

Recent Developments in Deployment of CCS Projects in the Offshore Gulf of Mexico

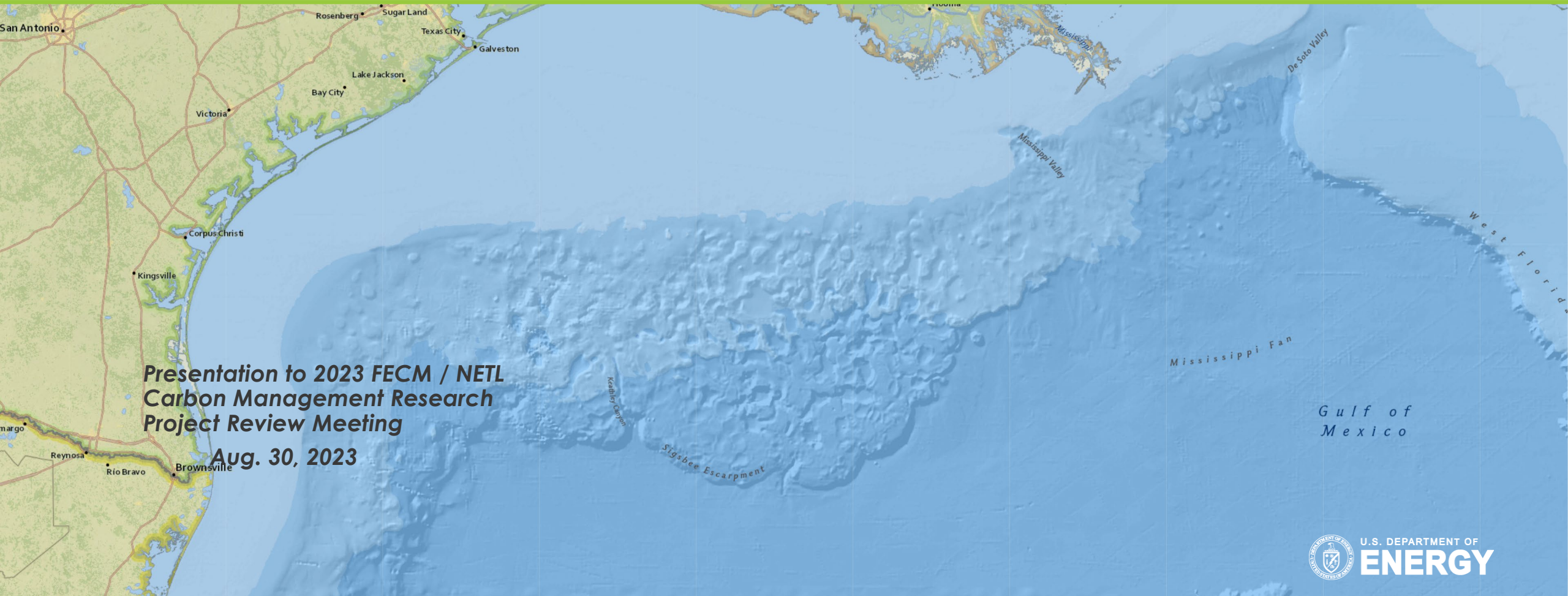


FWP-1022464

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**Presentation to 2023 FECM / NETL
Carbon Management Research
Project Review Meeting**

Aug. 30, 2023



U.S. Inflation Reduction Act (IRA)



Revisions to 26 U.S. Code § 45Q - Credit for Carbon Oxide Sequestration



45Q Tax Credit		Pre-IRA Per metric ton of CO ₂	Post-IRA* Per metric ton of CO ₂
CO ₂ Capture	Utilization	\$35	\$60
	Sequestration	\$50	\$85
Direct Air Capture	Utilization	\$35	\$130
	Sequestration	\$50	\$180

* This tax credit if the prevailing wage and apprenticeship requirements are met, otherwise, 5 times lower.

Additional IRA 45Q Provisions for CCUS

- 12-year carbon sequestration tax credit
- Direct pay option allows for a tax liability below zero to result in a refund (first five years)
- Provides funding for projects that start construction by the end of 2032
- Transferability eliminates the need for equity investment to receive tax credits, simplifying financing

Minimum quantity of CO ₂ to capture to qualify for 45Q tax credit		
Facility Type	Pre-IRA 45Q Limit Metric tons of CO ₂	Post-IRA 45Q Limit Metric tons of CO ₂
Power generation**	500,000	18,750
Industrial	100,000	12,500
Direct Air Capture	100,000	1,000

**Power generators must capture at least 75% of each unit's CO₂.

Carbon Capture and Storage Market

- First movers leading by executing decarbonization for industrial partners
- Employing CCS-as-a-service model
- Global CCS market
 - Estimated value of USD 3.22 billion in 2021
 - Forecast to reach USD 5.35 billion by 2030
 - Compound annual growth rate of 5.8% from 2022 to 2030



Blackstone

Blackstone Closes Record Energy Transition Private Credit Fund at More Than \$7 Billion

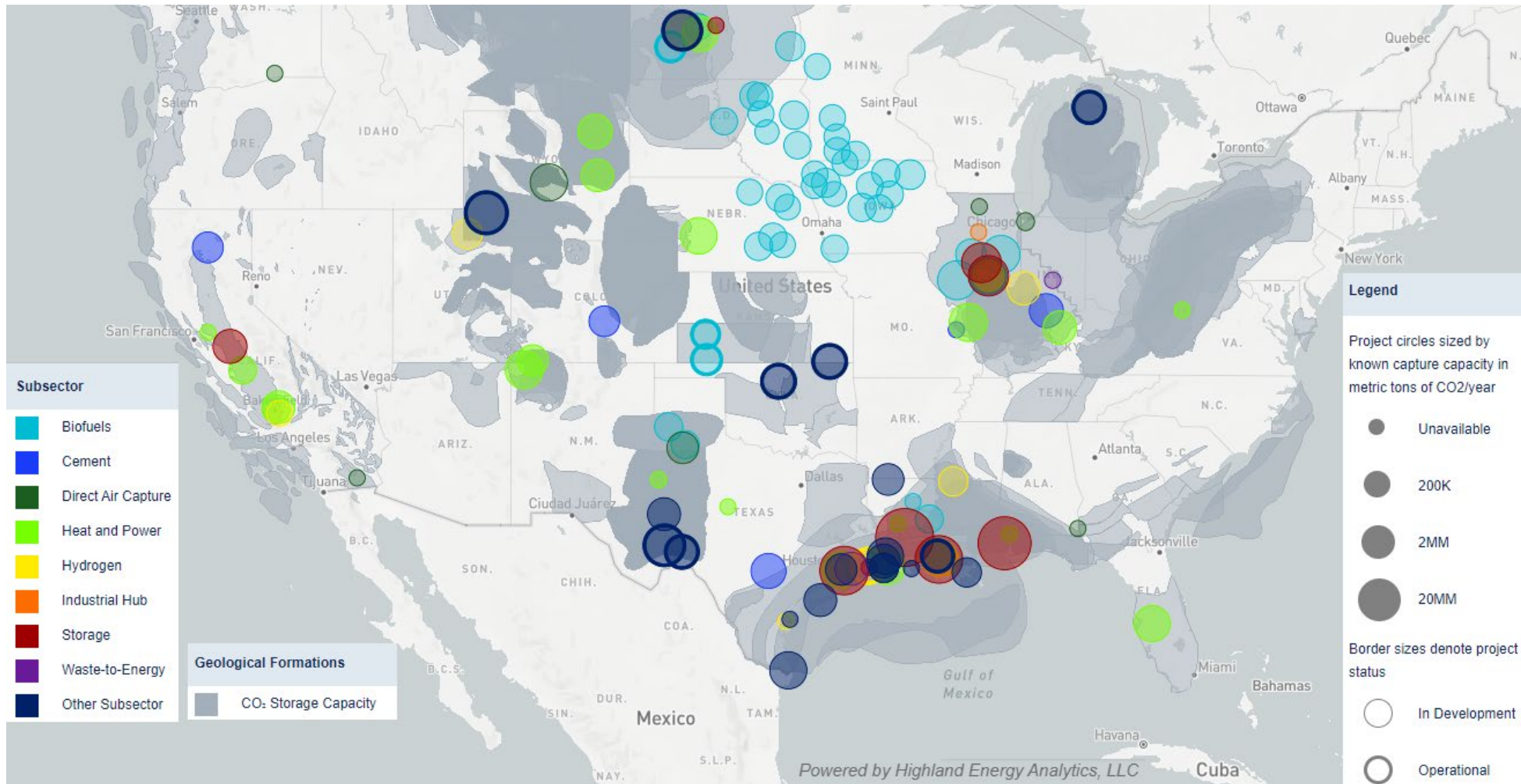
10 August 2023

“The energy transition is impacting large sectors of the economy and is resulting in a growing need for efficient private capital. We believe our experience and scale will enable Blackstone Credit to deliver flexible solutions to companies driving this historic transition and generate compelling returns for our investors.”

Robert Horn, Global Head of the Sustainable Resources Group for Blackstone Credit

Carbon Capture and Storage Market Size, Share & Trends Analysis Report By Application (Power Generation, Oil & Gas, Metal Production, Cement), By Capture Technology (Pre-combustion, Industrial Process), By Region, And Segment Forecasts, 2022 – 2030 <https://www.grandviewresearch.com/industry-analysis/carbon-capture-storage-ccs-market>

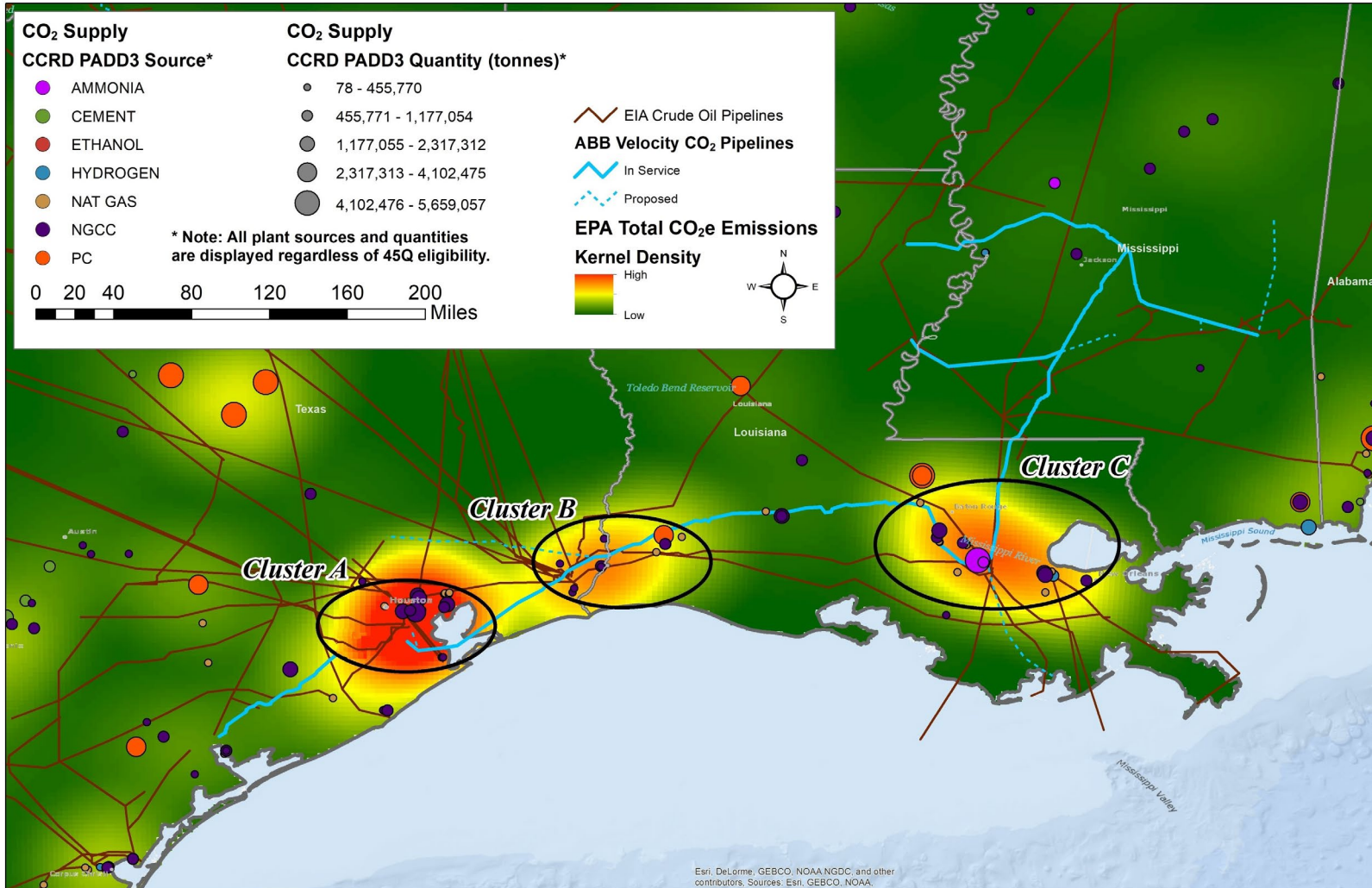
U.S. Carbon Capture Activity and Project Map



Used with permission of Clean Air Task Force U.S. (Interactive Map of CCUS Projects in Development in the U.S. <https://www.caft.us/2020/07/ccus-interactive-map/>)

CO₂ Emissions – Gulf Coast Region

Texas and Louisiana Industrial Point Source Emitters

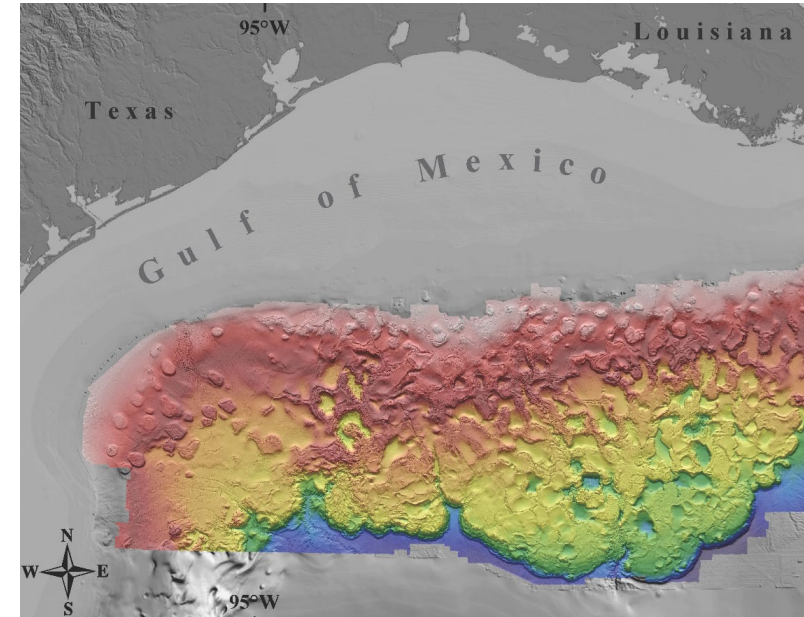


- Clusters of high-volume emissions
- Existing CO₂ pipeline

Offshore CO₂ Storage – Gulf of Mexico

Several Key Advantages

- Avoids storage beneath a populated area
- Reduces difficulty of establishing surface and mineral rights for storage sites
- Reduces risk of contaminating underground sources of drinking water (USDWs)
 - USDWs are not present in the Outer Continental Shelf (OCS)
- May reduce capital costs; could utilize existing
 - Right-of-way for CO₂ pipelines
 - Oil and gas infrastructure
- Federal government ownership simplifies securing leases and utilizing available pore space



CO₂ storage resource in GOM*

- Vast storage resource in offshore oil and gas reservoirs and saline formations
- 20 billion metric tons oil and gas reservoirs
- Hundreds of billions metric tons in saline formations

*<https://www.netl.doe.gov/carbon-management/carbon-storage/offshore>

Grant Awarded to Study Storage Complex Feasibility

Port of Corpus Christi

Carbon Storage Assurance Facility Enterprise (CarbonSAFE): Phase II — Storage Complex Feasibility

- Evaluate the technical and economic feasibility of permanently storing captured CO₂ from industrial operations including
 - Collection of geologic data under state-owned offshore tracts
- Collaboration between
 - Port of Corpus Christi
 - 1845 Carbon Storage LLC
 - Strategic Sequestration Development LLC
 - University of Texas Bureau of Economic Geology's Gulf Coast Carbon Center



Project Funded by Bipartisan Infrastructure Law to Study Carbon Transport



Phase III of FECM's CarbonSAFE Initiative

- Howard Midstream Energy Partners LLC (San Antonio, Texas) will perform a study
 - System capable of moving up to 250 million metric tons of CO₂ per year
 - Multiple sources to multiple storage locations on the Gulf Coast from the Port of Corpus Christi, Texas to the Mississippi River
- One of three projects selected to perform detailed engineering design studies for regional CO₂ pipeline networks



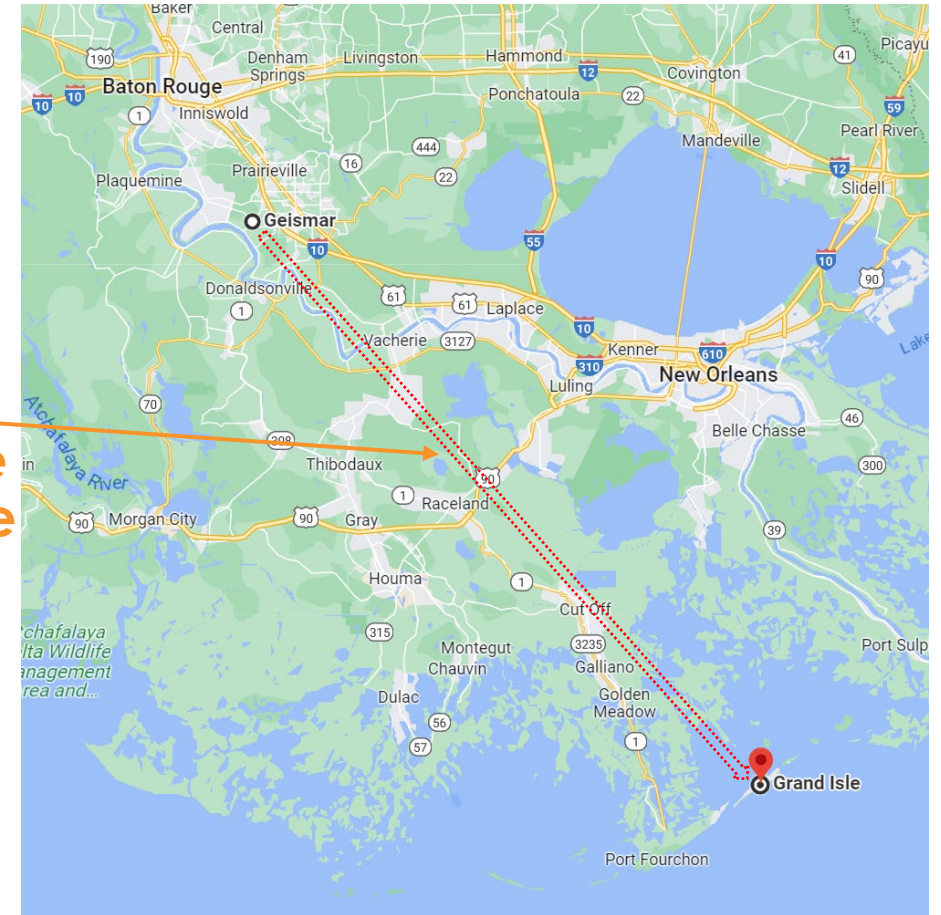
<https://www.energy.gov/articles/biden-harris-administration-invests-251-million-expand-infrastructure-support-co2>

Louisiana Offshore CO₂ Hub Repurposing Infrastructure to Decrease GHG Emissions

DOE CarbonSAFE – Project Lochridge

- Offshore CO₂ storage hub
 - Expected to hold up to 300 metric tons of CO₂
 - Consortium – Repsol, Cox Oil and Crescent Midstream
- Repurposing some of Cox Oil's offshore assets
 - More than 600 wells in 66 fields
- Planning 110-mile CO₂ pipeline from Geismar to Grand Isle
 - Initial front-end engineering and design complete
 - Repurposing existing Crescent Midstream pipeline rights of way

CO₂
Pipeline
110-mile



CARBON-ZERO



TALOS Bayou Bend Offshore CCS Project



Includes Texas General Land Office's Offshore Carbon Storage Site

Joint venture

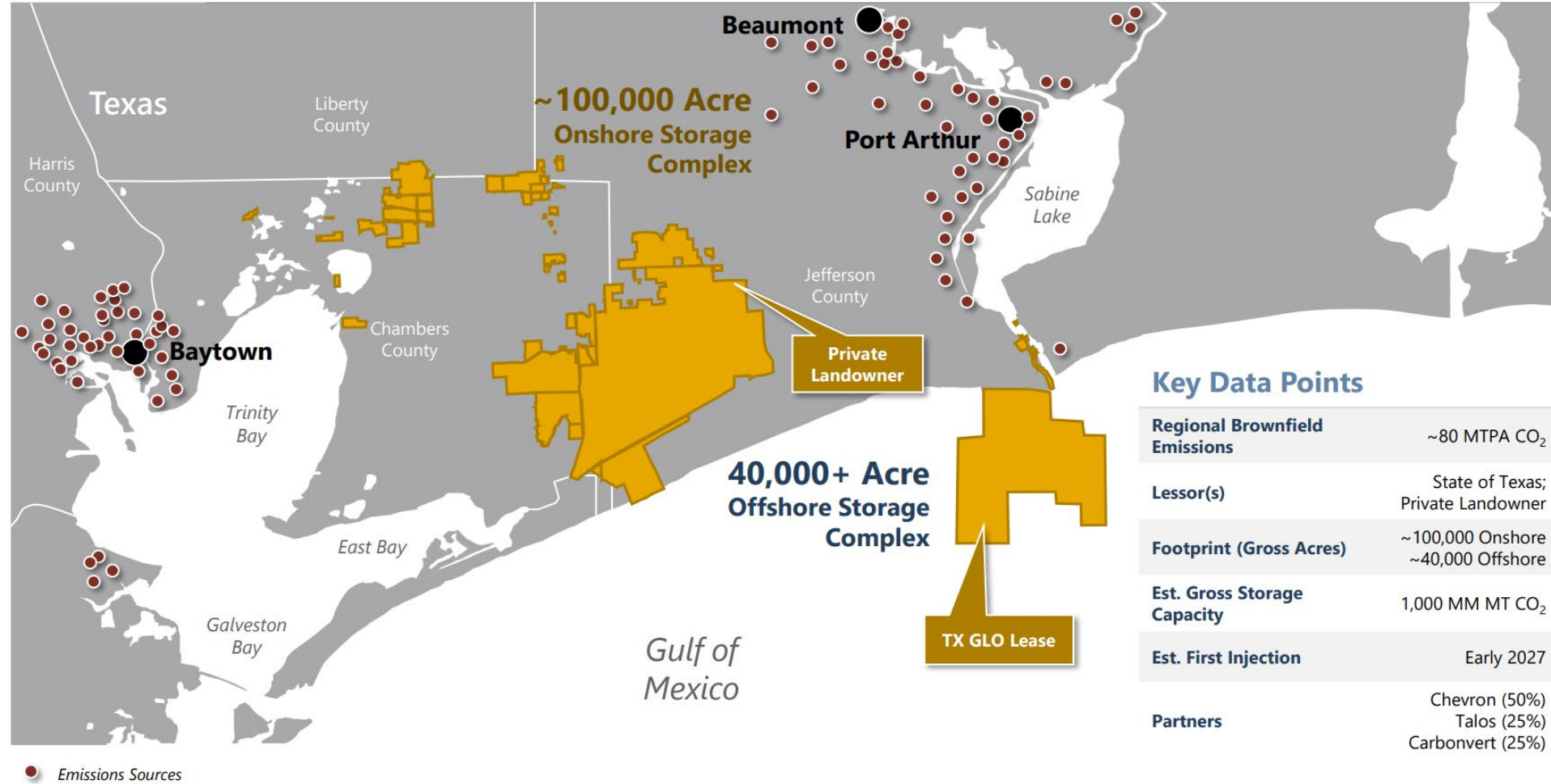
- Talos Low Carbon Solutions
- Carbonvert
- Chevron New Energies

Winning bid: Texas GLO Offshore site

- August 2021

Project expansion

- March 2023 acquired ~100,000 acres onshore



Key Data Points

Regional Brownfield Emissions	~80 MTPA CO ₂
Lessor(s)	State of Texas; Private Landowner
Footprint (Gross Acres)	~100,000 Onshore ~40,000 Offshore
Est. Gross Storage Capacity	1,000 MM MT CO ₂
Est. First Injection	Early 2027
Partners	Chevron (50%) Talos (25%) Carbonvert (25%)

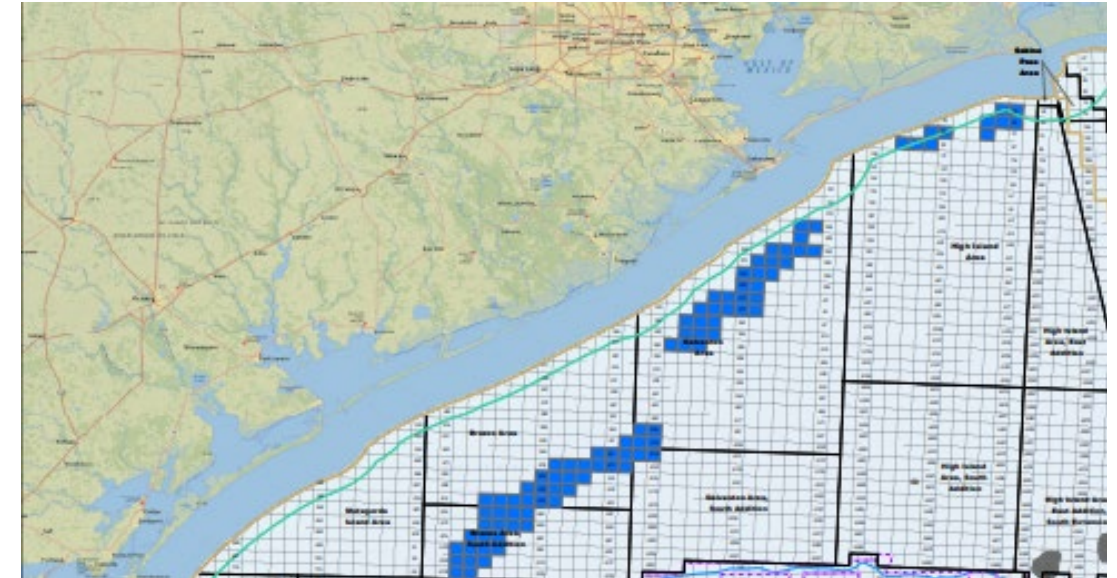
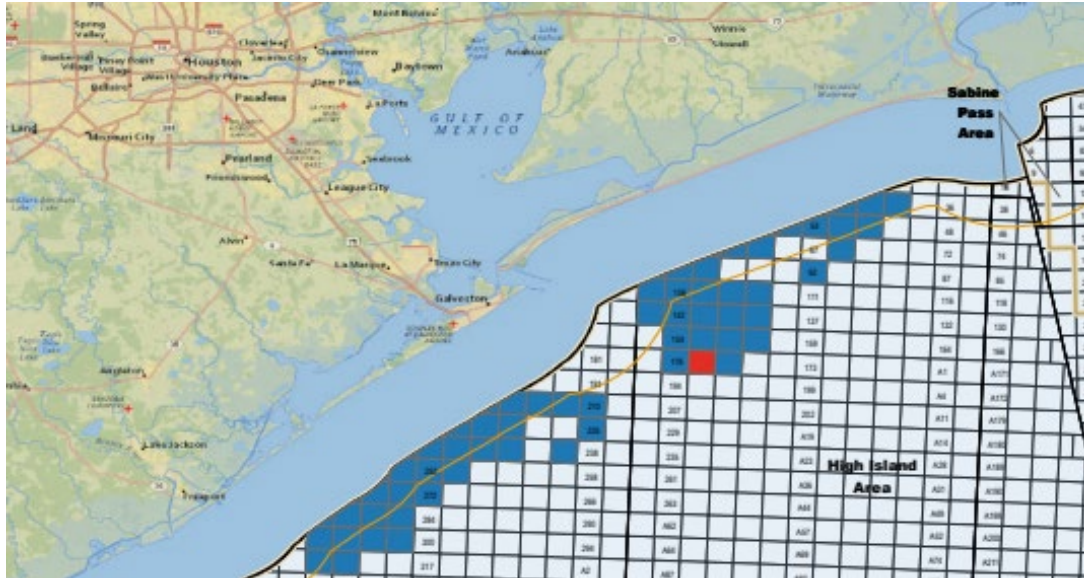


Used with permission of Talos Energy (Slide 34 - Talos "Latest Investor Presentation")

https://s201.q4cdn.com/120347489/files/doc_presentations/2023/07/2023-07-13-Talos-Energy-June-2023-Investor-Presentation-vFINAL_2-0.pdf

First Mover Strategy: Leverage Core Competence

ExxonMobil Shallow Water Blocks Near Houston Ship Channel



- BOEM Oil and Gas Lease Sale 259, 3/29/2023
 - Successful bid on 69 near-shore tracts
 - Blocks for offshore carbon storage
 - Regulations for CCS operational activities have yet to be promulgated.
 - Draft of regulations is expected later this year
- BOEM Oil and Gas Lease Sale 257, 11/17/2021
 - Successful bid on 94 shallow water blocks
 - First time an oil producer bid on blocks for offshore carbon storage
 - District Court vacated sale, citing NEPA violation, Jan. 2021
 - BOEM reinstated Lease Sale 257 bids, Sept. 2022
 - In compliance with Inflation Reduction Act

Source: BOEM <https://www.boem.gov/oil-gas-energy/leasing/lease-sale-259>,
<https://www.boem.gov/oil-gas-energy/leasing/regional-leasing/lease-sale-257>

First Mover Strategy: Partnership



ExxonMobil – three external carbon capture deals in U.S.

Nucor Steel

Covenant, LA

- Capture 800,000 tonnes CO₂ per year
 - MHI partnership
- Site produces direct reduced iron
- Tie into the same CO₂ transportation and storage infrastructure as utilized by CF Industries project
- Expected to begin in 2026

Linde Hydrogen

Beaumont, TX

- Linde is supplying clean hydrogen to OCI Global's new world-scale blue ammonia plant
- Carbon dioxide off-take agreement
- Transport and permanently store up to 2.2 million tonnes CO₂ per year
- Expected to begin in 2025

CF Industries

Donaldsonville, LA

- Carbon dioxide off-take agreement
- Transport and permanently store up to two million tonnes of CO₂ per year
- Expected start up in 2025

ExxonMobil

https://corporate.exxonmobil.com/news/news-releases/2023/0601_lcs-nucor-agreement

<https://www.linde.com/news-media/press-releases/2023/linde-signs-agreement-with-exxonmobil-for-carbon-dioxide-off-take>

https://corporate.exxonmobil.com/news/news-releases/2022/1012_landmark-emissions-reduction-project-in-louisiana-announced

First Mover Strategy: Acquisition



ExxonMobil announces acquisition of Denbury

“The breadth of Denbury’s network, when added to ExxonMobil’s decades of experience and capabilities in CCS, gives us the opportunity to play an even greater role in a thoughtful energy transition, as we continue to deliver on our commitment to provide the world with the vital energy and products it needs.”

Darren Woods, Chairman and CEO

Acquisition includes

- Largest owned and operated CO₂ pipeline network in the U.S.
 - 1,300 miles, including nearly 925 miles of CO₂ pipelines in Louisiana, Texas, and Mississippi
- Located within one of the largest U.S. markets for CO₂ emissions
 - With 10 strategically located onshore sequestration sites
- Gulf Coast and Rocky Mountain oil and natural gas operations
 - Proved reserves totaling over 200 million barrels of oil equivalent
 - With 47,000 oil-equivalent barrels per day of current production
 - Providing immediate operating cash flow and near-term optionality for CO₂ offtake and execution of the CCS business

The ExxonMobil logo is positioned to the right of the acquisition details. It consists of the word 'Exxon' in a red, sans-serif font and the word 'Mobil' in a blue, sans-serif font, both in a bold, italicized style.

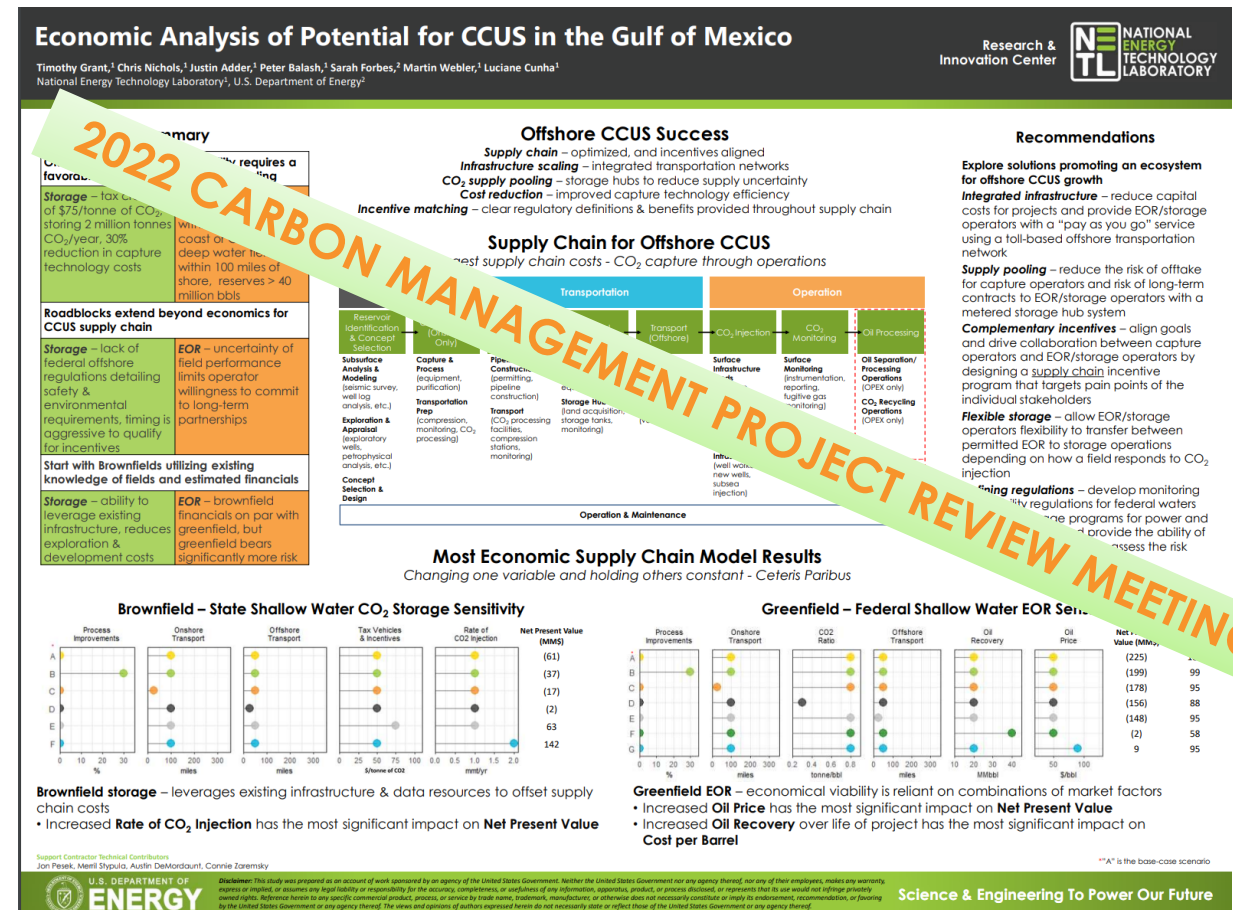
Cost-efficient transportation and storage system accelerates CCS deployment for ExxonMobil

https://corporate.exxonmobil.com/news/news-releases/2023/0713_exxonmobil-announces-acquisition-of-denbury

Economic Analysis of Potential for CCUS in the Gulf of Mexico Poster

Inflation Reduction Act Signed Into Law Aug. 16, 2022

- Economic viability for CO₂ Storage Offshore requires
 - Tax credits > \$75 per metric ton**
 - Reduction in capture technology costs > 30%
 - Storing > 2 million metric tons of CO₂ annually
- Roadblocks beyond economics
 - Timing to qualify for incentives is aggressive**
 - Lack of federal offshore regulations detailing safety and environmental requirements**
- Start with brownfields, utilizing existing knowledge of fields and estimated financials
 - May be able to leverage existing infrastructure and reduce exploration and development costs



White House Council on Environmental Quality (CEQ)



MARCH 24, 2023

CEQ Announces Members of Task Forces to Inform Responsible Development and Deployment of Carbon Capture, Utilization, and Sequestration

Required by the Utilizing Significant Emissions with Innovative Technologies (USE IT) Act to provide recommendations on how to ensure that

- CCUS projects, including carbon dioxide pipelines, are permitted in an efficient manner
- Reflect the input and needs of a wide range of stakeholders
- Deliver benefits rather than harms to local communities

- M. Jason Lanclos, Louisiana Department of Natural Resources
- Sasha Mackler, Bipartisan Policy Center
- Timothy "Tip" A. Meckel, Bureau of Economic Geology, University of Texas at Austin
- Jeremy Moddrell, United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry
- Julie M. Murphy, Colorado Oil and Gas Conservation Commission
- Stacey L. Noem, Bureau of Safety and Environmental Enforcement (BSEE)
- Merldine K. Elote-Oka, Jicarilla Apache Nation
- Bruno Pigott, United States Environmental Protection Agency
- John C. Poole, Talos Energy
- Jim Powell, Southern States Energy Board
- Tara K. Righetti, University of Wyoming College of Law
- Matt Rota, Healthy Gulf
- Nichole Saunders, Environmental Defense Fund
- Jan B. Sherman, Carbonvert Inc.
- Mark Joseph Spalding, The Ocean Foundation
- Gregory Todd, State of Utah, State of Utah Office of Energy Development
- Sherry Tucker, CapturePoint Solutions
- Jack Andreasen, Breakthrough Energy
- Lily R. Barkau, Wyoming Department of Environmental Quality
- Eric Bingham, Sweetwater County Land Use Director, Green River Wyoming
- Ken Brass, Representative, State of Louisiana
- Tristan Brown, Pipeline and Hazardous Materials Safety Administration (PHMSA)
- Bill Caram, Pipeline Safety Trust
- Al Collins, Oxy Low Carbon Ventures, Occidental
- Indra Dahal, Bureau of Land Management (BLM)
- Affie Ellis, Senator, State of Wyoming
- Matthew J. Fry, Great Plains Institute
- Raven A. Goswick, Aka Energy Group LLC
- Sallie E. Greenberg, University of Illinois, Illinois State Geological Survey
- Shannon Heyck-Williams, National Wildlife Federation
- Matt Holmes, Little Manila Rising
- Kenneth S. Jackson, Carbon-Zero US, LLC
- Jenny Joyce, ExxonMobil Low Carbon Solutions
- Anhar Karimjee, United States Department of Energy (DOE)
- James Kendall, Bureau of Ocean Energy Management (BOEM)

<https://www.whitehouse.gov/ceq/news-updates/2023/03/24/ceq-announces-members-of-task-forces-to-inform-responsible-development-and-deployment-of-carbon-capture-utilization-and-sequestration/>

Carbon Dioxide Capture, Utilization, and Sequestration Federal Lands and Outer Continental Shelf Permitting Task Force



Responsibilities of the Federal and Outer Continental Shelf (OCS) Task Force

- Inventory existing or potential Federal and state approaches to facilitate reviews associated with the deployment of CCUS projects and carbon dioxide pipelines, including best practices that avoid duplicative reviews to the extent permitted by law; engage stakeholders early in the permitting process; and make the permitting process efficient, orderly, and responsible.
- Develop common models for state-level carbon dioxide pipeline regulation and oversight guidelines that can be shared with states in the geographical area covered by the Federal and OCS Task Force.
- Provide technical assistance to states in implementing regulatory requirements and models developed by the Federal and OCS Task Force.
- Inventory current or emerging activities that transform captured carbon dioxide into a product of commercial value, or as an input to products of commercial value.
- Identify any priority carbon dioxide pipelines needed to enable efficient, orderly, and responsible development of CCUS projects at increased scale.
- Identify gaps in the current Federal and state regulatory framework and in existing data for the deployment of CCUS projects and carbon dioxide pipelines.
- Identify Federal and state financing mechanisms available to project developers.
- Develop recommendations for relevant Federal agencies on how to develop and research technologies that can capture carbon dioxide and would be able to be deployed within the region covered by the Federal and OCS Task Force including any projects that have received technical or financial assistance for research under section 103(g)(6) of the Clean Air Act ([42 U.S.C. 7403\(g\)](#)).

<https://www.federalregister.gov/documents/2022/07/28/2022-16103/carbon-dioxide-capture-utilization-and-sequestration-ccus-federal-lands-and-outer-continental-shelf>

Testimony of Director of BOE to House Committee on Natural Resources



Statement of
Elizabeth Klein
Director, Bureau of Ocean Energy Management U.S. Department of the Interior
Before the
House Committee on Natural Resources
Subcommittee on Energy and Mineral Resources
April 26, 2023

In 2022, BOEM began developing a Carbon Sequestration Program for the OCS.

- Section 40307 of the IIJA amended the OCS Lands Act to authorize the Secretary of the Interior to grant a lease, easement, or right-of-way on the OCS for activities that “provide for, support, or are directly related to the injection of a carbon dioxide stream into sub-seabed geologic formations for the purpose of long-term carbon sequestration.”
- Additionally, the IIJA directs the Secretary of the Interior to promulgate regulations to carry out this new authority. BOEM and BSEE have been working together on these regulations.
- We intend for the regulations to provide sound regulatory oversight by both BOEM and BSEE and to assure the American public that carbon sequestration operations on the OCS will be safe and protective of the environment.
- BOEM is requesting funds to develop a Carbon Sequestration Program comprised of specialized experts to implement and enforce the regulations, and to conduct the necessary scientific research to inform future decision-making.

https://naturalresources.house.gov/uploadedfiles/testimony_klein.pdf

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Questions?

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