TAXPAYERS for COMMON SENSE

ISSUE BRIEF

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Federal Support and Oversight of Enhanced Oil Recovery (EOR)

Enhanced oil recovery (EOR) is a technique that has been employed by the oil and gas industry for over half a century to boost oil recovery from existing reserves. Amid the increasing impacts from climate change, EOR has gained attention due to its connection with carbon capture technologies. In the U.S., most captured carbon is used for EOR. Recent legislation has boosted federal investments in carbon capture and its use for EOR, calling into question its overall net climate benefit.

What is EOR

Enhanced oil recovery (EOR) and enhanced gas recovery (EGR) involve injecting fluids into oil or gas bearing geological formations to increase the recovery oil and gas beyond what traditional methods, like primary or secondary recovery, allow.[1] Primary oil recovery relies on natural energy present in the reservoir to move oil to production wells, but this usually recovers only a small portion of the available oil. Secondary recovery techniques, such as water injection, can increase recovery by an additional 15 to 35 percent, However, once the easily extracted oil has already been recovered, EOR—also known as tertiary injection methods, can produce 30 to 60% or more of the original oil in place.[2]

[1] This issue brief uses EOR to refer to both enhanced oil and natural gas recovery.

[2] L. Stephen Melzer, "Carbon Dioxide Enhanced Oil Recovery (CO2 EOR): Factors Involved in Adding Carbon Capture, Utilization and Storage (CCUS) to Enhanced Oil Recovery," February 2012. https://carboncapturecoalition.org/wp-content/uploads/2018/01/Melzer_CO2EOR_CCUS_Feb2012.pdf

EOR has been used by the oil and gas industry since the 1970s, with carbon dioxide (CO_2) being the most common injection fluid for EOR (CO2-EOR). The U.S. has over 118,425 EOR wells, mainly located in Texas, California, Kansas, Illinois, and Oklahoma.[3] Most of the CO_2 used for EOR comes from naturally occurring sources, with only 27% of CO_2 captured from industrial sources like natural gas processing plants and ethanol plants reported to the EPA in 2022.[4]

EOR and Carbon Capture and Storage (CCS)

EOR is closely associated with carbon capture and sequestration (CCS) as it is one of the few economically viable uses of captured carbon. Once carbon is captured at carbon-emitting facilities such as power plants, it is then transported and injected into oil and gas reservoirs for EOR or stored underground in geological formations for sequestration.

Although captured carbon can also be utilized to produce materials like biomass, plastic, or cement, these applications are still in early development. As of 2023, 13 out of 15 commercial CCS facilities in the U.S. capture carbon for EOR, while two capture carbon for geological sequestration. Close to 95% of U.S. commercially captured carbon is used for EOR.[5] Globally, 91% of captured carbon is being used for EOR.[6]

Federal Tax Subsidies for EOR Operations

EOR is heavily subsidized by the federal government through various tax credits, the most significant being the 45Q tax credit for carbon oxide sequestration.

Carbon Oxide Sequestration Credit (Section 45Q)

Section 45Q offers a credit for every ton of carbon captured at a "qualified facility" that meets certain minimum capture thresholds. The captured carbon must be from industrial sources or captured directly from the air via Direct Air Capture (DAC). The owner of the capture equipment (i.e. owner of CCS equipment at a natural gas processing plant) may also transfer the credit to the party storing or using the carbon, such as EOR operators. The credit is worth up to $130 per ton for carbon captured at a DAC facility and $60 per ton for carbon from other industrial sources. Though not exclusively designed for EOR, most of the 45Q credits have gone towards EOR operations, as they are the primary use of captured carbon.

The 45Q tax credit has already cost taxpayers hundreds of millions of dollars and is estimated to cost tens of billions more over the next decade. The U.S. Treasury estimates that 45Q will cost $36.2 billion from FY2024 to FY2033.[7]

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[3] EPA, "UIC Injection Well Inventory: FY2022 State UIC Inventory," accessed August 2024. https://www.epa.gov/uic/uic-injection-well-inventory
[4] EPA, "Supply, Underground Injection, and Geologic Sequestration of Carbon Dioxide," accessed August 2024. https://www.epa.gov/ghgreporting/supply-underground-injection-and-geologic-sequestration-carbon-dioxide
[5] TCS calculation assumes facilities capture at full capacity. Facility capture capacity data from Global Status of CCS. Global CCS Institute, "Global Status of CCS Report 2023," November 2023. https://status23.globalccsinstitute.com/.
[6] K. Novak Mavar, N. Gaurina-Medimurec, L. Hrnčević, "Significance of Enhanced Oil Recovery in Carbon Dioxide Emission Reduction," Sustainability, Table 1, February 2021, https://doi.org/10.3390/su13041800
[7] U.S. Department of the Treasury, "Tax Expenditures FY2025," accessed August 2024. https://home.treasury.gov/system/files/131/Tax-Expenditures-FY2025.pdf

Expensing of Tertiary Injectants (Section 193)

EOR operators can deduct expenses related to tertiary injectants—such as CO_2—in the year they are incurred, except for costs associated with recoverable hydrocarbon injectants (i.e. recoverable crude oil or natural gas injected to recover more oil and gas). This immediate expensing is a subsidy because it deviates from the standard cost depletion method, which typically spreads the cost of tangible assets over their useful lives. By allowing immediate deductions, this tax treatment potentially incentivizing companies to spend more on tertiary injectants.

Credit for Production from Marginal Wells (Section 45I)

When oil and gas prices fall below specific thresholds, the marginal well credit is triggered. This credit applies to oil and gas produced from wells with daily production of 25 barrels of oil (or barrel-of-oil equivalents) or less, providing $3 (in 2005 dollars, or $2005) per barrel of oil and $0.50 ($2005) per 1,000 cubic feet (mcf) of natural gas. Production from a single well is capped at 1,095 barrels or barrel-of-oil equivalents of natural gas annually. The credit phases out if the previous year's reference price exceeds $15 per barrel for oil or $1.60 per mcf for natural gas. The credit was available in 2016, 2017, 2019, 2020, and 2021. Although the credit is not specifically designed for EOR, operators can use EOR to boost production from marginal wells, which may then qualify for the credit.

Credit for Enhanced Oil Recovery (Section 43)

When oil prices drop below a certain level, EOR operators can claim up to 15% of qualified EOR costs incurred domestically as a credit against their tax liabilities. The credit phases out over a $6 range once the reference price exceeds $28 (in 1991 dollars) per barrel. This credit was available in 2016, 2017, 2018, and 2021.

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Federal Oversight of EOR Wells

Environmental Protection Agency

The Environmental Protection Agency (EPA) oversees EOR operations through its authority under the Safe Drinking Water Act (SDWA), via the Underground Injection Control (UIC) program. This program ensures that fluids injected underground, including CO2 for EOR, do not contaminate underground sources of drinking water (USDWs). The EPA categorizes injection wells into six classes based on the type of fluid injected and the potential risk to USDWs. Class II wells are primarily used for injecting fluids related to oil and gas production, including CO_2 for EOR.

The EPA provides guidelines and support for state-level implementation of UIC programs. While the EPA directly administers these programs in some states, other states can apply for "primacy" (primary enforcement responsibility) if they meet the EPA's minimum requirements for state UIC programs. These requirements cover various aspects of underground injection, such as well construction, operation, maintenance, monitoring, testing, reporting, recordkeeping, site closure, financial responsibility, and post-injection care. As of August 2024, 40 states have primacy over Class II wells.

In addition to its SDWA authority, the EPA requires certain sources of greenhouse gases (GHG) to report emissions data under the Clean Air Act. The EPA's Greenhouse Gas Reporting Program (GHGRP) establishes standards for different GHG-emitting sources to quantify and report emissions. In 2010, an EPA rule clarified that all wells injecting CO_2 underground, whether for EOR (Class II) or geologic sequestration (Class VI), fall within the GHGRP covered source categories and must report their emissions to the EPA. This allows the EPA to track CO_2 volumes that Class II and Class VI receive for injection.[8] The GHGRP includes separate requirements for different GHG source categories, detailed in Subparts B through UU.

Subpart UU applies to facilities injecting CO_2 for EOR or other purposes not involving geologic sequestration. Facilities must report the volume of CO_2 received and its origin, if known, but are not required to report the amount sequestered or submit a monitoring, reporting, and verification (MRV) plan. Around 130 facilities have reported under Subpart UU since reporting became mandatory in 2011.[9]

Subpart RR applies to facilities injecting CO_2 for long-term geologic sequestration, which includes all UIC Class VI geologic sequestration wells. Subpart RR requires facilities injecting CO_2 for geologic sequestration to have an EPA-approved MRV plan and to report the amount of CO_2 sequestered. EOR operators seeking to claim the 45Q tax credit may choose to comply with Subpart RR to demonstrate that they have sequestered carbon in oil and gas wells. These operators must have a final EPA-approved MRV plan and comply with Subpart RR requirements to demonstrate secure sequestration.

[8] CRS, "EPA's Greenhouse Gas Reporting Program," March 2023. https://crsreports.congress.gov/product/pdf/IF/IF11754
[9] EPA, Facility Level GHG Emissions Data. https://ghgdata.epa.gov/ghgp/main.do#/listFacility/?q=Find%20a%20Facility%20or%20Location&st=&bs=&fid=&sf=1100 1100&ds=A&yr=2022&tr=current&cyr=2022&ol=0&sl=0&rs=ALL

Internal Revenue Service

While the Internal Revenue Service (IRS) does not directly oversee EOR operations, it requires EOR operators claiming the 45Q tax credit to demonstrate secure geological storage of carbon during EOR. Per IRS rules, operators must comply with either EPA Subpart RR or an international standard adopted by the International Organization for Standardization (CSA/ANSI ISO 27916:19). A 2021 IRS rule allows EOR facilities to self-certify carbon oxide volumes claimed for the 45Q credit if they comply with Subpart RR. Facilities using the ISO standard must have their documentation certified annually by a qualified independent engineer or geologist. Facilities not seeking the 45Q credit must comply with Subpart UU.

EOR Regulations Lack Stringent Safeguards for Taxpayers

EOR wells can pose significant risks to communities and the environment, particularly through groundwater contamination.[10] CO_2-EOR (EOR using CO_2) often involves large volumes of oil field wastewater, which can be difficult to manage and increases the risk of spills and leaks. The combination of CO_2 and water in oil formations can form carbonic acid, which corrodes equipment and mobilizes harmful elements that might contaminate drinking water. Additionally, CO_2 blowouts can cause surface contamination, threatening public health and air quality.

Class II well oversight is crucial to protect communities and taxpayers from the risks associated with CO_2 injection into oil and gas wells. A report by Clean Water Action found that EPA's oversight of state UIC programs is underfunded and understaffed, limiting its ability to conduct sufficient oversight of EOR operations.[11] The report recommends that the EPA update Class II regulations, raise minimum standards, and increase oversight of state-administered UIC programs, including through regular audits.

The IRS relies on EPA regulations to verify that 45Q claimants prove that captured carbon is securely sequestered underground. However, current requirements for MRV plans, a vital component of verifying 45Q eligibility under Subpart RR, are insufficient to guarantee long-term. Notably, the EPA does not require specific monitoring strategies or technologies, instead allows companies to develop their own standards. Nor do MRV plans require explicit monitoring timelines or activities, or onsite verification of data reported under Subpart RR.[12] Establishing specific technological standards, clear monitoring timelines, and onsite verification would provide stronger protection for taxpayers and communities.

The IRS does not currently conduct onsite verification of captured, sequestered, or used carbon either. The IRS allows EOR sites complying with Subpart RR to self-certify their reported data, with a company official merely signing off that the volume numbers reported to the IRS are correct.

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[10] Clean Water Action, "Carbon Dioxide Enhanced Oil Recovery (CO2-EOR): A Threat to Drinking Water and the Environment," November 2017. https://www.cleanwateraction.org/sites/default/files/docs/publications/Carbon%20Dioxide%20EOR%20-%20A%20Threat%20To%20Water%20and%20the%20Environment%20-%20Nov%202017.pdf

[11] Clean Water Action, "The Environmental Risks and Oversight of Enhanced Oil Recovery in the United States," August 2017.https://www.cleanwater.org/sites/default/files/docs/publications/The%20Environmental%20Risks%20and%20Oversight%20of%20Enhanced%20Oil%20Recovery%20in%20the%20United%20States.pdf

[12] Environmental Integrity Project, "Flaws in EPA's Monitoring and Verification of Carbon Capture and Projects," December 2023. https://environmentalintegrity.org/wp-content/uploads/2023/12/EIP_Report_CarbonCapture12.14.23.pdf

Alternatively, an EOR company operator may use the ISO standard where an "independent" engineer or geologist certifies the carbon figures. The ISO standard does not mandate reporting of leakage information, which raises concerns since leakage in EOR projects can occur over decades. EOR operators using the ISO standard are also not required to make their reports publicly available.[13]

Questions remain about how the IRS can improve transparency and accountability in the 45Q program. The 45Q tax credit has been subject to fraud in the past. In 2020, the Treasury Department's Inspector General for Tax Administration found that 10 taxpayers claimed over $1 billion in 45Q tax credits from 2010 to 2019,[14] with $894 million of those claims failing to comply with EPA reporting requirements.

To prevent future abuse of the 45Q credit, the IRS should implement stronger safeguards, including requiring third-party verification of reported data and conducting regular audits. Increasing public transparency by providing timely access to aggregated data on stored carbon and claimed credits would also help. Lastly, facilities should be required to keep records for at least 12 years—matching the duration of 45Q credit eligibility. Currently, claimants must only retain data for three years, during which the IRS can claw back credits if stored carbon leaks. Extending this clawback period would better protect against liabilities that could ultimately burden taxpayers, such as groundwater contamination.

Questionable Results for Climate

Capturing carbon for EOR has been championed as a climate solution that can help reduce emissions while maintaining oil and gas production. Historically, the CO_2 used for EOR has come from naturally occurring reservoirs. As federal subsidies for CCS grew, industrial facilities like natural gas processing, fertilizer, and ethanol plants began capturing CO_2 to sell to EOR operators for injection into marginal wells. However, it remains unclear whether CO_2-EOR actually leads to a net reduction in emissions.

The International Energy Agency reports that between 300 and 600 kg of CO_2 are injected per barrel of oil produced through EOR in the U.S. That same barrel releases around 400 kg of CO_2 when burned, with another 100 kg emitted on average during production, refining, and transportation.[15] Recent studies indicate that EOR projects using captured CO_2 may initially achieve a negative carbon footprint (a net reduction in emissions) because much of the injected CO_2 is trapped underground. However, as projects continue, less CO_2 is trapped, and the carbon footprint turns positive—meaning there is no net emission reduction.[16]

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[13] The sequestration data reported under subpart RR are publicly available on the EPA's Facility-Level Information on Greenhouse Gases Tool (FLIGHT). https://ghgdata.epa.gov/ghgp/main.do

[14] Inspector General for Tax Administration, April 2020. https://www.menendez.senate.gov/imo/media/doc/TIGTA%20IRC%2045Q%20Response%20Letter%20FINAL%2004-15-2020.pdf

[15] IEA, "Can CO2-EOR really provide carbon-negative oil?" April 2019. https://www.iea.org/commentaries/can-co2-eor-really-provide-carbon-negative-oil

[16] Núñez-López and Moskal, "Potential of CO2-EOR for Near-Term Decarbonization," Frontiers in Climate, September 2019. https://doi.org/10.3389/fclim.2019.00005; Sekera, J. & Lichtenberger, A, "Assessing Carbon Capture: Public Policy, Science, and Societal Need: A Review of the Literature on Industrial Carbon Removal," Biophysical Economics and Sustainability, October 2020. https://link.springer.com/article/10.1007/s41247-020-00080-5

The claim that EOR offers climate benefits and reduces emissions compared to other forms of oil production rests on the assumption that oil produced with EOR will replace more emissions-intensive production methods. Yet, this assumption overlooks the more likely scenario: increased EOR production will extend the life of the oil and gas industry and its associated infrastructure. According to Advanced Resources International's U.S. CO2-EOR Survey, there were 139 EOR projects producing a total of 245,000 barrels per day by the end of 2022, with roughly 20% of the CO2 supply coming from industrial sources.[17] An estimated 284 million barrels of "left behind" oil could be recovered using CO2-EOR, with an additional 80 million recoverable through next-generation EOR technology. In reality, EOR represents a growth strategy for the oil and gas industry, not a path to its phaseout.

The prospect of increased oil production presents a significant economic incentive to expand EOR. Until recently, this expansion was constrained by the limited supply and high cost of CO_2. The cost of capturing carbon from industrial sources can now be offset by the generous 45Q tax credit, allowing the industry to eke out more oil at a lower cost. The oil and gas industry is well-positioned to boost their production as well as revenue, all while framing its use of CO_2 in EOR as an effort to fight climate change.

Conclusion

EOR is not a new technology. For over half a century, the oil and gas industry has used it to boost recovery from existing reserves. However, with the reliance on captured carbon, proponents now label it as part of the climate solution. Federal subsidies like the 45Q tax credit have been pivotal in promoting CCS adoption. But since the only commercially viable use for captured carbon is currently EOR, much of this federal support has, and will continue to, fuel the production of a major greenhouse gas-emitting industry—oil and gas. To implement fiscally responsible climate solutions that truly reduce emissions, policymakers must strengthen oversight of EOR and explore alternatives that do not extend the life of fossil fuels or incentivize further emissions.

[17] Advanced Resources International, "The U.S. CO2 Enhanced Oil Recovery Survey," 2022. https://adv-res.com/pdf/2022-CO2-EOR-Survey-Brochure-FINAL-FEB-26-2024.pdf