FEDERAL AND STATE POLICY PRIORITIES: PROVIDING AN INCENTIVE FRAMEWORK TO ACCELERATE COMMERCIAL CARBON CAPTURE DEPLOYMENT

CARBON CAPTURE, UTILIZATION, AND STORAGE: STATUS, ISSUES, NEEDS
RESOURCES FOR THE FUTURE
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GREAT PLAINS INSTITUTE

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Overview

- Background on National Enhanced Oil Recovery Initiative (NEORI)
- Federal Policy Priorities of NEORI Industry, Labor and NGO Coalition
- Background on State CO_2-EOR Deployment Work Group
- Federal and State Carbon Capture Incentive Recommendations from States
- Federal CO_2 Pipeline Infrastructure Recommendations from States

About the Great Plains Institute

GPI is an independent, nonpartisan regional and national organization that aims to:

1. Forge agreement among diverse interests and helping them advocate jointly for energy policy and technology solutions;
2. Foster the adoption of new energy technologies, practices & programs at local, state, regional and national levels; and
3. Provide decision-makers, stakeholders and the media with reliable information and analyses.

www.betterenergy.org

Background on NEORI

- NEORI launched in 2011 and convened by Great Plains Institute and Center for Climate & Energy Solutions.
- Coalition includes coal, oil, electric power, ethanol, industrial and technology companies, labor unions, and environmental and energy policy organizations.
- NEORI calls for a framework of federal and state incentives to accelerate commercial deployment of carbon capture at industrial facilities and power plants for use in enhanced oil recovery (CO_2-EOR) with geologic storage.
- Goal: Close the gap between the cost of CO_2 capture and transport and revenue received from the sale of CO_2 for use in EOR, thus driving private investment in technology deployment, innovation and cost reductions over time.
- Proposed federal incentives endorsed by NEORI:
  - Extension and reform of the Section 45Q Tax Credit for Carbon Dioxide Sequestration;
  - Making carbon capture projects eligible for tax-exempt private activity bonds; and
  - Allowing carbon capture projects to take advantage of the tax and equity benefits of master limited partnerships.

NEORI's Diverse Membership Reflects the Many Benefits and Broad-Based Support for CO_2-EOR

National Enhanced Oil Recovery Initiative

Coal
- Arch Coal
- Cloud Peak
- Peabody Energy

Electric Power
- Great River Energy
- NRG Energy
- Summit Power Group
- Tenaska Energy

Oil and Gas
- Core Energy
- Occidental Petroleum Corporation

Ethanol
- Archer Daniels Midland
- Conestoga Energy Partners, LLC
- White Energy

Industrial Suppliers of CO_2/Technology Vendors
- Air Liquide
- Air Products
- Alstom
- GE Oil & Gas
- Jupiter Oxygen
- Linde
- Praxair

Project Developers
- EBR Development, LLC
- Lake Charles Methanol

Environmental and Energy Policy NGOs
- Center for Carbon Removal
- Clean Air Task Force
- Energy Innovation & Reform Project
- Global Carbon Capture & Storage Institute
- Jackson Hole Center for Global Affairs
- Natural Resources Defense Council
- Wyoming Outdoor Council

Labor
- AFL-CIO
- International Brotherhood of Boilermakers
- International Brotherhood of Electrical Workers
- SMART Transportation Division
- United Mine Workers of America
- Utility Workers Union of America

Observers
- Chaparral Energy
- Enhanced Oil Recovery Institute (University of WY)
- Interstate Oil and Gas Compact Commission
- LI-COR Biosciences
- Mitsubishi Heavy Industries of America, Inc.
- Tellus Operating Group

Top Coalition Priority: Extend, Reform and Expand Existing Federal Section 45Q Tax Credit for CO_2 Storage

National Enhanced Oil Recovery Initiative

Key reform elements:

- **Increase financial certainty** for carbon capture project investors by eliminating the existing cap on credits (current credit about to run out).
- **Increase the credit value** to close the gap between the cost of carbon capture and revenue from the sale of CO_2 for EOR.
- **Expand industrial sector participation** by lowering tonnage threshold for eligibility of carbon capture projects.
- **Enhance flexibility** in utilization of the tax credit to allow for multiple business models, including participation of tax-exempt electric cooperatives, municipal utilities and many other project developers.

Bipartisan Support for 45Q Unparalleled for Energy & Climate Legislation of Its Kind

National Enhanced Oil Recovery Initiative

- In 2016, one-fifth of Senate supported Carbon Capture, Utilization and Storage Act (S. 3179) introduced by Heidi Heitkamp (D-ND), including GOP Senate Majority Leader Mitch McConnell, Energy Committee Chair Lisa Murkowski, and Assistant Minority Leader Dick Durbin:
  - GOP co-sponsors: Capito (WV), Blunt (MO), McConnell (KY), Barrasso (WY), Murkowski (AK), Portman (OH), Kirk (IL), and Graham (SC)
  - Democratic co-sponsors: Whitehouse (RI), Tester (MT), Schatz (HI), Booker (NJ), Kaine (VA), Casey (PA), Klobuchar (MN), Durbin (IL), Franken (MN), Brown (OH), and Warner (VA)
- Over 10 percent of House supported Rep. Mike Conaway's (R-TX) H.R. 4622: 50 co-sponsors spanning political spectrum from the Freedom Caucus to Congressional Black Caucus (32 Rs and 17 Ds, from 26 states).

Anticipated Elements of 2017 45Q Legislation

House: Carbon Capture Act

- **Specifications**
  - Keeps existing 45Q threshold in place for current projects
  - Credit for EOR storage and saline storage increases to $35. There is only one credit
  - Ramps credit for 10 years
  - Reduces 500,000 threshold to 100,000 tons for all facilities– was 150,000
  - Includes stronger transferability provision from last year's Senate bill
  - Authorizes programs for projects that commence construction within 7 years
  - Credit can be claimed for 15 years once placed in service
  - Adds language to allow carbon monoxide capture and direct air capture to get the credit
  - Credit authorization language is changed to allow all projects that "have never received 45Q tax credit before" to qualify (NRG, Petra Nova, and Core Energy)

Senate: Carbon Capture, Utilization & Storage Act

- **Specifications**
  - Keeps existing 45Q threshold in place for current projects
  - Credit for EOR storage increases to $35 and $50 for saline storage
  - Ramps credit over 10 years
  - Reduces 500,000 threshold to 100,000 for industrial and 25,000 threshold for non-EOR utilization and keeps 500,000 threshold for electric generating units
  - Includes stronger transferability provision
  - Authorizes programs for projects that commence within 7 years
  - Credit can be claimed for 12 years once placed in service
  - Provides eligibility for new forms of CO2 (algae, biomass, alternative fuels, etc.)
  - Adds language to allow carbon monoxide and direct air capture to get the credit
  - Credit authorization language is changed to allow electric power projects that "have never received 45Q tax credit before" to qualify (NRG/Petra Nova)

45Q Legislation: 2017 Status

House: Carbon Capture Act

- **Progress**
  - Legislative being finalized.
- **Timeline**
  - Recruitment of co-sponsors during and following Memorial Day recess.
  - Introduction to follow.

Senate: Carbon Capture, Utilization and Storage Act

- **Progress**
  - Recruiting cosponsors. Greater support expected than in 2016.
- **Timeline**
  - Introduction expected after Memorial Day recess.

Complementary Federal Policies: Tax-Exempt Private Activity Bonds

National Enhanced Oil Recovery Initiative

- The Carbon Capture Improvement Act (2017) makes carbon capture projects eligible for PABs, providing project developers with access to tax-exempt debt.
- PABs would lower project financing costs and complement a strengthened and extended 45Q tax credit.
- Bill's low fiscal score of $126 million over ten years would make it an attractive supplement to 45Q.
- S. 843: Introduced by Sens. Portman (R-OH) and Bennet (D-CO) this spring.
- H.R. 2011: Introduced by Reps. Curbelo (R-FL) and Veasey (D-TX) as companion.
- Cosponsor recruitment underway.

Complementary Federal Policies: Master Limited Partnerships

National Enhanced Oil Recovery Initiative

- S. 1656 and H.R. 2883, the Master Limited Partnerships Parity Act, introduced with bipartisan support in previous two Congresses.
- Allows carbon capture facilities to qualify for the MLP structure, combining tax benefits of a partnership with the ability to raise capital in public equity markets.
- Legislation not yet reintroduced this Congress.

2017 Priorities for NEORI and the Federal Coalition

National Enhanced Oil Recovery Initiative

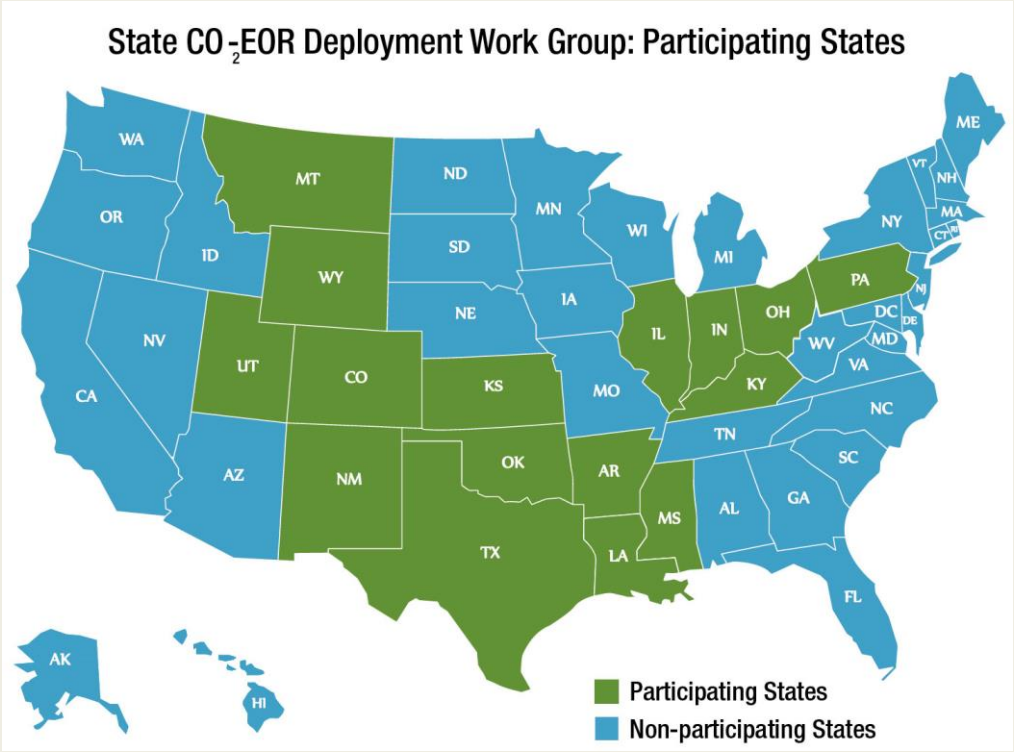
- **Encourage support for carbon capture and EOR in the Trump Administration and new Congress**, emphasizing jobs, American energy independence, fiscal benefits, U.S. technology leadership and continued emissions reductions through non-regulatory means.
- **Secure a place for 45Q in comprehensive tax reform or alternative tax legislation**, as well as the inclusion of complementary incentives.
- **Incorporate carbon capture and CO_2 pipeline infrastructure into a broader federal infrastructure agenda** and position carbon capture and pipeline projects for consideration as high priority infrastructure projects.

Infrastructure: Include Carbon Capture Projects in Federal Portfolio of Priority Infrastructure Projects

- Industry, labor and NGO letter in April to the President and Congress requesting consideration of candidate carbon capture projects as part of federal infrastructure portfolio:
  - Lake Charles Methanol, LA (petcoke gasification);
  - Texas Clean Energy Project (coal gasification);
  - New Steel International, MI and OH (advanced steel production);
  - LanzaTech, IL (steel production, refining and other industrial processes);
  - NET Power Allam Cycle demonstrations, TX and ND (new natural gas and coal power generation);
  - Project Tundra, ND (existing coal power generation); and
  - Colstrip, MT (existing coal power generation).

State CO_2-EOR Deployment Work Group: Background

- Co-convened by Governor Matt Mead (R-WY) and Governor Steve Bullock (D-MT). Staffed by GPI.
- Launched in 3Q 2015:
  - *Officials from 16 states**
  - *Leading industry and NGO stakeholders*
  - *CO_2–EOR Experts*
- Objectives:
  - *Help policy-makers better understand states' potential for carbon capture and CO_2-EOR;*
  - *Recommend strategies and policies to states and the federal government;*
  - *Support state policy-makers in implementing those recommendations; and*
  - *Encourage enactment of federal policies that complement state priorities.*



*Map above does not include Illinois and Louisiana, which are now represented. State participation varies and includes governors' staff, cabinet secretaries secretaries, utility commissioners and agency and commission staff. Kansas and New Mexico are not currently represented in the Work Group.

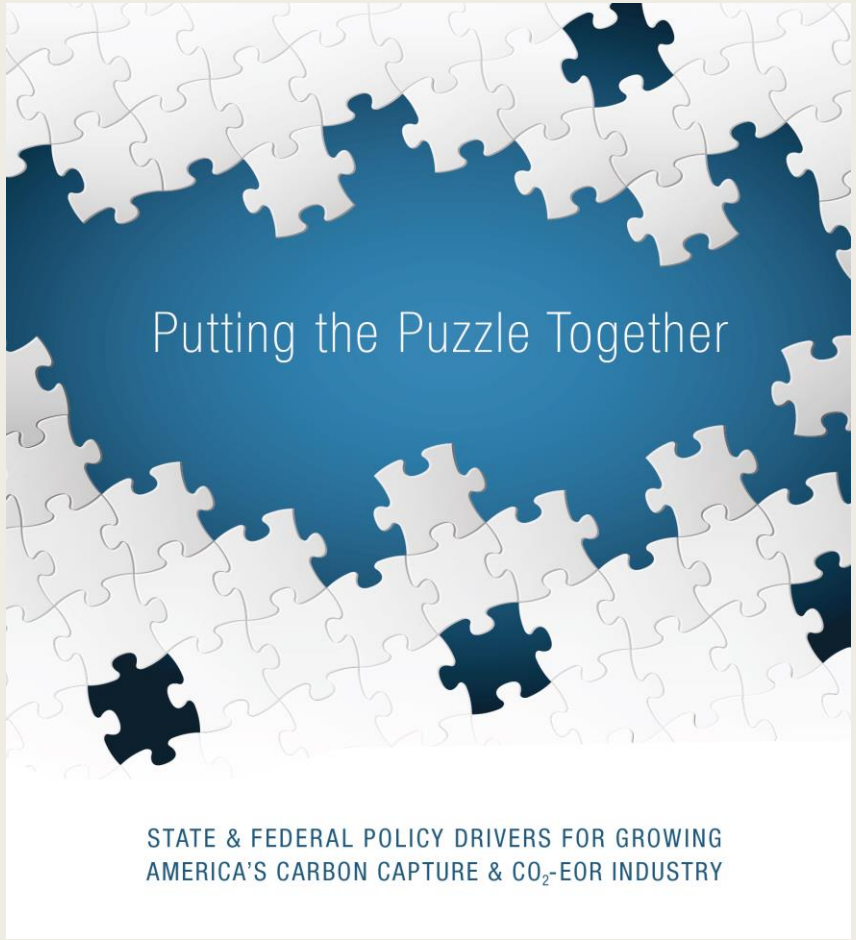
Growing State Support for Carbon Capture & CO_2-EOR

- In 2015, Great Plains Institute staff traveled to nine states to brief governors' staff and state officials and request support for federal and state policy resolutions and recruit Work Group participation.
- Since then, state officials from across the U.S. have signaled growing support for policies to foster commercial deployment of carbon capture and CO_2-EOR. This has provided an important new base of support for the work of the federal coalition.

Year	Organization	Resolution Highlights
2015	**Western Governor's Association**	Recognized economic and environmental benefits of carbon capture and CO_2-EOR; called on Congress to extend and strengthen the federal Sec. 45Q tax credit.
2015	**Southern States Energy Board**	Emphasized need for federal incentives and state policy measures.
2016	**National Association of Regulatory Utility Commissioners**	Highlighted economic, energy production and carbon mitigation benefits, and the importance of state and federal action.

Putting the Puzzle Together: State & Federal Policy Drivers for Growing America's Carbon Capture & CO_2-EOR Industry

- Major report released in December with support of participating state officials.
- Includes detailed modeling analyses and recommendations and narrative rationale for CO_2-EOR deployment as a national priority.
- Represents research, study and collaboration of the State CO_2-EOR Deployment Work Group, including private sector stakeholders and CO_2-EOR experts.



Work Group Recommendations for Federal Incentives

- Project-level financial feasibility modeling undertaken for the Work Group determined that a targeted package of federal incentives are ultimately needed to help mitigate risk and uncertainty in commercial deployment of carbon capture projects.
- By order of priority and impact in achieving commercial feasibility, the Work Group recommends that Congress and the Administration:
  1. **Extend, reform and expand the existing Section 45Q Tax Credit for Carbon Dioxide Sequestration** to increase its value, make it financially certain and provide for greater flexibility for carbon capture project developers;
  2. **Establish federal price stabilization contracts, or contracts for differences (CfD), for the CO_2 sold from capture facilities to EOR operators** in order to eliminate the risk of price volatility that deters private investment in carbon capture projects; and
  3. **Make carbon capture eligible for tax-exempt private activity bonds (PABs) and for master limited partnerships (MLPs)** in order to provide debt and equity, respectively, on more favorable terms.
- The consistency of these recommendations with the federal NEORI coalition, especially the prioritization of 45Q, facilitates greater engagement and support from states in the federal effort going forward.

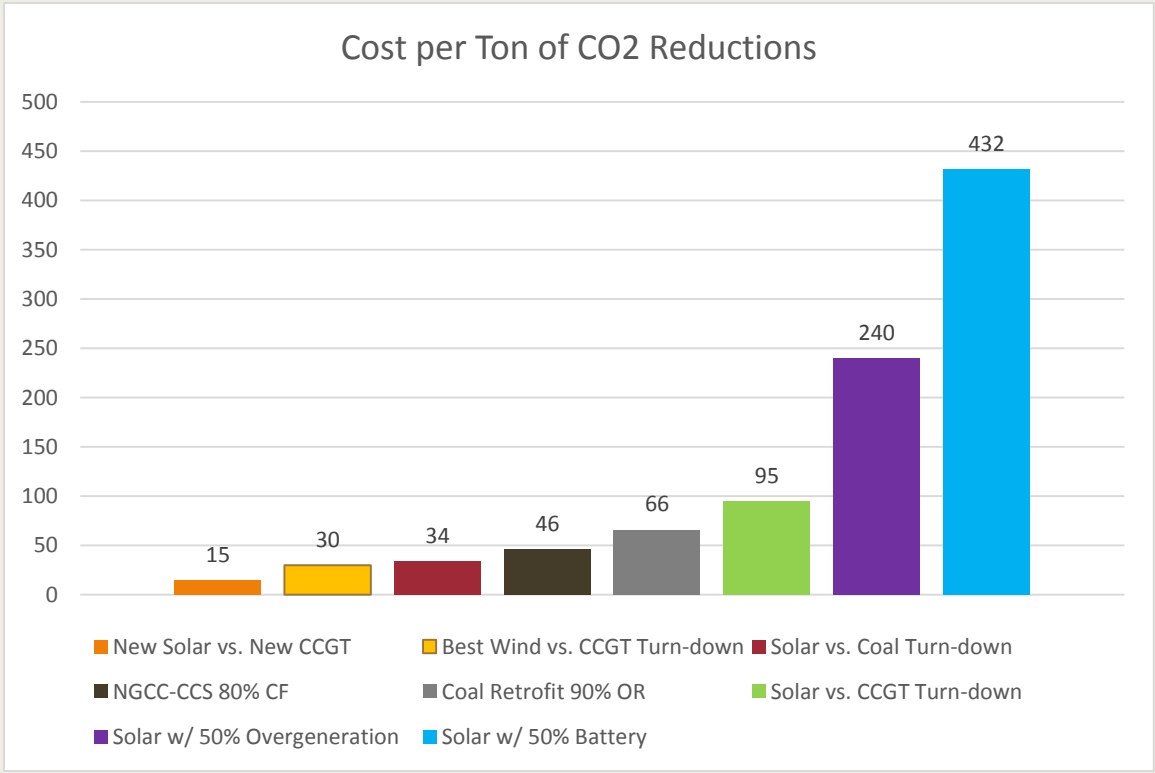
Work Group Recommendations for State Incentives

- In conjunction with improved federal policy, **states can positively affect the overall carbon capture project feasibility by optimizing taxes common to most oil and gas-producing states.**
- The work group reviewed:
  - Sales taxes on equipment purchased to build a carbon capture facility;
  - Property taxes on the carbon capture facility;
  - Sales taxes on equipment acquired to adapt an oilfield to CO_2-EOR operations; and
  - Oil and gas taxes, such as production and severance taxes.

- **Based upon life-of-project modeling of the carbon capture and oil recovery portions of integrated carbon capture and EOR projects, it appears that certain targeted reductions in state taxes can have a beneficial impact on project economics that is equivalent to roughly an $8 per barrel increase in the price of oil, which is significant compared to existing federal incentives.**

Work Group Calls for a Balanced, Cost-Effective Approach to Emissions Reductions

- Carbon capture **merits federal and state policy support to accelerate its commercial deployment, as has been done successfully for other energy technologies.**
- As public policy and market conditions drive industry to look for ways to reduce emissions, **carbon capture deserves equivalent support as a critical component of a broader, cost-effective portfolio of carbon mitigation options.**
- On the basis of cost per ton of CO_2 emissions avoided, carbon capture at power plants with EOR already compares cost-effectively with other options, especially at higher levels of emission reductions. The retrofit of an existing coal plant for carbon capture and EOR lands in the middle of the cost curve for a number of low- and zero-carbon power generation options.



Work Group's CO_2 Pipeline Infrastructure Recommendations

- In February, the State CO2-EOR Deployment Work Group released *21st Century Energy Infrastructure: Policy Recommendations for Development of American CO_2 Pipeline Networks* with three primary recommendations:
  1. Calls on Trump Administration and Congress to make CO_2 pipelines a priority component of a broader national infrastructure agenda (in addition to enacting federal carbon capture incentives);
  2. Recommends federal role to supplement private capital in financing increased capacity for large-volume, long-distance trunk CO_2 pipelines based on modeling showing that "super-sizing" trunk pipelines up front can take advantage of enormous economies of scale and enable future carbon capture and EOR project deployment; and
  3. Urges federal agencies, in consultation with states, tribal governments and key stakeholders, to identify and foster development of priority pipelines, including support for planning, streamlined permitting, and financing.

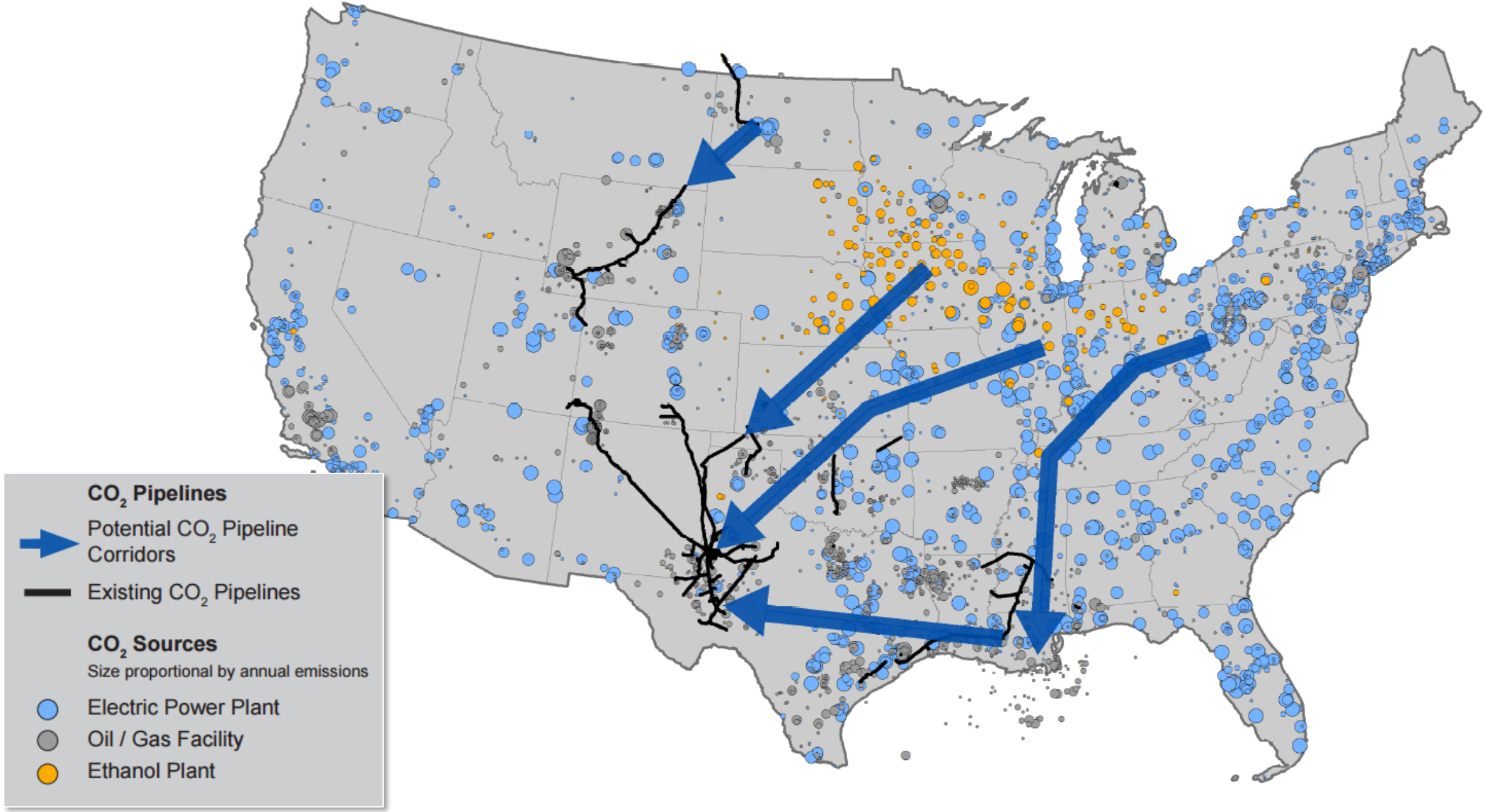
21st Century Energy Infrastructure:

Policy Recommendations for Development of American CO_2 Pipeline Networks

White paper prepared by the
State CO_2-EOR Deployment Work Group

February 2017

Map of 5 Potential CO_2 Pipeline Corridors



Benefits of Proposed a National CO_2 Pipeline Buildout

- Work Group recommends five major CO_2 pipeline corridors equivalent to the scale and volume of the current Cortez pipeline (30” @ 30 million tpy), the world’s largest.
- Development of this magnitude would expand on existing pipeline networks to create a national infrastructure to supply up to an additional 150 million tons of CO_2 annually for EOR and storage, resulting in an estimated:
  - Tripling of domestic EOR production, or 375 million barrels of oil per year;
  - Reduction in U.S. oil imports of one-fifth from current levels, valued at $30 billion;
  - Capture of over four percent of current U.S. stationary source emissions from power plants and industrial facilities;
  - Capital investment in carbon capture, CO_2 pipeline construction, and EOR equipment of $75 billion; and
  - Annual economic activity of $30 billion.

Federal CO_2 Pipeline Financing Options

- Work Group released a menu of federal CO_2 pipeline financing options to President Trump and Congress in April, including:
  - *Applying President's tax credit proposal to equity-financed portion of pipelines;*
  - *Allow tax-exempt private activity bonds for debt-financed portion;*
  - *Authorize federal loans through expansion of U.S. DOT's Transportation Infrastructure Finance and Innovation Act or modeled after it;*
  - *Provide loans through U.S. DOE's Loan Program Office for debt portion of projects;*
  - *Allow accelerated depreciation for an entire CO2 pipeline*
- Currently working with Senate and House members and staff to pursue bipartisan legislation for carbon capture and CO_2 pipeline infrastructure.

Forthcoming: State Work Group Paper on Carbon Capture in Wholesale Electricity Markets

- Carbon capture-equipped power plants face similar challenges to their commercial viability in competitive wholesale markets as do nuclear and other dispatchable low and zero-carbon generation resources.
- Work Group will release a paper on market design and federal, ISO/RTO and state policies to recognize the economic, reliability and environmental benefits that power plants with carbon capture can contribute to the grid.
- Report and recommendations anticipated prior to DOE's release of the grid study requested by Secretary Perry.

THANK YOU

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Carbon Capture and Storage is Essential to Meeting Mid-Century Climate Goals and Doing So Affordably

- Under the IEA's scenario to limit warming to 2° C, CCS contributes 14% of 2015-2050 CO_2 reductions and 20% annually by 2015.
- CCS is an essential control strategy for industrial sources, not just coal and natural gas power generation:
  - In IEA's 2° C scenario, 45% of CO_2 captured comes from industrial sources.
- The IPCC's 5th Assessment found the overall cost of carbon mitigation under the 2° C scenario to cost 138% more, if CCS was excluded.
- IPCC modeling of the 1.5° C aspirational scenario is even starker: requires deployment of 25 GW of negative emissions biomass power generation with carbon capture annually by 2040.

Carbon Capture Works: Nearly 50 Years of Commercial-Scale Carbon Capture and Geologic Storage through EOR in the U.S.

- 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 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
- 2016: Emirates Steel Plant in Abu Dhabi, United Arab Emirates
- 2017: NRG Petra Nova Coal Power Plant Post-Combustion Retrofit in Texas

Figure 7-8. Current CO_2-EOR Operations and Infrastructure[112]

U.S. regions with large-scale CO_2 pipeline systems currently in operation	Miles of Pipeline
Permian Basin (W. TX, NM, and S. CO)	2,320
Rocky Mountains (N. CO, WY and MT)	810
Gulf Coast (MS, LA and E. TX)	740
Mid-Continent (OK and KS)	480
Other (ND, MI, Canada)	215

The current CO_2 pipeline system has been built to deliver CO_2 for CO_2-EOR to oil fields in the Permian Basin of west Texas and eastern New Mexico. This system spans across more than a dozen U.S. states and into Saskatchewan, Canada.

CO_2-EOR Delivers Substantial Net Carbon Reductions and Major Energy Production/Security, Jobs, Trade and Fiscal Benefits

- U.S. independent oil and gas industry currently purchases roughly 70 million tons of CO_2 per year, transports it over 4,500 miles of CO_2 pipelines, and injects it in mature fields to yield four percent of domestic U.S. oil production. About a quarter of the CO_2 is from man-made sources.
- With the capture of more power plant and industrial CO_2, U.S. has the potential to produce an estimated 28 billion barrels of economically recoverable oil with today's commercial industry best practices and over 81 billion barrels with next generation techniques. By comparison, current U.S. proved reserves are just under 40 billion barrels.
- Producing that much oil with man-made CO_2 would result in the safe and permanent geologic storage of 11 to 24 billion tons of CO_2—the equivalent of 55 to 120 GW of coal-fired generation over 35 years, or roughly 6-12 years of U.S. power sector CO_2 emissions at 2015 levels.
- These production and storage estimates reflect only conventional oilfields, not unconventional residual oil zones which are vastly greater (and unconventional shale still greater, but CO_2-EOR remains to be commercially demonstrated in tight hydrocarbon geology).
- According to the IEA, CO_2-EOR results in an estimated net life cycle CO_2 emissions reduction of 37 percent, *including the additional oil produced*.
- Provides fiscal benefits at a time when the federal government and many states face budget challenges and directly supports high-paying jobs across a range of sectors.