Mitigating Climate Change While Producing More Oil: Economic Analysis of Government Support for CCS-EOR

Hossa Almutairi[a], Axel Pierru[b]

This paper examines the potential environmental impact of Carbon Capture and Storage with Enhanced Oil Recovery (CCS-EOR) technology from an economic perspective. CCS-EOR involves capturing carbon dioxide (CO_2) from various sources and injecting it into oil fields, leading to increased oil production through enhanced reservoir pressures. This approach has been regarded as a readily deployable carbon capture technology due to its economic viability and revenue potential from increased oil output.

A significant challenge faced by CCS-EOR, however, concerns the public perception of the technology, as storing CO_2 to stimulate oil production does not have an obvious climate benefit when first presented. As a result, the status of CCS-EOR as a climate change mitigation technology is often contested.

Addressing the question of the potential impact of CCS-EOR projects on global CO_2 emissions is therefore critical, since, presumably, the degree to which governments support these projects should be commensurate with their resulting reduction in emissions. Therefore, to design incentives that enable CCS-EOR projects, governments need to know whether the implementation of CCS-EOR reduces global CO_2 emissions, and, if so, to what extent.

Using a partial-equilibrium framework, we develop analytical formulas and marginal reasoning to evaluate the impact of incentivizing CCS-EOR projects on global emissions.

The total amount of global emissions attributable to implementing the incentivized CCS-EOR projects results from the addition of three effects:

- The first effect is the reduction in emissions due to the capture and storage of CO_2. Note that capturing a ton of CO_2 does not directly translate into an equivalent reduction in emissions at the source. For instance, facilities equipped with carbon capture tend to have a higher energy consumption per unit of output. Similarly, DAC installations are energy-intensive, potentially releasing CO_2 in their operational cycle. Emissions from CO_2 transportation to oil fields must also be considered.
- The second effect is the increase in emissions from the EOR oil produced.
- The third effect is the emissions saved due to the oil displaced from the global oil market by the EOR oil. We quantify the displacement effect with a simple, novel formula that depends on the price elasticities of global oil supply and demand.

Results indicate that CCS-EOR technology can potentially contribute to reducing global emissions. Depending on the technique used for enhanced oil recovery, the calculated emission reduction varies between 0.05 and 0.60 tons per ton of CO_2 stored (after full well-to-wheel decarbonization of the EOR oil).

If fully allocated to oil production, the environmental benefits of capturing a ton of CO_2 and storing it through conventional EOR can allow the oil producer to decarbonize 3.4 barrels on a well-to-wheel basis (i.e., including the emissions from the consumption of the barrels, which rep-

a KAPSARC, P.O. Box 88550, Riyadh 11672, Saudi Arabia. Email: hossa.mutairi@kapsarc.org.

b Corresponding author. KAPSARC, P.O. Box 88550, Riyadh 11672, Saudi Arabia. Email: axel.pierru@kapsarc.org.

resents most of the producer's scope 3) and 14.4 barrels when offsetting its oil-upstream emissions only. Fiscal incentives granted by governments to support CCS-EOR as a climate-change mitigation technology should be sized accordingly.

The US Inflation Reduction Act of 2022 (IRA) provides tax credits for CCS-EOR projects. Capturing a ton of CO_2 from industrial facilities or power plants for EOR provides a tax credit of \$60, while the credit for storing it in a saline reservoir is \$85 (Financial Times[4], 2022). The corresponding tax credits for a ton of CO_2 captured by DAC projects are \$130 and \$180, respectively. Political negotiations have significantly shaped the legislation, and the subsidies might have been tailored to the economics of CCS-EOR projects. However, the ratios 60 over 85 (equivalent to 71%) and 130 over 180 (equivalent to 72%) could be interpreted as an indication that, for the Biden administration, storing a ton of captured CO_2 through EOR reduces global emissions by 30% less compared to storing it in a saline reservoir. When examined in the context of our findings, the tax credit for CCS-EOR in the IRA is slightly higher than the amount that our calculations would justify.

With many countries committing to net-zero emissions targets by the second half of this century, it is imperative to consider and encourage all technology options. Since CCS-EOR has the potential to reduce global emissions, it must be recognized as part of the solution for achieving a net-zero world.