



National and Regional Collaborative Efforts to Develop CCUS Projects / 45Q and other updates

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Kansas CCUS Forum
Lawrence, KS

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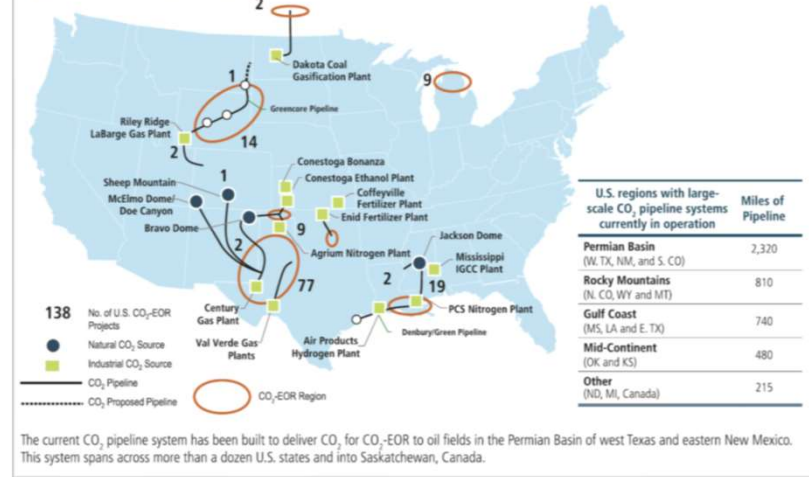
**GREAT PLAINS
INSTITUTE**

Better Energy.
Better World.

- 1972: Val Verde Gas Processing Plants in Texas
- 1982: Koch Nitrogen Company Enid Fertilizer Plant in Oklahoma
- 1986: Exxon Shute Creek Gas Processing Facility in Wyoming
- 2000: Dakota Gasification's Great Plains Synfuels Coal Gasification Plant in North Dakota
- 2003: Core Energy/South Chester Gas Processing Plant in Michigan
- 2009: Chaparral/Conestoga Energy Partners' Arkalon Bioethanol Plant in Kansas
- 2010: Occidental Petroleum's Century gas processing plant in Texas
- 2012: Air Products Port Arthur Refinery Hydrogen Production in Texas
- 2012: Conestoga Energy Partners/PetroSantander Bonanza Bioethanol Plant in Kansas
- 2013: ConocoPhillips Lost Cabin Gas Processing Plant in Wyoming
- 2013: Chaparral/CVR Energy Coffeyville Fertilizer Gasification Plant in Kansas
- 2014: SaskPower Boundary Dam Coal Power Plant Post-Combustion Capture Retrofit in Saskatchewan
- 2015: Shell Quest hydrogen production at bitumen upgrader in Alberta
- 2016: Emirates Steel's Mussafah direct reduction iron plant in the United Arab Emirates
- 2017: NRG Petra Nova Coal Plant Post-Combustion Retrofit in Texas
- 2017: Archer Daniels Midland large-scale ethanol capture in Illinois

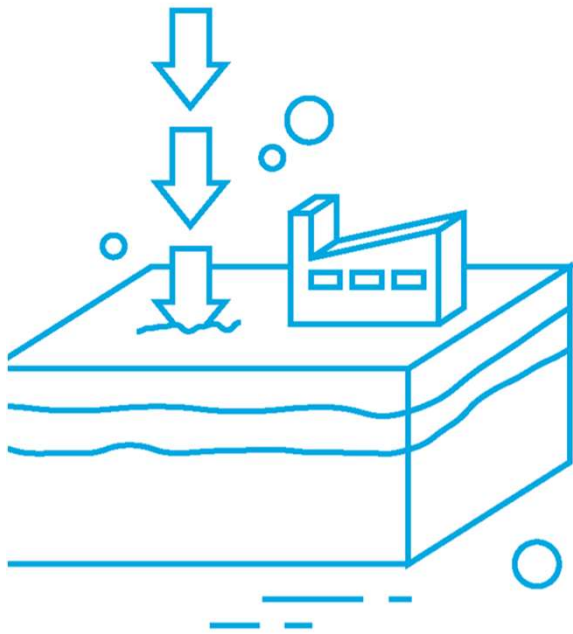
Carbon Capture Works: Nearly 50 Years of Commercial Experience

Figure 7-8. Current CO₂-EOR Operations and Infrastructure¹¹²



There are nearly 5,000 miles of
CO₂ pipeline infrastructure in the U.S.

Carbon Capture is Scalable and Delivers Domestic Energy Production, Jobs & Emissions Reduction Benefits



Source: IEA

- **U.S. oil industry has purchased, transported and injected nearly 1.5 billion tons of CO₂ over the past half century** with no fatalities, serious injuries, or major environmental incidents (~65 million tons of CO₂ annually; nearly 4 percent of U.S. oil production).
- **~37% net lifecycle emissions reductions achieved through geologically storing industrial and power plant CO₂ through enhanced oil recovery (EOR), including the additional oil produced** (IEA analysis).
- **Saline geologic storage of CO₂ has been demonstrated successfully at scale** (e.g. ADM in Illinois and Equinor in the North Sea) and achieves even greater lifecycle emissions reductions, including potentially atmospheric carbon removal for negative emissions.
- **Over a century's worth of U.S. annual stationary source emissions can be stored in oil and gas fields;** thousands of years' worth in saline formations.
- **Carbon capture provides direct economic and fiscal benefits from oil and other related energy production,** and it protects and creates good-paying, highly-skilled jobs across the value chain of capture, transport, use and storage.

**REGIONAL
CARBON
CAPTURE
DEPLOYMENT
INITIATIVE**



**CARBON CAPTURE
COALITION**

**STATE
CARBON
CAPTURE
WORK
GROUP**

“All hands on deck” to achieve economywide
deployment of carbon capture

Unique, Unprecedented National Energy Coalition

- 70+ members, including industry, NGO and labor interests
- Unites very diverse interests
- Non-partisan, technology agnostic
- Working to achieve economywide deployment of carbon capture to foster domestic energy production, support jobs and reduce emissions



Participants		
<ul style="list-style-type: none">• Accenergy• AFL-CIO• Air Liquide• Air Products• AK Steel• American Carbon Registry• ArcelorMittal• Arch Coal• Archer Daniels Midland Co.• Baker Hughes, a GE Company• Bipartisan Policy Center• Carbon180• Carbon Wrangler LLC• Center for Climate and Energy Solutions• Citizens for Responsible Energy Solutions Forum• Clean Air Task Force• ClearPath Foundation• Cloud Peak Energy• Constoga Energy Partners• Core Energy LLC• EBR Development LLC• EnergyBlue Project• Energy Innovation Reform Project	<ul style="list-style-type: none">• Glenrock Petroleum• 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 LLC• Mitsubishi Heavy Industries America, Inc.• National Audubon Society• National Farmers Union• National Wildlife Federation• NET Power• New Steel International, Inc.	<ul style="list-style-type: none">• NRG Energy• Occidental Petroleum Corporation• Pacific Ethanol• Peabody• Prairie State Generating Company• Praxair, Inc.• Renewable Fuels Association• Shell• SMART Transportation Division (of the Sheet Metal, Air, Rail and Transportation Workers)• Summit Power Group• Tenaska Energy• The Nature Conservancy• Third Way• Thunderbolt Clean Energy LLC• United Mine Workers of America• United Steel Workers• Utility Workers Union of America• White Energy• Wyoming Outdoor Council

Observers		
<ul style="list-style-type: none">• Algae Biomass Organization• Biomass Power Association• Carbon Engineering• Carbon Utilization Research Council	<ul style="list-style-type: none">• Cornerpost CO2 LLC• Enhanced Oil Recovery Institute, University of Wyoming• Environmental Defense Fund• Growth Energy	<ul style="list-style-type: none">• Institute of Clean Air Companies• Melzer Consulting• Tellus Operating Group• World Resources Institute



To learn more and view our complete membership list, visit www.carboncapturecoalition.org.

Unparalleled Bipartisan Support for Reform of 45Q Tax Credit

Key Changes of Reformed 45Q Tax Credit

Increases credit values.

Expands eligibility to include other beneficial uses of captured carbon (in addition to EOR), projects that capture CO and direct air capture projects.

Creates **greater financial certainty** by lifting the credit cap and providing clear timing for eligibility

Expands eligibility to more industries by lowering the annual carbon capture threshold and expanding definitions for qualified facilities and qualified carbon.

Enables the owner of the capture equipment to transfer the credit to another party that stores or puts the CO₂ or CO to beneficial use.

45Q Tax Credit Amount: Depends on Project Type

There is a 10-year ramp up to the following dollar per ton amounts, with the value depending on project type as shown below.

\$35/ton

for CO₂ stored geologically through EOR.

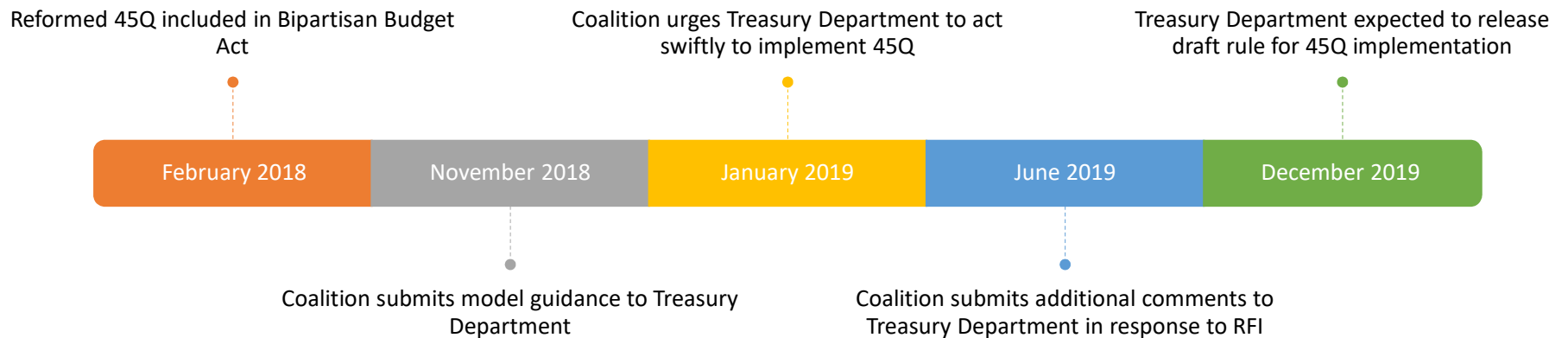
\$35/ton

for other beneficial uses of CO₂ or CO such as converting carbon emissions into fuels, chemicals, or useful products like concrete.

\$50/ton

for CO₂ stored in other geologic formations and not used in EOR.

Shaping U.S. Treasury's 45Q Tax Credit Guidance



Key Recommendations

Ensure flexible contractual assurance and transferability of the tax credit

Limit investor risk of credit recapture by establishing a safe harbor

Define commence construction and continuous construction for projects

Provide an equivalent ISO-based monitoring and reporting program (in addition to the Subpart RR Greenhouse Gas Reporting Program) for demonstrating secure geologic storage through CO₂-enhanced oil recovery

Federal Policy Agenda Going Forward

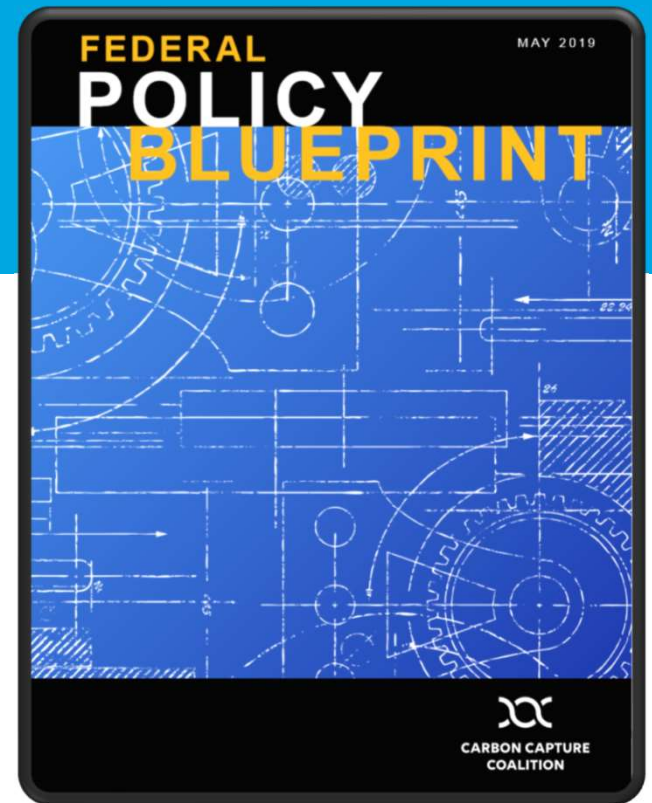
- Ensure effective implementation of 45Q by the U.S. Treasury to provide the investment certainty and business model flexibility intended by Congress;
- Provide a portfolio of federal carbon capture policies to complement 45Q, similar to wind and solar;
- Incorporate CO₂ pipeline infrastructure into national infrastructure legislation, including measures for federal financing of extra capacity; and
- Support a robust U.S. Department of Energy budget for carbon capture, utilization, removal and storage R&D, demonstration and deployment to ensure that lower-cost next-generation technologies enter the market.



**CARBON CAPTURE
COALITION**

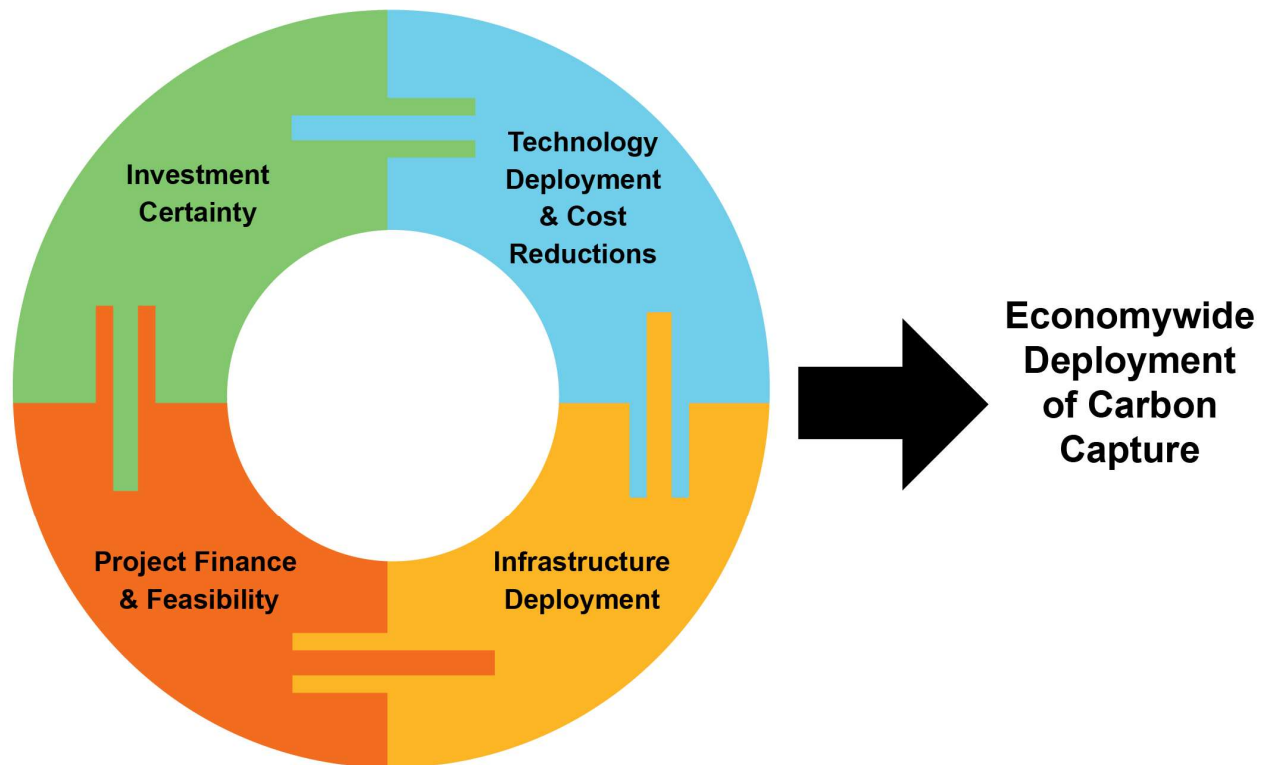
Carbon Capture Coalition Federal Policy Blueprint

- ✓ **First-ever policy blueprint on federal carbon capture policies**
- ✓ **Promotes economywide deployment of carbon capture technologies**
- ✓ **Represents consensus of Coalition's more than 60 energy, industrial and technology companies, labor unions, and conservation, environmental, clean energy and agricultural organizations**



NEXT Ten Years for Carbon Capture: How do we reach “Threshold Scale”

Reform of the 45Q tax credit is a significant accomplishment and provides a foundation for the broader suite of policies needed to scale commercial deployment of carbon capture, similar to what has benefitted other low and zero-carbon technologies.





CARBON CAPTURE COALITION

Current Bipartisan Legislative Priorities

USE IT Act

- Supports demonstration of direct air capture technologies and R&D of next generation carbon utilization technologies to transform CO₂ into a beneficial resource and economic opportunity, while reducing emissions
- Facilitates planning, siting and permitting of pipeline infrastructure to transport CO₂

Carbon Capture Modernization Act

- Corrects program design flaws to make companies eligible to access existing Section 48A tax credits for retrofitting currently operating US coal-fired power plants with carbon capture technology

Senate EFFECT Act/House Fossil Energy R&D Act

- Expands and retools the U.S. DOE fossil energy research, development and demonstration (RD&D) objectives and programs to help meet the challenge of reducing our nation's carbon emissions and sustaining U.S. leadership in carbon capture, utilization, removal and storage technologies



CARBON CAPTURE COALITION

Current Bipartisan Legislative Priorities

Carbon Capture Improvement Act of 2019

- Authorizes use of tax-exempt private activity bonds to help finance the purchase of carbon capture equipment for installation at power plants and industrial facilities.

Financing Our Energy Future Act

- Makes carbon capture and utilization projects eligible for tax-advantaged master limited partnerships to reduce the cost of equity and provide project developers with access to capital on more favorable terms.

Clean Industrial Technology Act

- Directs the Secretary of Energy to establish an Industrial Emissions Reduction Technology Development Program aimed at developing innovative low- and zero-emissions technologies, including carbon capture.

Forthcoming: Federal CO₂ Transport Infrastructure Legislation

Coalition working with Rep. Bustos (D-IL) to develop and introduce legislation this month to **advance CO₂ transport recommendations in Coalition's federal policy blueprint:**

- Low and zero-interest federal loans to help finance extra pipeline capacity and realize economies of scale;
- Federally-supported flagship CO₂ trunk line demonstration projects in key regions; and
- Encourage state and local governments to consider anthropogenic CO₂ pipelines as “pollution control devices” to facilitate state and local ad-valorem and property tax abatement.





Additional Focus on Carbon Capture in the Industrial Sector

- Roughly one-third of global carbon emissions come from the industrial sector, and industrial emissions are growing at twice the rate of emissions as a whole.
- Over half of industrial emissions occur in just three sectors: steel, cement and basic chemicals.
- Steel production has the largest share at 3.2 billion metric tons (GtCO₂) per year, followed by cement (2.5 GtCO₂) and chemicals (1.9 GtCO₂).
- These sectors rely on chemical processes in which carbon emissions are inherent and cannot be eliminated through efficiency or electrification with low and zero-carbon power.
- About half of all emissions associated with steel production represent such direct emissions.

A photograph of an industrial facility at night, featuring a complex network of steel structures, walkways, and pipes illuminated by warm lights. A large, semi-transparent white circle is overlaid on the left side of the image, containing text.

Industrial Sector: Near-Term Opportunities to Catalyze Action

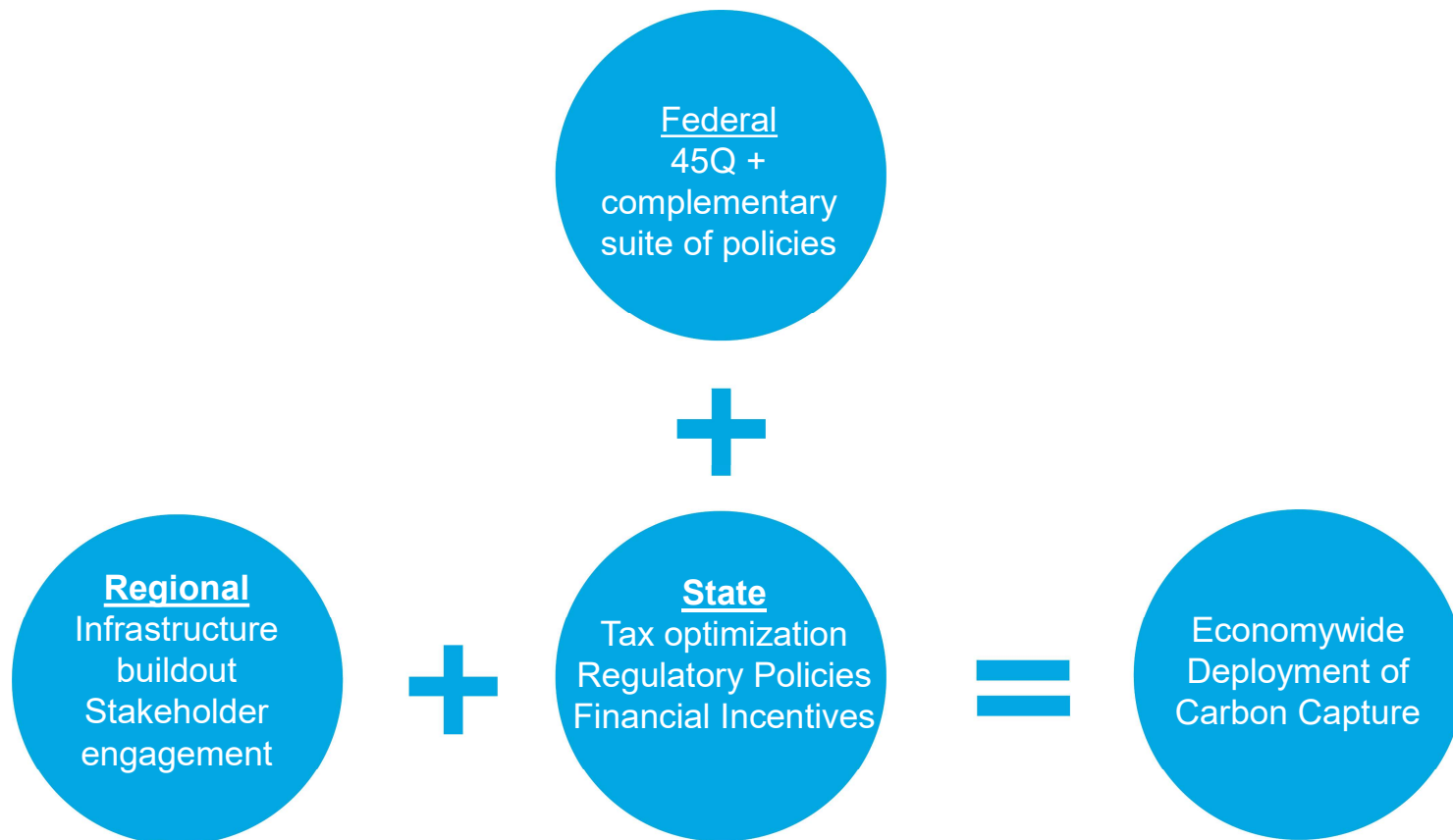
Further development of industrial decarbonization strategy:

- Most neglected aspect of broader climate agenda, especially carbon capture component.
- We must urgently deploy large-scale industrial capture while the 45Q tax credit remains authorized, or we run risk of not scaling deployment economywide by 2050.

Industrial decarbonization next steps:

- September steel delegation to the UAE, Belgium, and the Netherlands.
- Potential cement delegation to Belgium and perhaps other European locations in Q1 or Q2 2020.
- Prioritization of industrial carbon capture in CO₂NNECT 2020

Integrated Federal, Regional & State Policy are Key to Success



REGIONAL CARBON CAPTURE DEPLOYMENT INITIATIVE



- Midwest & Western regions
- Significant analysis and modeling
- Broad state and stakeholder engagement
- Materials development and forthcoming website to share information
- Policy teams in states to drive legislative to support deployment



CARBON CAPTURE COALITION



- Broad, bipartisan coalition
- Work streams:
 - Legislation
 - 45Q implementation
 - Regulatory Issues
 - Appropriations
 - Future policy development
 - Markets
 - Public/stakeholder education
 - Industrial sector

STATE CARBON CAPTURE WORK GROUP



- State leadership
- State policy research and development
- Networking and idea sharing

STATE CARBON CAPTURE WORK GROUP

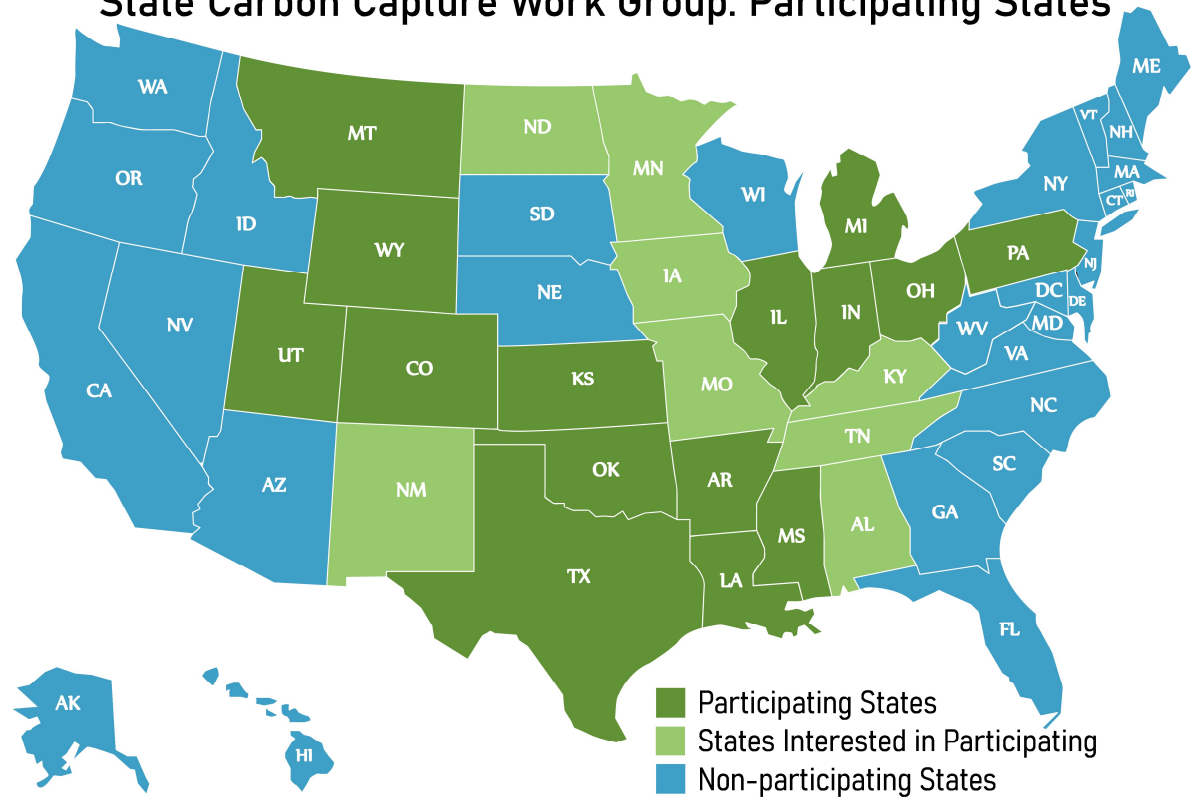
Four Major Work Group Deliverables To Date

- [Putting the Puzzle Together: State and Federal Policy Drivers for Growing America's Carbon Capture and CO₂-EOR Industry](#)
- [21st Century Energy Infrastructure: Policy Recommendations for Development of American CO₂ Pipeline Networks](#)
- [Electricity Market Design and Carbon Capture Technology: The Opportunities and the Challenges](#)
- [Capturing and Utilizing CO₂ from Ethanol: Adding Economic Value and Jobs to Rural Economies and Communities While Reducing Emissions](#)

Interest in State Carbon Capture Work Group and Midwest/Western Regional Deployment Initiatives Continues to Grow

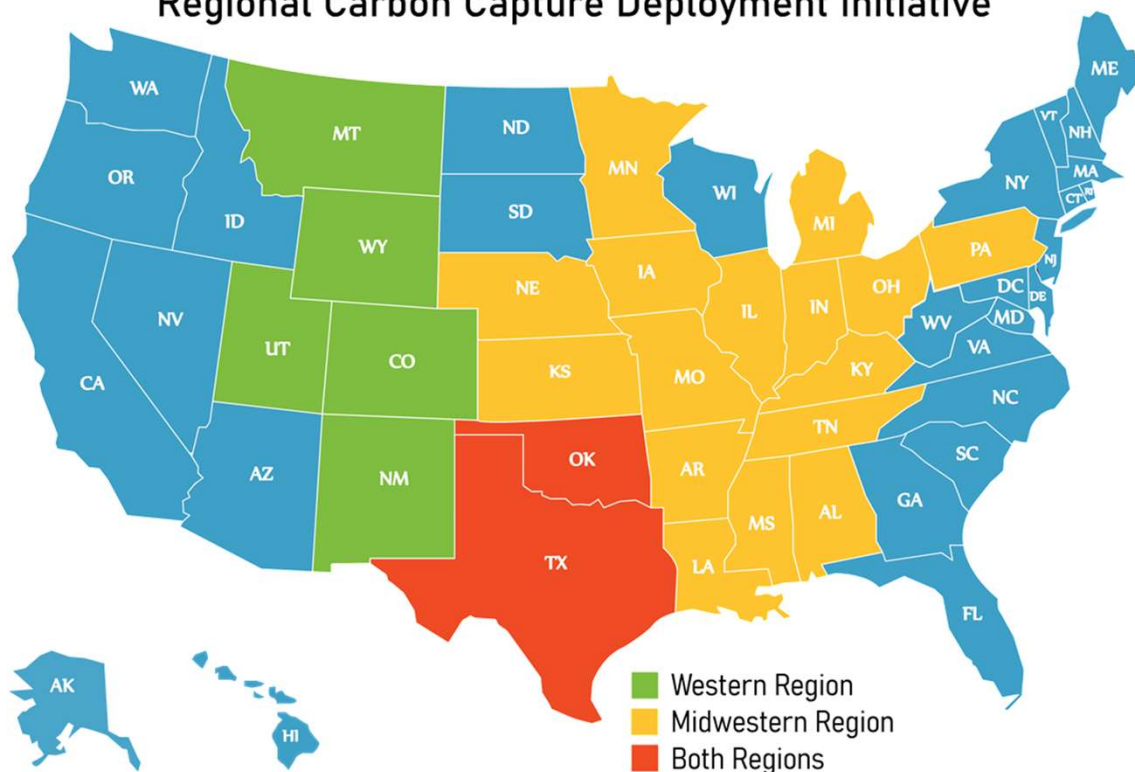
- Formed in 2015 by then Governor Mead (R-WY) and Governor Bullock (D-MT)
- Actively recruiting additional states to participate (light green)
- Even more states participate in Regional Carbon Capture Deployment Initiatives. State representation and industry, labor and NGO participation growing.
- Nearly complete: Regional modeling of candidate carbon capture and storage projects and associated pipeline infrastructure, including facility-by-facility analysis of capture costs (~1.5-year effort)
- Forming state policy teams to develop tailored policy recommendations informed by analysis to complement 45Q for 2020 legislative sessions and beyond.
- Developing policy checklist and inventory, state-by-state factsheets and other materials to support state policy development and advocacy.

State Carbon Capture Work Group: Participating States



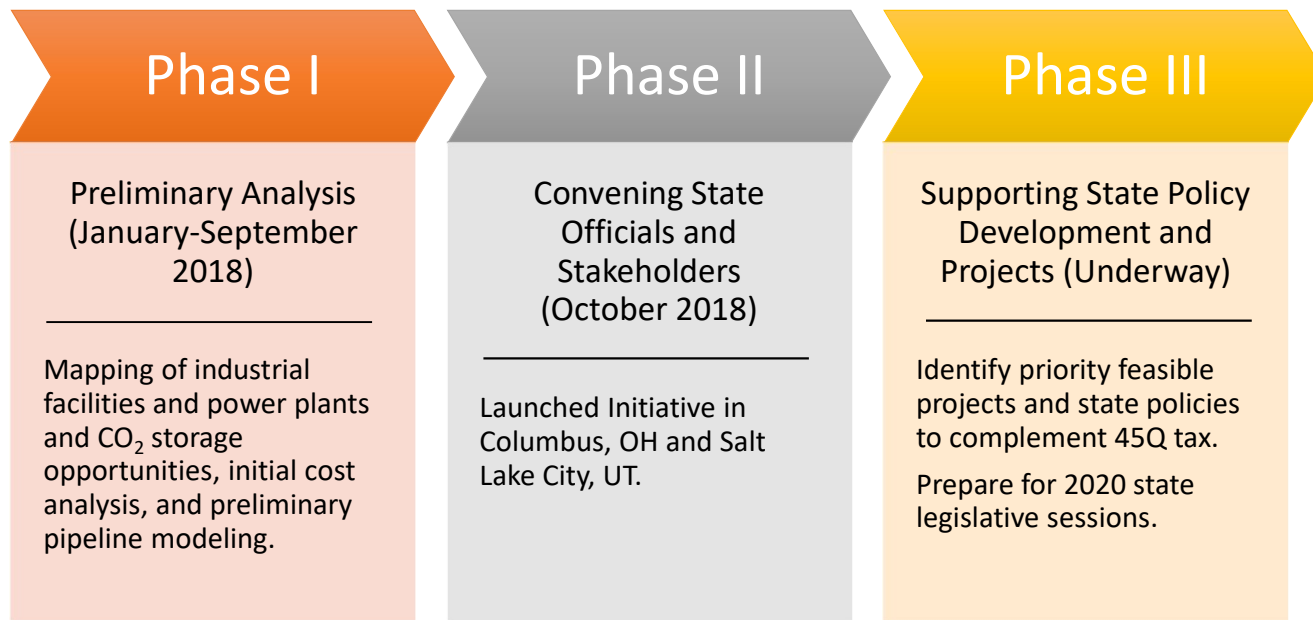
Regional Deployment Initiatives: Western & Midwest Regions

Regional Carbon Capture Deployment Initiative



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Regional Deployment Initiatives: Where We are in the Process



EPA GHGRP & eGRID
US DOE EIA
ABB / Energy Velocity

CO2 Supply
Industrial & Power

Stanford
NETL, IEA
National Petroleum Council

Capture Costs

Advanced Resources
International

EOR
Potential Demand

NETL & USGS
Los Alamos National Lab
Indiana University
Ohio State

Saline
Storage Potential
SCO2T

NETL
Los Alamos
Princeton
Industry Consulting

Pipeline Costs

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INITIATIVE**

SimCCS
Los Alamos

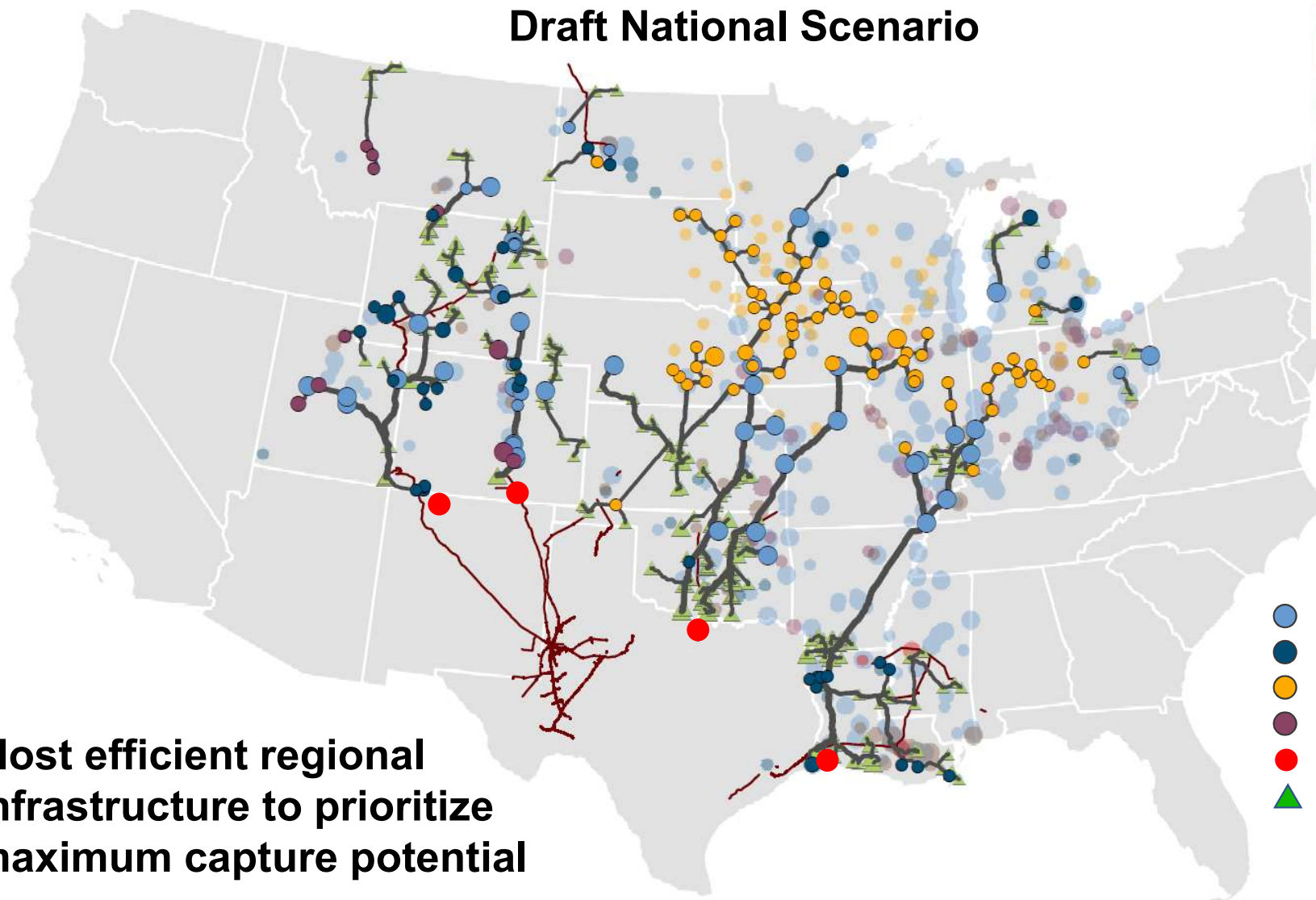
**GPI
Coordinated
Team**

Economic
buildout at break
even – **identify
early mover
capture projects**

Regional scale
transport
infrastructure to
**maximize
utilization** with
financing support

Draft National Scenario

REGIONAL CARBON CAPTURE DEPLOYMENT INITIATIVE



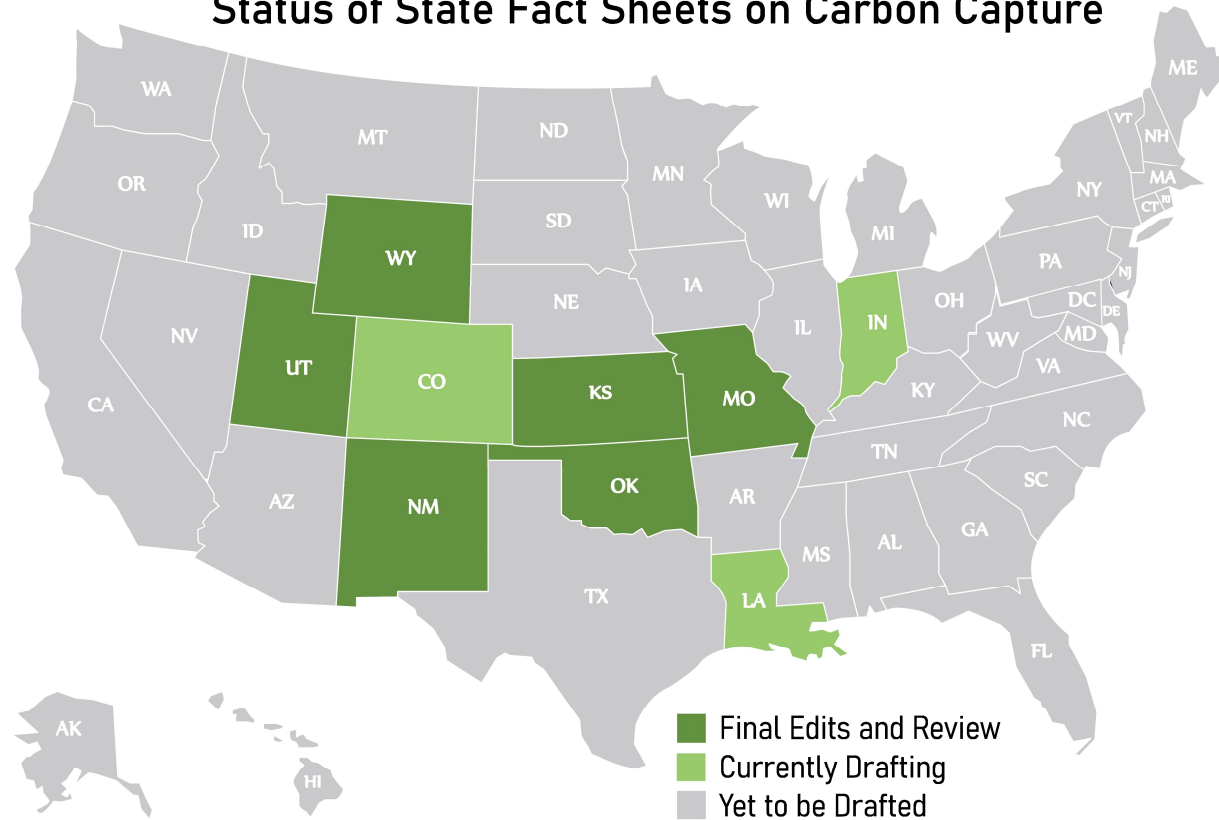
- Electricity
- Petro-chem/NG Refining
- Ethanol
- Cement
- Texas Interconnection
- ▲ EOR Sink

**Most efficient regional
infrastructure to prioritize
maximum capture potential**

Developing Communications & Educational Tools in States

We will work with state policy teams and other stakeholders to engage with the public and media in 2020.

Status of State Fact Sheets on Carbon Capture



Class VI Primacy: Top Priority in Several States

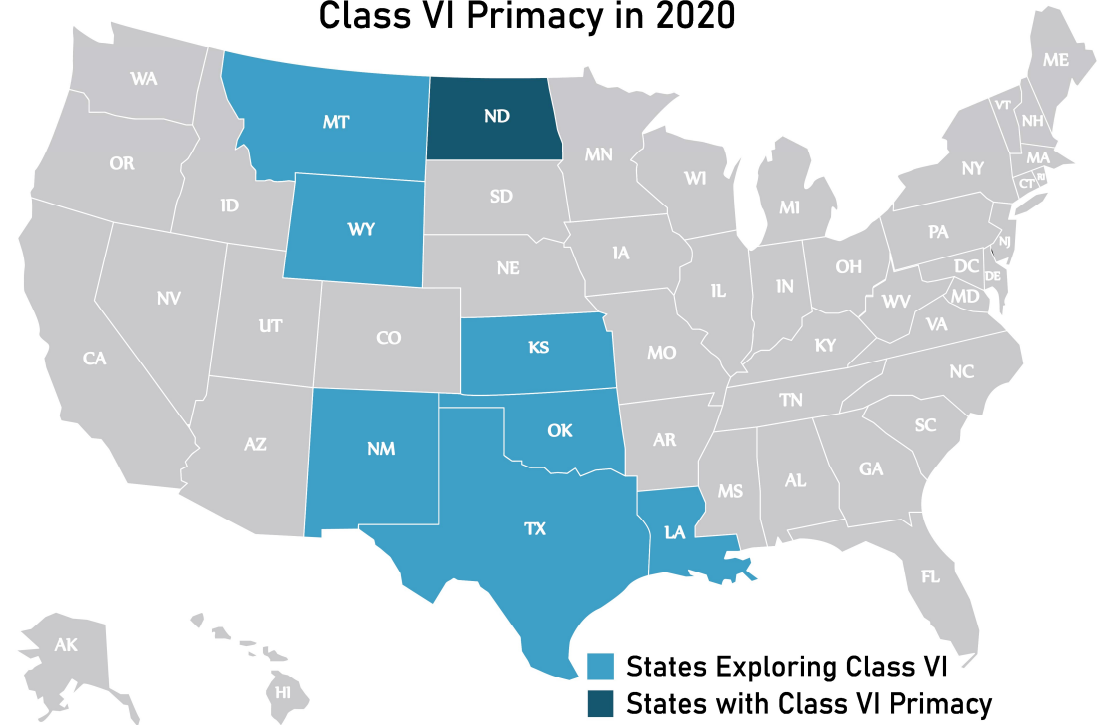
Assisting and elevating states Class VI efforts as critical element for enabling saline storage under current authorization of 45Q.

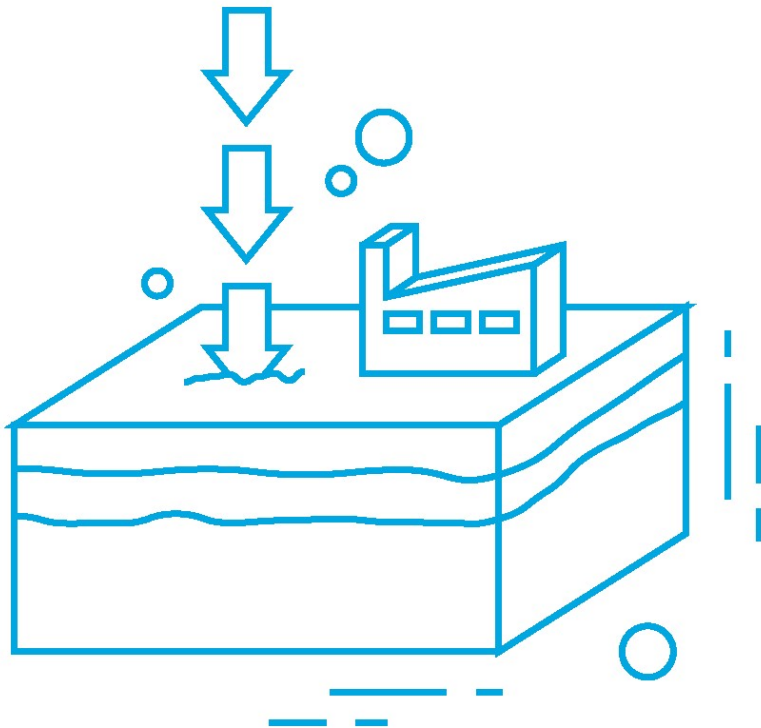
Other priorities: Individual outreach to states reveals various stages of legislative readiness for the 2020 legislative sessions. Examples:

- Kansas to introduce legislation related to carbon capture and storage
- Wyoming to seek policy directive to allow PSC “innovative rulemaking” for carbon capture
- MT to have legislative recommendations next summer

State policy teams established and meeting in several states; several others forthcoming this fall.

Class VI Primacy in 2020



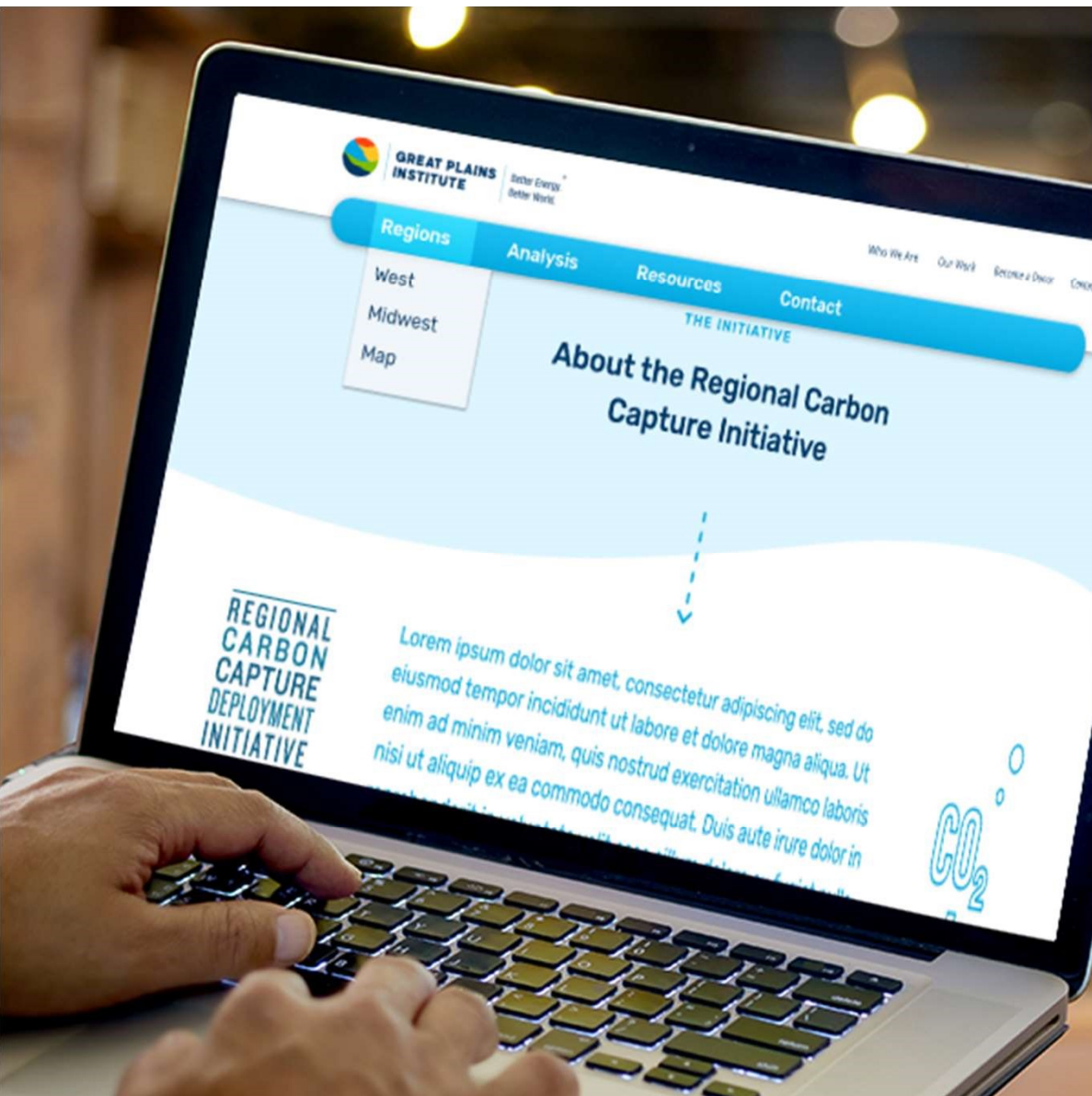


Carbon Capture Ready

Legislative Readiness: Policy Approaches & Best Practices

Developing print and online policy checklist for states, combined with updated state-by-state inventory of existing policies:

- ✓ Regulatory Policies
- ✓ Rules for Long Term CO₂ Storage
- ✓ Rules for CO₂ Transport and Storage Space
- ✓ Rules for Clarifying the Purpose of CO₂ Injection
- ✓ Financial Incentives for Carbon Capture
- ✓ Tax Incentives/Optimization



Building Out Web Presence and Tools for States and Policymakers

- Analysis and model results for states Midwest and Western regions
- State-level fact sheets detailing carbon capture opportunities
- Best practices for states to ensure they are “carbon capture ready”
- Detailed information on policies already implemented in states
- Additional resources, including one-page primers on carbon capture, 45Q and the federal policy landscape



CO₂NNECT 2019: 2nd Event in Jackson Hole, WY

- Held at Jackson Lake Lodge, May 20-22
- Broad cross-section of over 200 leaders from industry, finance and investment, state and federal government, environmental, clean energy and agricultural organizations, organized labor, philanthropy, the media and other sectors.
- Themes: industrial decarbonization, broader federal policy agenda for economywide deployment, and state leadership.

CO₂NNECT 2020 in New Mexico

- June 7-9, 2020 – Tamaya Resort & Spa, Santa Ana Pueblo, NM
- Continued emphasis on industrial decarbonization.
- Global leadership component, involving ADNOC, ArcelorMittal and perhaps others.
- Broader engagement of state leadership.

Thank You

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**GREAT PLAINS
INSTITUTE**

Better Energy.
Better World.

