To: Republican Presidential Transition Team
From: National Enhanced Oil Recovery Initiative
Date: November 1, 2016
Re: Priorities for Carbon Capture, Use and Storage

As representatives of industry, organized labor and the environmental community, we support accelerated commercial deployment of carbon capture, utilization and storage (CCUS) as an energy, economic and environmental priority for our nation. Participants in the National Enhanced Oil Recovery Initiative (NEORI) represent an unprecedented coalition that includes: three of America's top-five coal companies (Peabody Energy, Arch Coal and Cloud Peak Energy), the third largest oil company (Occidental Petroleum), top merchant and co-op power companies (NRG and Great River Energy), top chemical companies (Air Products, Linde and Praxair), the largest ethanol producer (ADM), key industrial unions (AFL-CIO, Boilermakers, Building Trades, Electrical Workers, Mineworkers, Transportation Workers, and Utility Workers), and national environmental organizations (Clean Air Task Force and Natural Resources Defense Council). NEORI is convened by the Center for Climate & Energy Solutions and the Great Plains Institute.

NEORI participants have prepared this memo to provide joint input into the deliberations and planning being undertaken by GOP Presidential candidate Donald Trump's transition team in the area of energy policy. Our immediate interest is in the capture, utilization and storage of CO2 and we are actively pursuing legislation to provide more robust federal incentives to stimulate deployment of carbon capture technologies and projects and increase the supply of manmade CO_2 for enhanced oil recovery (EOR).

Immediate Priority

The existing Section 45Q Tax Credit for Carbon Dioxide Sequestration has essentially expired and must be extended. As of October 2016, credits representing 44,590,130 metric tons, or roughly 60 percent of the total credits for the 75 million tons of CO_2 authorized by Congress, have already been claimed. 45Q is capped and offers no certainty that credits will be available to carbon capture projects once operational. This has a significantly negative impact on the economics of new projects. A stable, long-term incentive is essential because large, capital intensive CCUS projects take longer to develop, permit, finance and construct than smaller, less capital intensive wind and solar projects.

45Q needs to be reformed in three ways:

- *Tax Credit Value Must Be Higher*: Given what is known about the cost of carbon capture and the fact that CO_2 capture technology remains costly for most industries, the current $10 per ton value of 45Q needs to increase to $35 to help cover the gap between the cost of carbon capture and revenue earned from selling CO_2 for use in EOR.
- *Eligibility Threshold Must Be Lower*: The requirement to capture 500,000 tons of CO_2 per year renders ineligible most facilities in key industries, such as ethanol and

fertilizer production. It also arbitrarily constrains carbon capture technology innovation in coal and natural gas-fired power generation. Reducing the threshold for all facilities to 100,000 tons will expand CCUS in more industries in more states and support technology innovation.

- *Recipient of the Tax Credit Must Be Broadened*: Electric cooperatives and many other CCUS project developers cannot fully utilize existing 45Q credits. Changing the entity to claim the credit to the owner of the carbon capture equipment will provide the necessary flexibility to accommodate different business models and investors.

Extending and reforming Section 45Q enjoys unusually broad bipartisan support. In 2016:

- Congressman Conaway (R-TX) introduced the bipartisan Carbon Capture Act (H.R. 4622), which has 45 co-sponsors from 25 states spanning the entire political spectrum.
- Sens. Heitkamp (D-ND) and Capito (R-WV) filed SA 3645 as a Senate companion with Sens. Blunt (R-MO), Barrasso (R-WY), Coats (R-IN), Daines (R-MT), Enzi (R-WY), Donnelly (D-IN), and Tester (D-MT).
- Sens. Heitkamp (D-ND), Whitehouse (D-RI) and Capito (R-WV) introduced the Carbon Capture Use and Storage Act (S. 3179), which is co-sponsored by GOP Majority Leader Mitch McConnell (R-KY), Democratic vice presidential candidate Tim Kaine (D-VA) Assistant Minority Leader Dick Durbin (D-IL), as well as Sens. Barrasso (R-WY), Blunt (R-MO), Booker (D-NJ), Brown (D-OH), Casey (D-PA), Franken (D-MN), Graham (R-SC), Kirk (R-IL), Klobuchar (D-MN), Murkowski (R-AK), Portman (R-OH), Schatz (D-HI), and Tester (D-MT).

Longer-term priorities

From the perspective of project developers, the extension and expansion of Section 45Q will do the most to accelerate the deployment of CCUS technology, although private activity bonds (PABs) and master limited partnerships (MLPs) will play a critical role. Like with other low- and zero-carbon energy technologies such as wind and solar, multiple and complementary incentive policies are ultimately needed to enable investment and drive deployment at a level commensurate with meeting U.S. and global emissions reductions goals. The following are the next-highest policy priorities for accelerating carbon capture technology deployment.

- **Private Activity Bonds:** Bipartisan legislation to allow the use of tax-exempt PABs issued by state or local governments to finance carbon capture projects has been introduced in the Senate.[i] Access to PABs will provide project developers with tax-free debt to help attract private investment in carbon capture projects.
- **Master Limited Partnerships:** Bipartisan legislation to extend to renewable energy and carbon capture projects the tax and equity benefits of the publicly-traded MLP ownership structure that is currently available to the oil and gas industry has been introduced in the Senate and in the House.[ii] The bills are co-

sponsored in the Senate by three Republicans, three Democrats and one Independent and in the House by six Republicans and six Democrats.

- **Oil Price Stabilization Mechanism:** The Senate Energy Bill directs the DOE to report on long-term contracts to provide oil price stabilization—also referred to as contracts for differences—to mitigate oil price volatility that deters private investment in carbon capture projects.[iii]
- **Increased Appropriations for Carbon Capture RD&D:** We need more research, development and deployment of commercial-scale projects to bring down the cost of CCUS, just as has been accomplished with wind, solar and other energy technologies for decades. As new projects and new technological innovations come online, we learn how to better design carbon capture systems and deploy them more efficiently. Financing costs will also come down as private investors learn more about the technology and perceived technology risks diminish. To that end, DOE funding for carbon capture programs in the FY 2017 budget request should be increased, especially for:
    - **Innovation CCS;**
    - **Industrial CCS Regional Engagement Initiative; and the**
    - **Regional Sequestration Partnership Program**

FREQUENTLY ASKED QUESTIONS

1) **What is CO_2-EOR?**

Since the 1970s, the U.S. independent oil and gas industry has led the world in carbon dioxide enhanced oil recovery (CO_2-EOR). Captured CO_2 is used commercially in the U.S. to recover more oil from already developed oil fields. That CO_2 is then safely and permanently stored underground in those same oil and gas reservoirs. The U.S. gets 300,000 barrels per day, or nearly 3.5 percent of our annual domestic oil production, through this method.[iv] Recent estimates suggest that the oil and gas industry could technically produce between 56 – 106 billions of barrels of additional American oil from existing conventional oil fields using CO_2-EOR technology.[v] This would involve the use and storage of 22.3 – 33.1 billion metric tons of CO_2.[vi] Production and carbon storage estimates would increase significantly with the inclusion of unconventional formations such as residual oil zones.

CO_2-EOR would generate federal revenue through additional oil production sufficient to cover the cost over time of incentives for further carbon capture. More CO_2 is needed to realize the full potential of EOR for both oil production and carbon storage. Thus, capturing more man-made CO_2 provides mutual energy and environmental benefits for our country.

Last fall, the IEA published the Storing CO_2 through Enhanced Oil Recovery report and concluded that for every barrel of oil produced through enhanced oil recovery (EOR) using

manmade CO_2, there is a net CO_2 emissions reduction of 0.19 metric tons per barrel.[vii] This analysis includes the CO_2 emissions from use of the oil and the impact of lowered oil prices from the additional supply. Put in other words, CO_2-EOR using power plant and industrial CO_2 results in a 63 percent net reduction in CO_2 emissions for those facilities for every ton of CO_2 delivered to the field which produces a barrel of EOR oil, even taking into account emissions from oil consumption.[viii] Table 4 from the IEA report is reproduced below:

Table 4 • Illustrative CO_2 emissions resulting from three *EOR+* practices including combustion of the produced oil and price effects in global oil markets

Scenario	*Conventional EOR+*		*Advanced EOR+*		*Maximum Storage EOR+*	
Functional unit	1 tCO_2 delivered	1 bbl produced	1 tCO_2 delivered	1 bbl produced	1 tCO_2 delivered	1bbl produced
Additional emissions from EOR+ (tCO_2-eq)	0.13	0.04	-0.01	-0.01	-0.07	-0.06
Displaced emissions from other oil (tCO_2-eq)	-0.76	-0.23	-0.72	-0.43	-0.72	-0.65
Net emissions (tCO_2-eq)	**-0.63**	**-0.19**	**-0.73**	**-0.44**	**-0.79**	**-0.71**

IEA, Storing CO_2 through Enhanced Oil Recovery[ix]

The IEA concluded that there is a potential to store 140 billion tons of CO_2 in oil reservoirs around the world through CO_2-EOR resulting in a net emissions reduction of 88 billion tons of CO_2.[x]

Accelerating commercial deployment of CO_2 capture from power plant and industrial facilities will help:

- Produce billions of barrels of American oil and store billions of tons of CO_2;
- Protect and create high-paying jobs in energy production and other industries;
- Enable continued use of our nation's abundant oil, coal and natural gas resources; and
- Meet mid-century goals for mitigating carbon emissions from power generation and industrial activities.

The opportunity to sell captured CO_2 for use in EOR can offset the costs of CCUS investment and help drive the development of more projects.

2) How does investing in carbon capture technology create jobs?

Supporting carbon capture technology can help achieve these objectives while significantly reducing CO_2 emissions. There are substantial economic benefits associated with the deployment of carbon capture technology across a range of economic sectors, including: extraction and mining; energy infrastructure; the manufacture of CO_2 capture system components; supply chains, including raw materials and component parts; building pipelines to transport CO_2; monitoring storage long-term; and the creation of a new CO_2

commodity industry for use in enhanced oil recovery, bio-refining, and other products.[xi] The electric power generation and fuel production industries employed 1.6 million people in 2015 including over 1 million in fossil fuel-based electrical generation and fossil fuel extraction and mining.[xii] Deployment of carbon capture technology has the potential to catalyze domestic employment because the U.S. is a global leader in this technology, and there may be opportunities to export our carbon capture technologies, products, and services around the world.[xiii]

The U.S. Department of Energy (DOE) conducted an analysis of potential power sector carbon capture deployment. DOE used a version of the National Energy Modeling System and concluded that tax credits consistent with the extension and reform of Section 45Q in S. 3179, together with Federal research, development and deployment (RD&D) would drive significant CCUS deployment, as much as 150 billion kWh of generation from power plants equipped with carbon capture in 2030 and roughly 275 billion kWh in 2040. [xiv] This would be equivalent to more than 150 million metric tons of CO_2 stored from power plants in 2030 and over 200 million metric tons of CO_2 in 2040.[xv] The estimated power plant capacity with CCUS could be nearly 30 GW in 2030 and almost 50GW in 2040.[xvi]

3) What is the current deployment scale of carbon capture technology in the U.S.?

There are over 10 active commercial-scale CCUS projects in the U.S.:

- 5 natural gas processing facilities:
    - Val Verde gas processing plants in Texas - Several natural gas processing facilities began supplying CO_2 in West Texas in 1972 through the first large-scale, long-distance CO_2 pipeline to an oilfield.
    - Exxon Shute Creek Gas Processing Facility in Wyoming – This natural gas processing plant serves ExxonMobil, Chevron and Anadarko Petroleum CO_2 pipeline systems to oil fields in Wyoming and Colorado and is the largest commercial carbon capture facility in the world at 7 million tonnes of capacity annually. It began operations in 1986.
    - Core Energy/South Chester Gas Processing Plant in Michigan – Since 2003, CO_2 is captured by Core Energy from natural gas processing for EOR in northern Michigan, with over 2 million MT captured to date.
    - Occidental Petroleum's Century Plant in Texas – Since 2010, the CO_2 stream from this natural gas processing facility is compressed and transported for use in the Permian Basin.
    - ConocoPhillips Lost Cabin plant in Wyoming – Since 2013, the CO_2 stream from this natural gas processing facility is compressed and transported to the Bell Creek oil field in Montana via Denbury Resources' Greencore pipeline.
- 2 fertilizer plants:
    - Koch Nitrogen Company Enid Fertilizer plant in Oklahoma – Since 1982, this fertilizer production plant has supplied CO_2 to oil fields in southern Oklahoma.
    - Chaparral/CVR Energy Coffeyville Gasification Plant in Kansas – Since 2013, the CO_2 stream (approximately 850,000 tonnes per year) from a nitrogen

fertilizer production process based on gasification of petroleum coke is captured, compressed and transported to a Chaparral-operated oil field in northeastern Oklahoma.

- 2 ethanol plants:
    - Chaparral/Conestoga Energy Partners' Arkalon Bioethanol plant in Kansas – In 2009, it became the first ethanol plant to deploy carbon capture and supplies 170,000 tonnes of CO_2 per year to Chaparral Energy, which uses it for EOR in Texas oil fields.
    - Conestoga Energy Partners/PetroSantander Bonanza Bioethanol plant in Kansas – Beginning in 2012, this ethanol plant captures and supplies approximately 100,000 tonnes per year of CO_2 to an EOR field in Kansas.
- 1 hydrogen production facility at a refinery: Air Products Port Arthur Steam Methane Reformer Project in Texas – Beginning in 2012, two hydrogen production units at this refinery produce a million tons of CO_2 annually for use in Texas oilfields.
- 1 synthetic natural gas plant: Dakota Gasification's Great Plains Synfuels Plant in North Dakota – This coal gasification plant produces synthetic natural gas, fertilizer and other byproducts and since 2000 has supplied over 30 million tonnes of CO_2 to Cenovus and Apache-operated EOR fields in southern Saskatchewan as of 2015.

Two commercial-scale CCUS power plants are under construction in the United States and will come online soon: Mississippi Power's Kemper IGCC in Mississippi and NRG's Petra Nova project in Texas.[xvii]

4) Why is carbon capture important in reducing emissions?

CCUS is the only technology available to capture carbon emissions from stationary sources, including coal and natural gas power plants, and a variety of industrial facilities, many of which lack adequate alternatives for reducing emissions.[xviii] Industrial processes where large-scale carbon capture is demonstrated and in commercial operation include natural gas processing, fertilizer production, coal and petcoke gasification, ethanol production, and refinery hydrogen production.[xix] The IEA suggests that CCUS could account for around 13 percent of needed cumulative global emissions reductions of CO_2 between now and 2050 to meet international goals.[xx]

[i] On Nov. 19, 2015, Sens. Michael Bennet (D-CO) and Rob Portman (R-OH) introduced S. 2305, the Carbon Capture Improvement Act.

[ii] On June 24, 2015, Sens. Chris Coons (D-DE) and Jerry Moran (R-KS) and Reps. Ted Poe (R-Texas) and Mike Thompson (D-CA) re-introduced companion bills S. 1656 and H.R. 2883, the Master Limited Partnerships

Parity Act. S. 1656 is co-sponsored by four Republicans and three Democrats. H.R. 2883 is co-sponsored by seven Democrats and six Republicans.

[iii] Section 3404 of the Senate Energy Bill (S. 2012) authored by Senate Energy Committee Chair Lisa Murkowski (R-AK) and Ranking Member Maria Cantwell (D-WA) was added by Sens. Heidi Heitkamp (D-ND) and Shelley Moore Capito (R-WV) and co-sponsored by six Democrats and four Republicans.

[iv] Oil and Gas Journal Survey (2014).

[v] National Coal Council, CO_2 BUILDING BLOCKS: ASSESSING CO_2 UTILIZATION OPTIONS 96 (Aug. 2016).

[vi] Id.

[vii] IEA, Storing CO_2 Through Enhanced Oil Recovery (2015), *available at* https://www.iea.org/publications/insights/insightpublications/CO2EOR_3Nov2015.pdf

[viii] Deepika Nagabhushan and Kurt Waltzer, Clean Air Task Force, The Emission Reduction Benefits of Carbon Capture Utilization and Storage using CO_2 Enhanced Oil Recovery (Sep. 2016).

[ix] IEA, supra (emphasis added).

[x] IEA Greenhouse Gas R&D Programme (IEA, GHG), "CO_2 Storage in Depleted Oilfields: Global Application Criteria for Carbon Dioxide Enhanced Oil Recovery, 2009/12, December 2009".

[xi] U.S. DEPARTMENT OF ENERGY (DOE), CARBON CAPTURE, UTILIZATION, AND STORAGE: CLIMATE CHANGE, ECONOMIC COMPETITIVENESS, AND ENERGY SECURITY (Aug. 2016), available at http://energy.gov/sites/prod/files/2016/09/f33/DOE%20-%20Carbon%20Capture%20Utilization%20and%20Storage_2016-09-07.pdf

[xii] Id.

[xiii] Id.

[xiv] DOE, supra n. vi at 8-10.

[xv] Id.

[xvi] Id.

[xvii] Other upcoming carbon capture milestones include the following: 1) By early 2017, NRG should commence carbon capture at its Petra Nova project in Texas, a commercial-scale retrofit of an existing coal power plant that will use the CO_2 for EOR with permanent geologic storage; 2) By early 2017, Archer Daniels Midland should begin deep saline storage of CO_2 from its ethanol plant in Decatur, Illinois, pending final permit clearance; 3) By mid-2017, the NetPower demonstration plant in Texas should begin operations testing a new technique for using CO_2 in natural power generation that has the potential to reduce significantly the costs of CCUS. *See* Global CCS Institute, Large Scale CCS Projects, *available at* http://www.globalccsinstitute.com/projects/large-scale-ccs-projects.

[xviii] Id.

[xix] Id.

[xx] IEA, supra.