieves economywide deployment in the next ten years.

"A comprehensive and robust federal policy agenda can help the U.S. sustain its position as a global leader in the commercialization and deployment of these crucial energy and industrial technologies and infrastructure. The economywide deployment of carbon capture and related technologies represents a critical component of any U.S. or global strategy to decarbonize power generation and other key industry sectors by midcentury."

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