NFiP Nasjonal forskerskole i petroleumsfag
NORWAY Petroleum Research School of Norway

NorTex Petroleum Cluster

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Regulatory Challenges in CO_2 Storage

Michael Moore
Program Director USEA
Golden Colorado 11-16-2022

USEA
United States Energy Association

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The Cadmus Group, LLC

October 2021

With the help of The Cadmus Group, USEA is releasing the study "Carbon Capture, Utilization, & Sequestration: A State Comparison of Technical and Policy Issues." This study evaluates laws, policies, and regulations governing CO_2 storage operations and geologic storage across ten states including: Alabama, California, Indiana, Kansas, Louisiana, Michigan, Mississippi, Nebraska, Oklahoma, and Utah. As a result of the expanded interest in CCUS due to the amended 45Q tax credit and the urgency of decarbonization, it is increasingly important for prospective CCUS project operators, legislatures and policy makers to understand legal and regulatory challenges to a more integrated and widespread implementation of CO2 storage. In addition to providing an oversight of the storage capacity and pipeline infrastructure of the states, this project provides comprehensive and comparative analysis of four dimensions of CO_2 law, regulation, and policy:

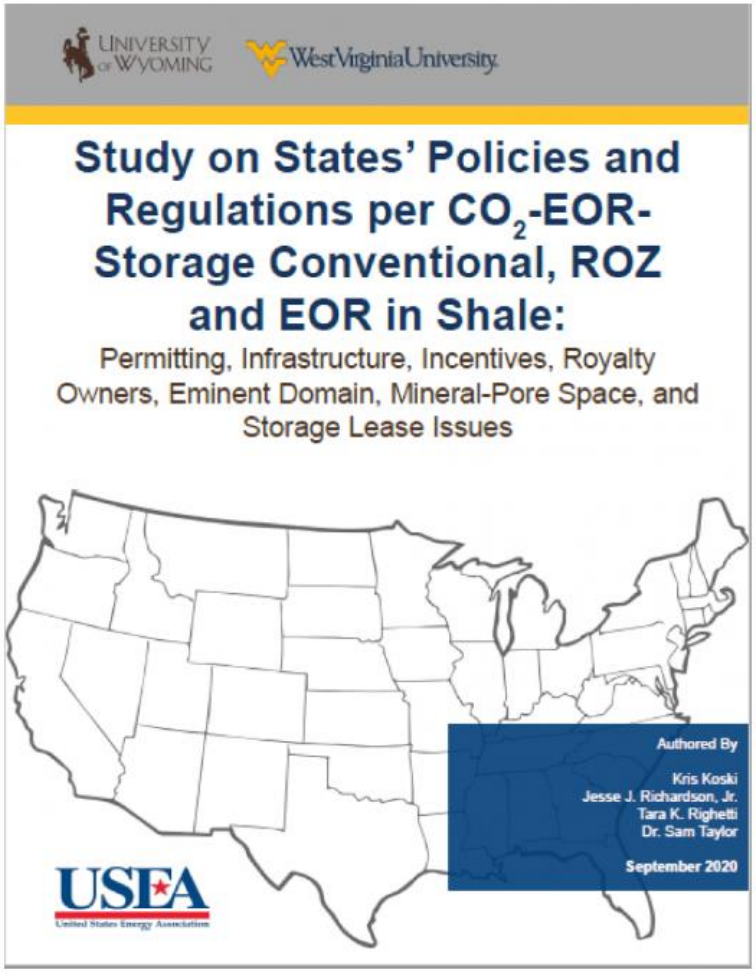
1) land use, mineral, water, and pore space rights;

2) geologic CO_2 storage and incremental storage regulation;

3) eminent domain; and

4) regulation of CO_2-EOR, oil and gas activities, and CO_2 pipelines.

The study suggests opportunities to harmonize energy policies and address regulatory gaps and inconsistencies. The aim of this



https://usea.org/event/ccus-state-comparison-technical-and-policy-issues

https://usea.org/publication/study-states-policies-regulations-co2-eor-storage-conventional-roz-and-eor-shale

Second Annual Carbon Dioxide Removal Law Conference

September 27-28, 2022

Conference Theme: The Role of Domestic Law and Policy in Regulating and Facilitating Carbon Dioxide Removal

Link to the Agenda
https://sites.northwestern.edu/cdrlaw/conference-agenda/

Link to the recordings of each session:
https://sites.northwestern.edu/cdrlaw/conference-recordings/

Review of the Diversity of State Policies and Regulations of CO2 Storage

Session Summary:

The United States Energy Association's Consensus Program, a cooperative program with the United States Department of Energy's Office of Fossil Energy and Carbon Management, with the help of its partners at the University of Wyoming's (UW) College of Law and UW School of Energy Resources, West Virginia University's (WVU) College of Law and WVU Energy Institute, and the Cadmus Group has published two separate studies looking at CO2 Storage policies and regulations across 22 states and onshore federal lands in the United States. Each study provided comprehensive and comparative analyses of four dimensions of CO2 law, regulation, and policy: 1) land use, mineral, water, and pore space rights; 2) geologic CO2 storage and incremental storage regulation; 3) eminent domain; and 4) regulation of CO2 pipelines. The studies also suggest opportunities to harmonize energy policies and address regulatory gaps and inconsistencies. The aim of these studies was to facilitate a better understanding of the legal underpinnings that frame risk, uncertainty, and investment in CO2 utilization and storage infrastructure and projects, and to provide a roadmap for changes that are conducive to project development. As a result of the expanded interest in CCUS and CDR due to the amended 45Q tax credit and the urgency of decarbonization, it is increasingly important for prospective CCUS project operators, legislatures, and policymakers to understand legal and regulatory challenges to a more integrated and widespread implementation of CO2 storage.

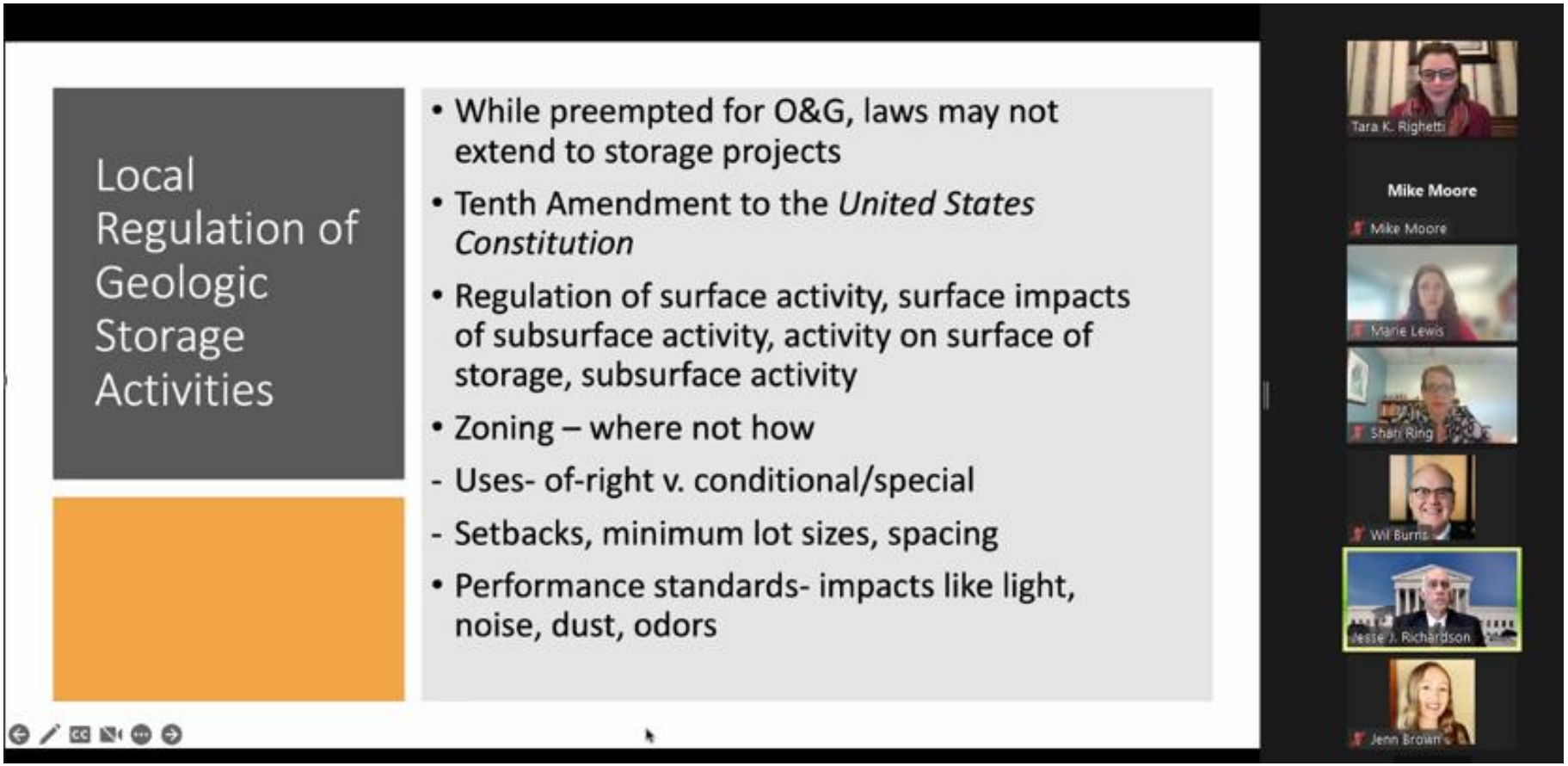
This panel will be especially useful for stakeholders who plan to utilize technological carbon removal solutions and geologically sequester or transport the captured carbon dioxide in the following states covered in each of the studies: Alabama, California, Colorado, Illinois, Indiana, Kansas, Kentucky, Louisiana, Michigan, Mississippi, Montana, Nebraska, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, Tennessee, Texas, Utah West Virginia, and Wyoming.

Moderator: Mike Moore, Program Director, United States Energy Agency

Roundtable Panelists:

- **Tara K. Righetti**, Professor, University of Wyoming – College of Law
- **Marie Lewis**, Research Analyst, The Cadmus Group
- **Jesse J. Richardson**, Professor of Law, West Virginia University College of Law
- **Shari Ring**, Senior Associate, Cadmus Group

Excerpts from the Northwestern CCS Program September 28th.



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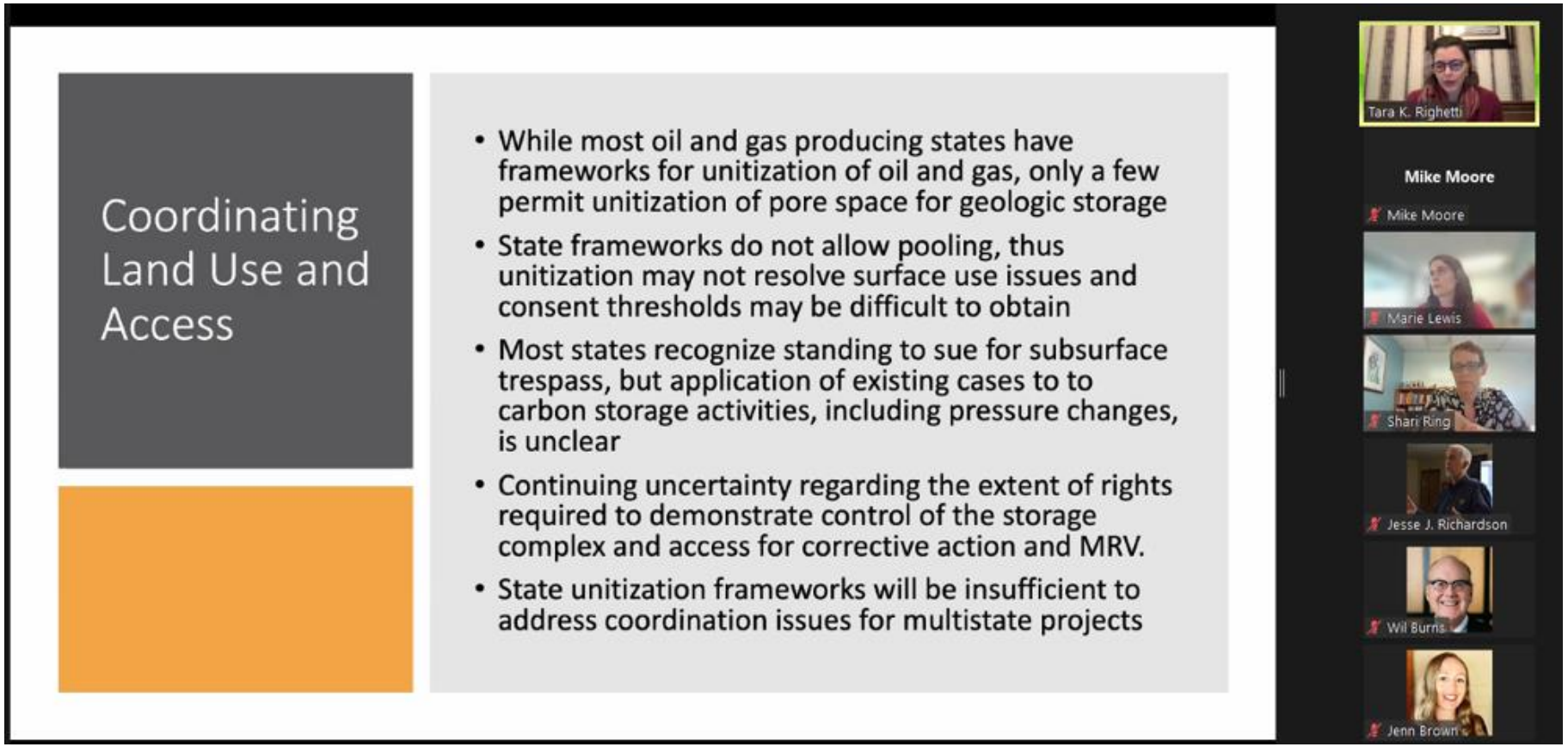
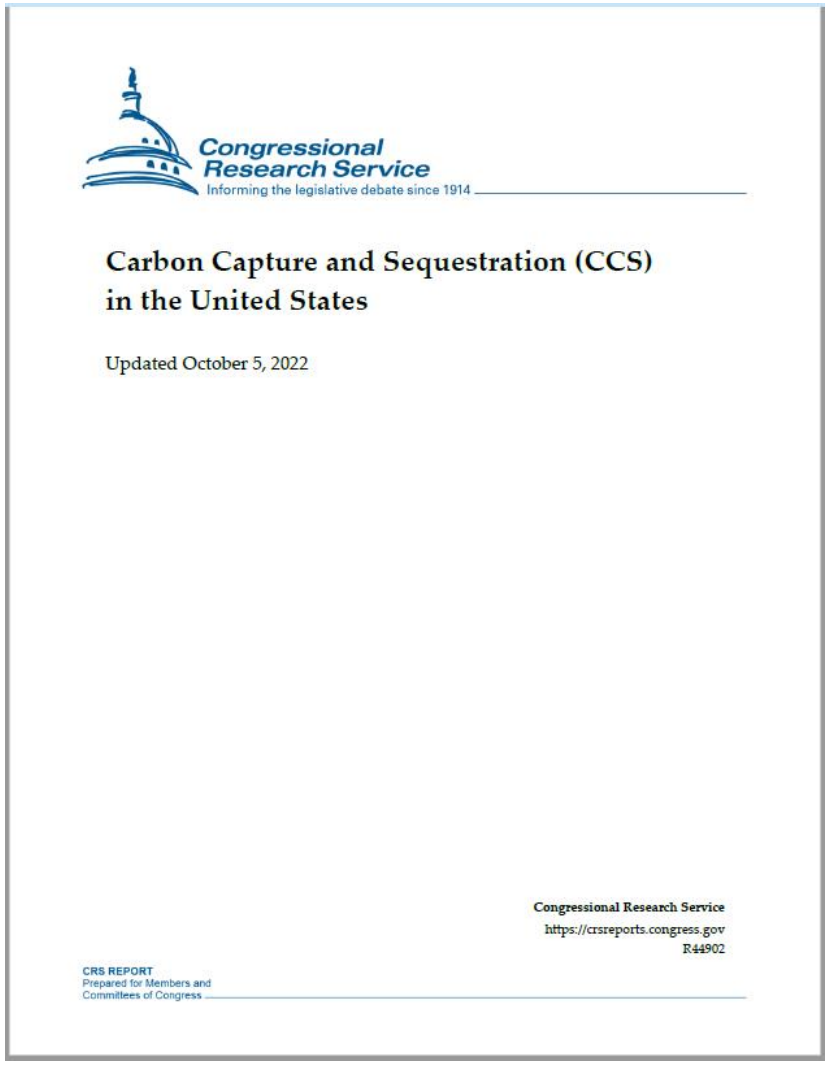


Latest Report for Congress on CCS



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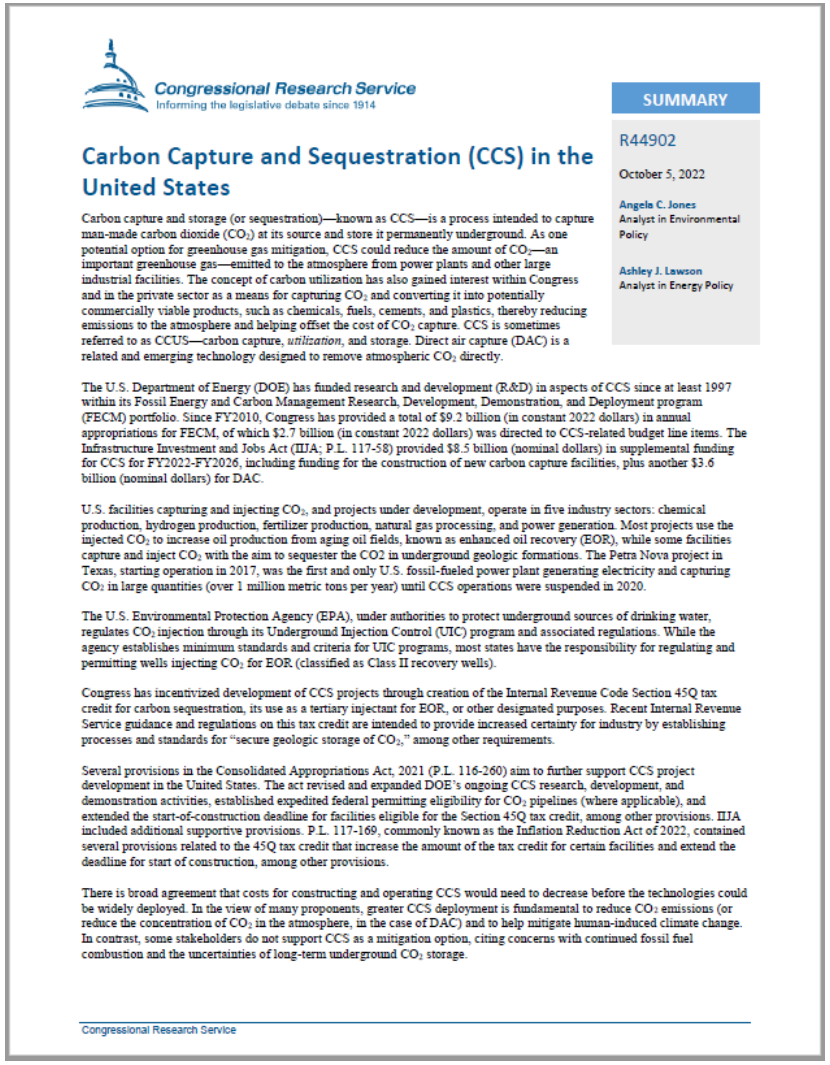
Carbon Capture and Sequestration (CCS) in the United States

Updated October 5, 2022

Congressional Research Service
https://crsreports.congress.gov
R44902

CRS REPORT
Prepared for Members and Committees of Congress



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SUMMARY

R44902

October 5, 2022

Angela C. Jones
Analyst in Environmental Policy

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Carbon Capture and Sequestration (CCS) in the United States

Carbon capture and storage (or sequestration)—known as CCS—is a process intended to capture man-made carbon dioxide (CO_2) at its source and store it permanently underground. As one potential option for greenhouse gas mitigation, CCS could reduce the amount of CO_2—an important greenhouse gas—emitted to the atmosphere from power plants and other large industrial facilities. The concept of carbon utilization has also gained interest within Congress and in the private sector as a means for capturing CO_2 and converting it into potentially commercially viable products, such as chemicals, fuels, cements, and plastics, thereby reducing emissions to the atmosphere and helping offset the cost of CO_2 capture. CCS is sometimes referred to as CCUS—carbon capture, *utilization*, and storage. Direct air capture (DAC) is a related and emerging technology designed to remove atmospheric CO_2 directly.

The U.S. Department of Energy (DOE) has funded research and development (R&D) in aspects of CCS since at least 1997 within its Fossil Energy and Carbon Management Research, Development, Demonstration, and Deployment program (FECM) portfolio. Since FY2010, Congress has provided a total of $9.2 billion (in constant 2022 dollars) in annual appropriations for FECM, of which $2.7 billion (in constant 2022 dollars) was directed to CCS-related budget line items. The Infrastructure Investment and Jobs Act (IIJA; P.L. 117-58) provided $8.5 billion (nominal dollars) in supplemental funding for CCS for FY2022-FY2026, including funding for the construction of new carbon capture facilities, plus another $3.6 billion (nominal dollars) for DAC.

U.S. facilities capturing and injecting CO_2, and projects under development, operate in five industry sectors: chemical production, hydrogen production, fertilizer production, natural gas processing, and power generation. Most projects use the injected CO_2 to increase oil production from aging oil fields, known as enhanced oil recovery (EOR), while some facilities capture and inject CO_2 with the aim to sequester the CO2 in underground geologic formations. The Petra Nova project in Texas, starting operation in 2017, was the first and only U.S. fossil-fueled power plant generating electricity and capturing CO_2 in large quantities (over 1 million metric tons per year) until CCS operations were suspended in 2020.

The U.S. Environmental Protection Agency (EPA), under authorities to protect underground sources of drinking water, regulates CO_2 injection through its Underground Injection Control (UIC) program and associated regulations. While the agency establishes minimum standards and criteria for UIC programs, most states have the responsibility for regulating and permitting wells injecting CO_2 for EOR (classified as Class II recovery wells).

Congress has incentivized development of CCS projects through creation of the Internal Revenue Code Section 45Q tax credit for carbon sequestration, its use as a tertiary injectant for EOR, or other designated purposes. Recent Internal Revenue Service guidance and regulations on this tax credit are intended to provide increased certainty for industry by establishing processes and standards for "secure geologic storage of CO_2," among other requirements.

Several provisions in the Consolidated Appropriations Act, 2021 (P.L. 116-260) aim to further support CCS project development in the United States. The act revised and expanded DOE's ongoing CCS research, development, and demonstration activities, established expedited federal permitting eligibility for CO_2 pipelines (where applicable), and extended the start-of-construction deadline for facilities eligible for the Section 45Q tax credit, among other provisions. IIJA included additional supportive provisions. P.L. 117-169, commonly known as the Inflation Reduction Act of 2022, contained several provisions related to the 45Q tax credit that increase the amount of the tax credit for certain facilities and extend the deadline for start of construction, among other provisions.

There is broad agreement that costs for constructing and operating CCS would need to decrease before the technologies could be widely deployed. In the view of many proponents, greater CCS deployment is fundamental to reduce CO_2 emissions (or reduce the concentration of CO_2 in the atmosphere, in the case of DAC) and to help mitigate human-induced climate change. In contrast, some stakeholders do not support CCS as a mitigation option, citing concerns with continued fossil fuel combustion and the uncertainties of long-term underground CO_2 storage.

https://CRSreports.congress.gov R44902

Significant Footnote
October 5th CRS CCS Report

[100] For example, in its May 2021 interim final recommendations, the White House Environmental Justice Advisory Council (WHEJAC) listed CCS projects as among those projects that would not benefit communities (WHEJAC, *Justice40, Climate and Economic Justice Screening Tool & Executive Order 12898 Revisions: Interim Final Recommendations,* May 13, 2021). See also Carlos Anchondo, "Industry Warns Lawmakers of CCS Threats," *Energywire*, November 25, 2019; and Richard Conniff, "Why Green Groups Are Split on Subsidizing Carbon Capture Technology," *YaleEnvironment360*, April 9, 2018.

EPA Regulation of Underground Injection in CCS

EPA issues regulations for underground injection of CO_2 as part of its responsibilities for underground injection control (UIC) programs under the Safe Drinking Water Act (SDWA). EPA also develops guidance to support state program implementation, and in some cases, directly administers UIC programs in states.[77] The agency has established minimum requirements for state UIC programs and permitting for injection wells. These requirements include performance standards for well construction, operation and maintenance, monitoring and testing, reporting and recordkeeping, site closure, financial responsibility, and, for some types of wells, post injection site care. Most states implement the day-to-day program elements for most categories of wells, which are grouped into "classes" based on the type of fluid injected. Owners or operators of underground injection wells must follow the permitting requirements and standards established by the UIC program authority in their state.

EPA has issued regulations for six classes of underground injection wells based on type and depth of fluids injected and potential for endangerment of underground sources of drinking water (USDWs). Class II wells are used to inject fluids related to oil and gas production, including injection of CO_2 for EOR. There are more than 119,500 EOR wells in the United States, predominantly in California, Texas, Kansas, Illinois, and Oklahoma.[78] This total includes EOR wells that can be used to inject CO_2 captured from anthropogenic sources and wells using naturally derived CO_2. Class VI wells are used to inject CO_2 for geologic sequestration. Two EPA-permitted Class VI wells are currently operating for sequestration in the United States, both located at the ADM facility in Illinois.[79] In 2022, North Dakota, which has delegated authority for its UIC Class VI well program, issued two CO_2 injection permits for geologic sequestration.

Geologic deep saline formations and existing oil fields with CO_2 storage potential

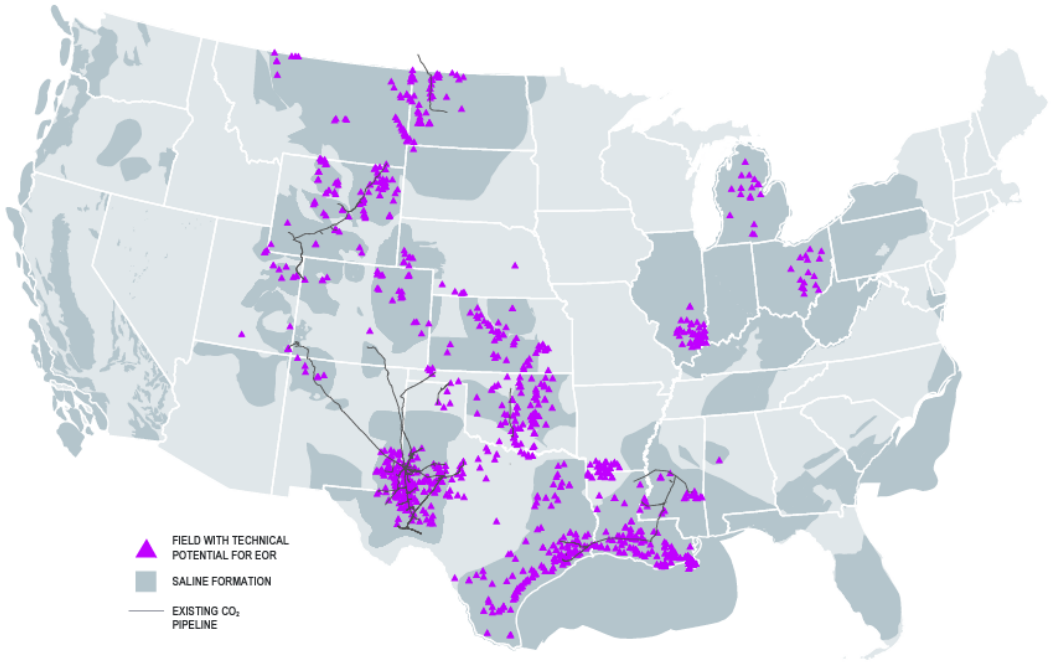
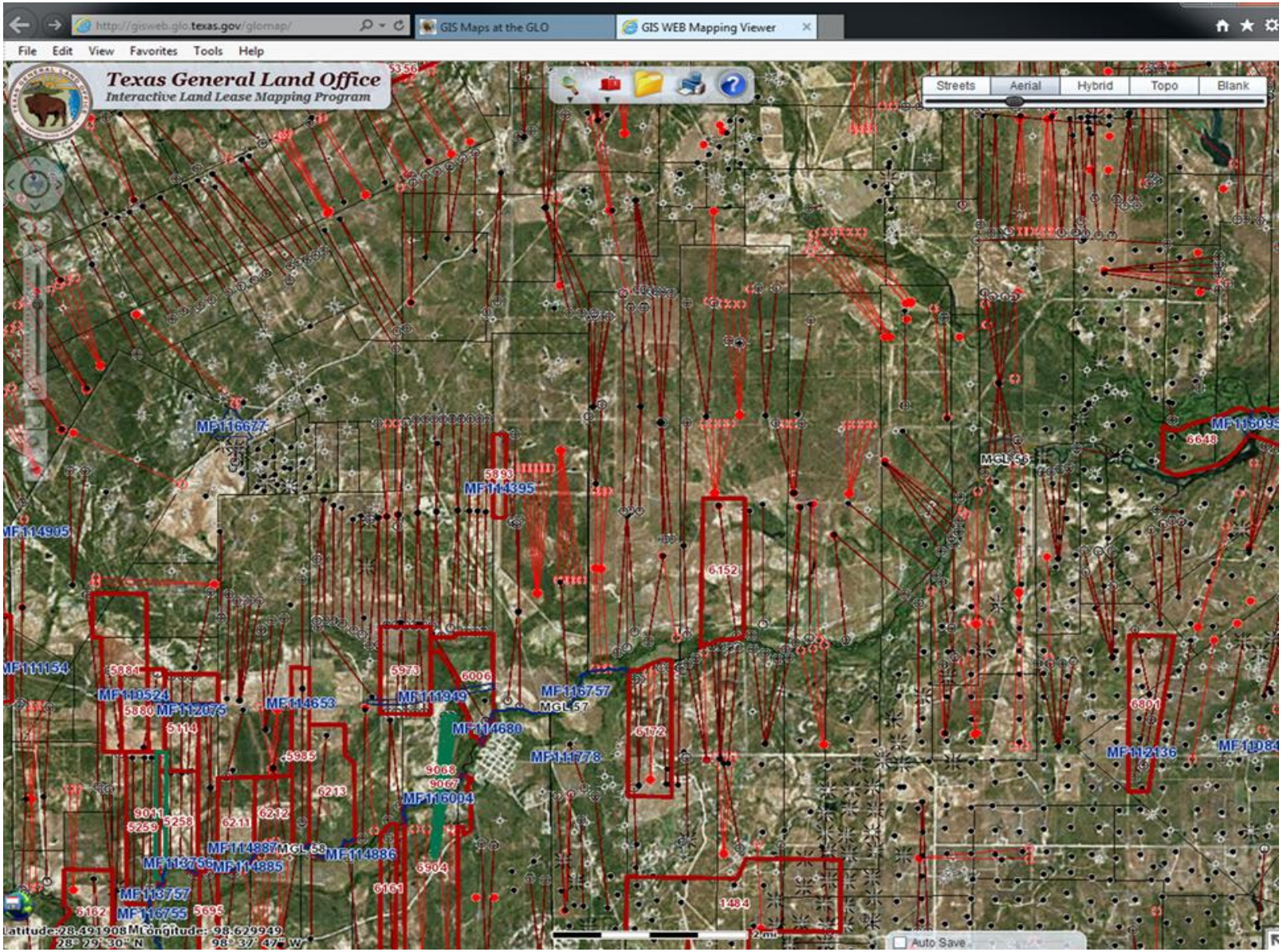


Figure authored by GPI based on data from ARI and NATCARB.

https://www.betterenergy.org/wp-content/uploads/2020/06/GPI_RegionalCO2Whitepaper.pdf

Eagleford Shale - Laterals



Conventional CO_2-EOR Permian Basin

Social Cost of CO_2

Executive Order 13990, of January 20, 2021, directs Federal agencies to immediately review, and take action to address, Federal regulations promulgated and other actions taken during the last 4 years that conflict with national objectives to improve public health and the environment; ensure access to clean air and water; limit exposure to dangerous chemicals and pesticides; hold polluters accountable, including those who disproportionately harm communities of color and low-income communities; reduce greenhouse gas emissions; bolster resilience to the impacts of climate change; restore and expand our national treasures and monuments; and prioritize both environmental justice and employment.

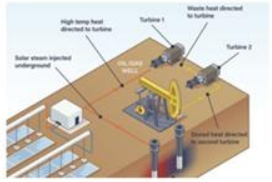
Table ES-1: Social Cost of CO_2, 2020 – 2050 (in 2020 dollars per metric ton of CO_2)[3]

	Discount Rate and Statistic			
Emissions Year	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	14	51	76	152
2025	17	56	83	169
2030	19	62	89	187
2035	22	67	96	206
2040	25	73	103	225
2045	28	79	110	242
2050	32	85	116	260

https://www.energy.gov/nepa/articles/eo-13990-protecting-public-health-and-environment-and-restoring-science-tackle
https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

Another Player Enters Geologic Storage USE—stored heat…..

Attractions



Concentrated Solar Power Could Give Oil Companies A Second Revenue Stream

by hyperlight | Mar 8, 2022 | In The News

"This technology turns existing oil wells into clean energy generators," says John King, CEO of San Diego-based Hyperlight Energy Natural gas has traditionally been the energy source to increase oil production. But in this case, solar power is used to generate steam,...

Forbes

Mar 7, 2022, 09:00am EST | 3,881 views

Concentrated Solar Power Could Give Oil Companies A Second Revenue Stream

Ken Silverstein Senior Contributor
Energy
I write about the global energy business.

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Repurposing Oil Wells

"The industry is increasingly embracing the concept of cost reduction through repurposing oil wells, as shown by the Department of Energy's Geothermal Technology Office [GTO] recently announced group of projects aiming to use old oil wells to access traditional geothermal-based heat, and Southern Company's research collaboration with innovator Petrolern, to 'Convert Oil Wells to Geothermal Resources'," said John King, CEO of Hyperlight Energy. (The DOE last year announced as much as $46 million to support other geothermal projects.)

Hyperlight in a news release said the application of CSP thermal energy for power generation and emissions reduction "is an industry first," adding that the company "estimates the statewide potential [energy] storage capacity of its technology" would exceed the combined generation from California's natural gas-fired power plants. Hyperlight said the Bakersfield demonstration "builds on groundbreaking analysis work on geological thermal energy storage (GeoTES) performed by Hyperlight partner, [the] National Renewable Energy Laboratory [NREL]."

Questions & Thank You!

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