

Storing CO₂ through Enhanced Oil Recovery

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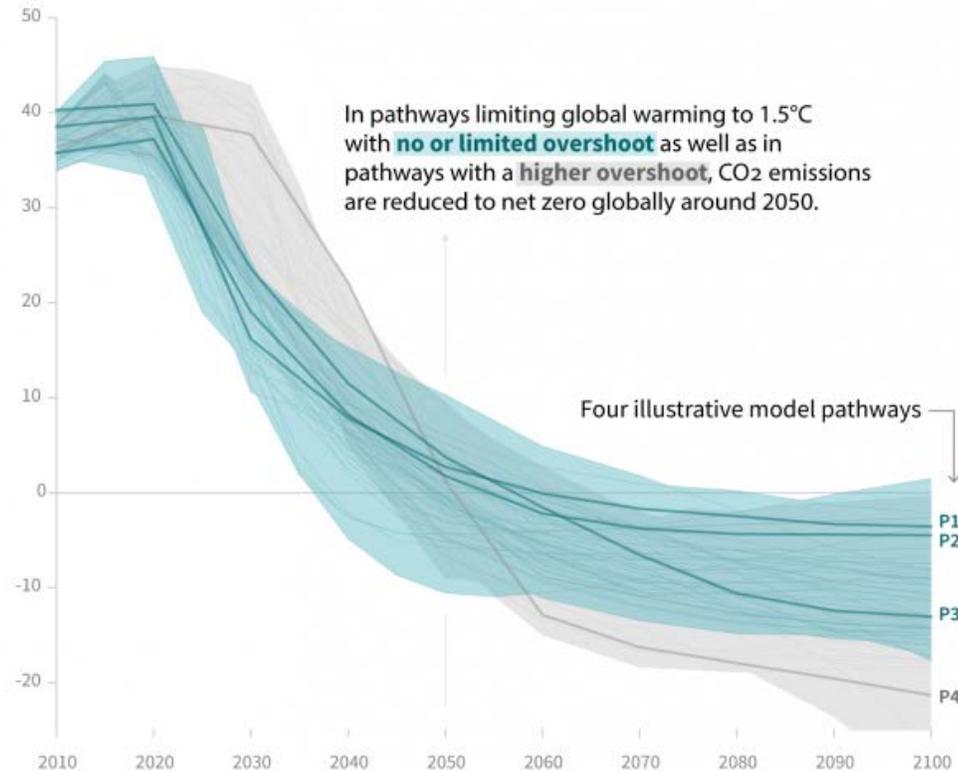
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Global CO₂ emissions need to be zeroed out by mid-century. Attempting this without CCUS is to make risky trade-offs.

Global total net CO₂ emissions

Billion tonnes of CO₂/yr



GOAL: Limit temperature rise to 1.5°C



Use CCUS



Use 1/3rd less energy, globally

RISKY BET

Large CO₂ storage capacity exists globally. But, CO₂ demand from U.S. Enhanced Oil Recovery is key.

NEED:

To reach 1.5°C, IPCC estimates CCUS to store **350 billion to 1.2 trillion metric tons of CO₂**

CAPACITY:

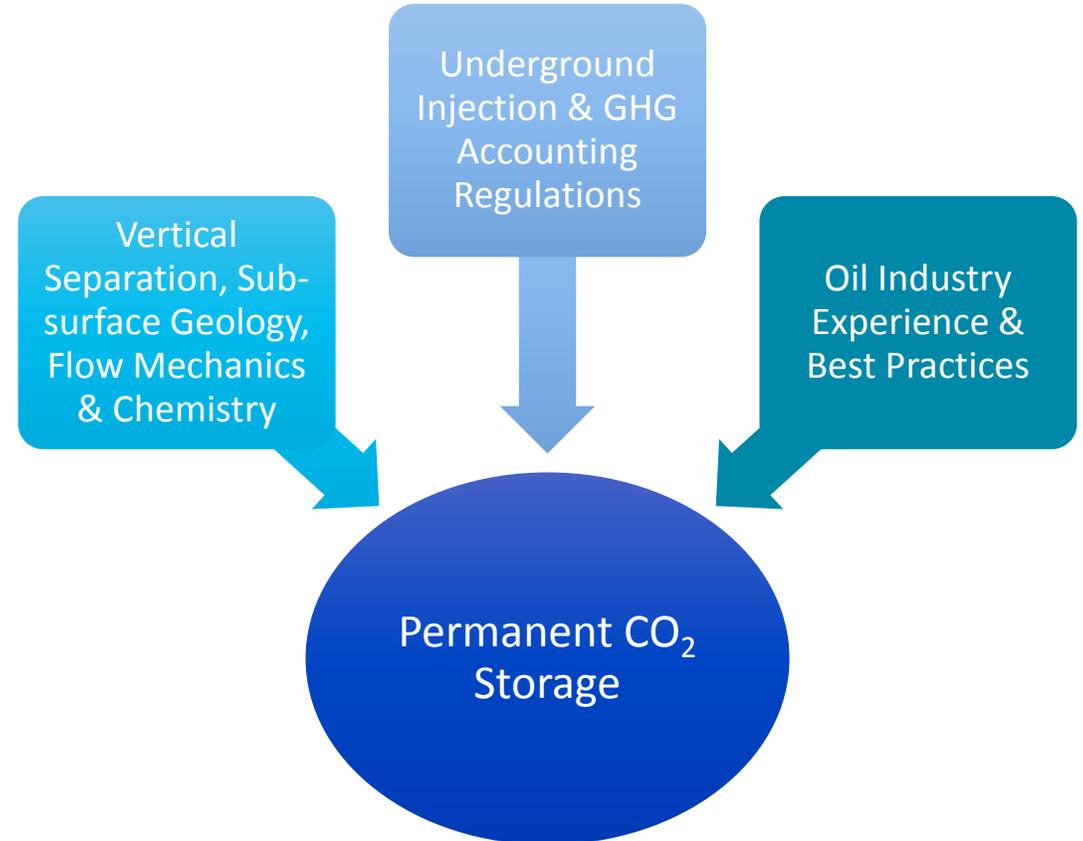
IEA estimates, **140 billion tons** of CO₂ storage available through **EOR**. The estimated capacity for **saline storage** is estimated to be as high as **10,000 billion tons** of CO₂.

ECONOMIC DRIVER:

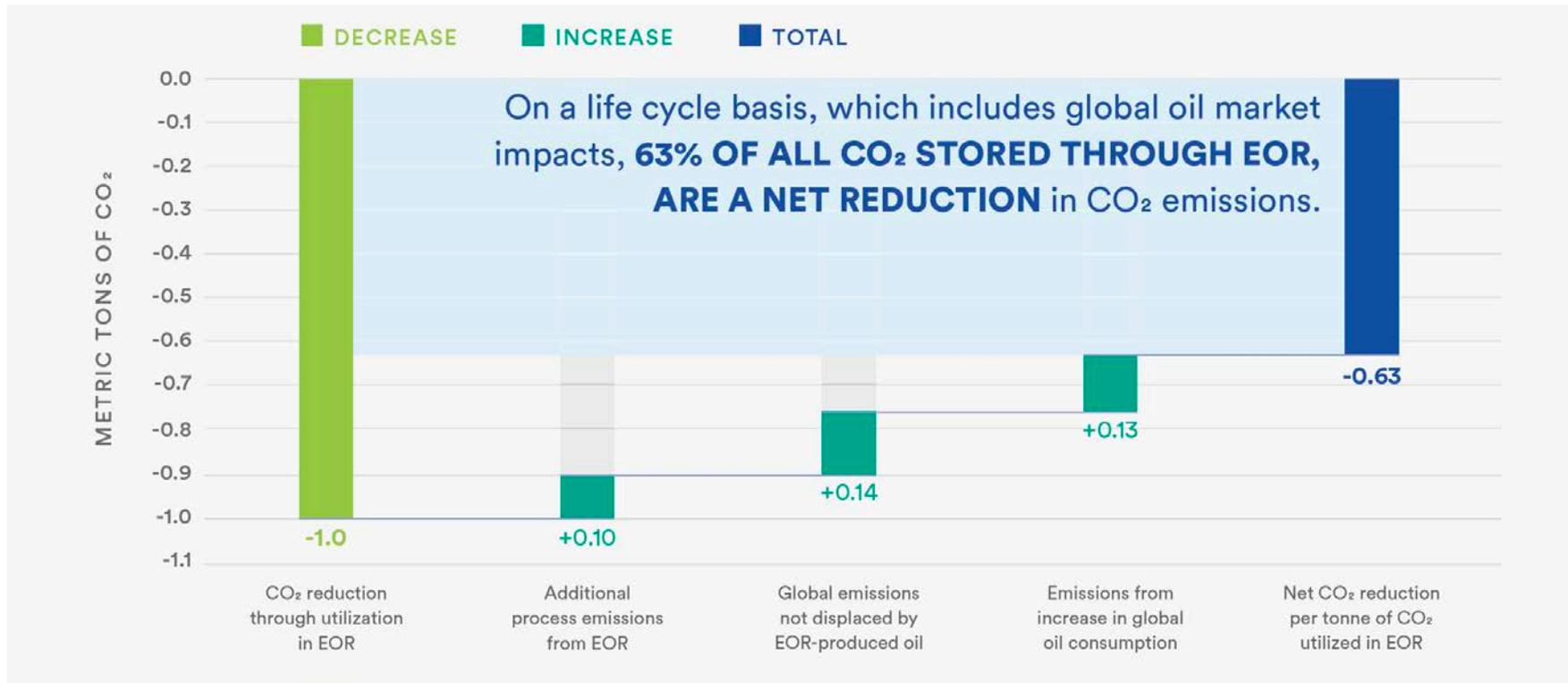
The **U.S. EOR industry** injects tens of **million tons of CO₂** today, most of which comes from natural sources. 45Q tax credit in addition to CO₂ revenues from EOR is expected to make CCS-EOR projects more economical relative to saline projects, which would not earn any additional revenues.

Geologic storage of CO₂ is secure.

- Current U.S. regulations for geologic storage of CO₂ either via EOR or in saline reservoirs require site assessment and identification of & mitigation of leakage pathways. Regulations also dictate parameters such as injection pressures, well construction and monitoring requirements. These regulations protect drinking water sources and provide accounting standards to determine CO₂ volumes stored.
- U.S. Treasury is expected to provide requirements for crediting storage under the 45Q. Discussions presently focused on ISO standard as a alternative to reporting under GHGRP Subpart RR
- The U.S. oil & gas industry has injected roughly a billion tons of CO₂ through EOR, leading to the development of knowledge that has led to carbon sequestration.



EOR results in a net CO₂ emission reduction, from "Well to Wheel", including oil consumption increase.



DISPLACEMENT:

- This assumes 80% displacement and 20% additional oil consumption
- We get a net reduction in emissions even at 50% additional oil consumption

TYPE OF OIL DISPLACED:

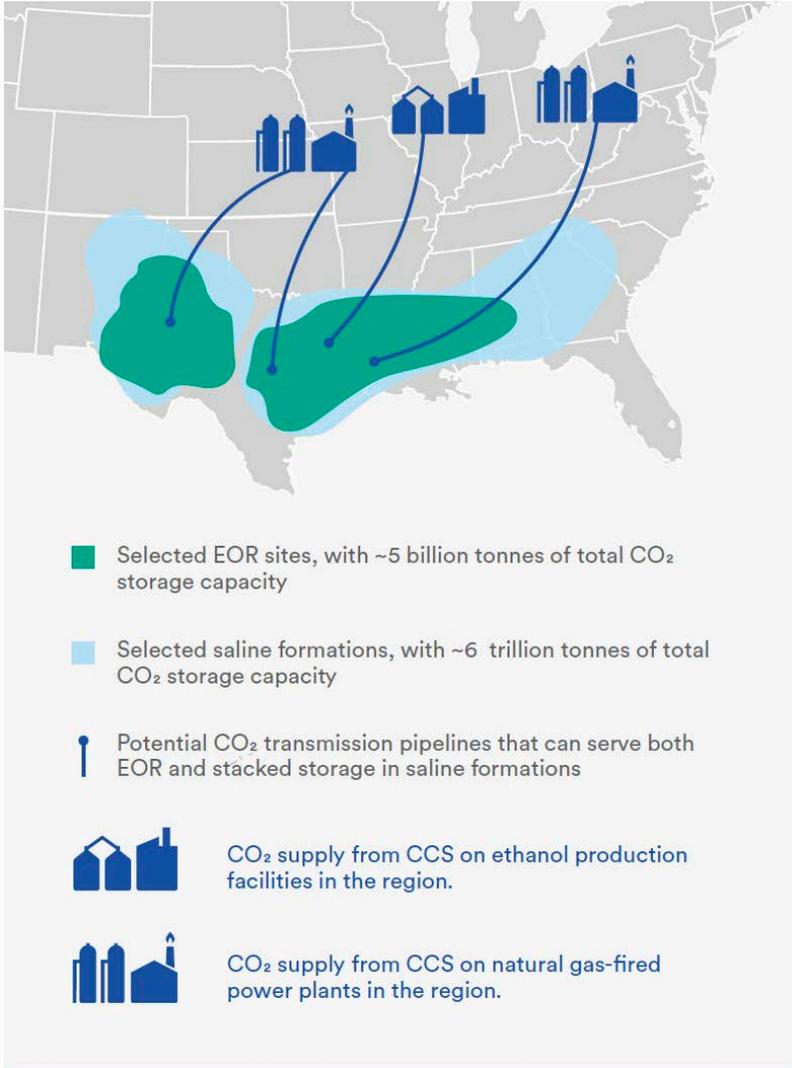
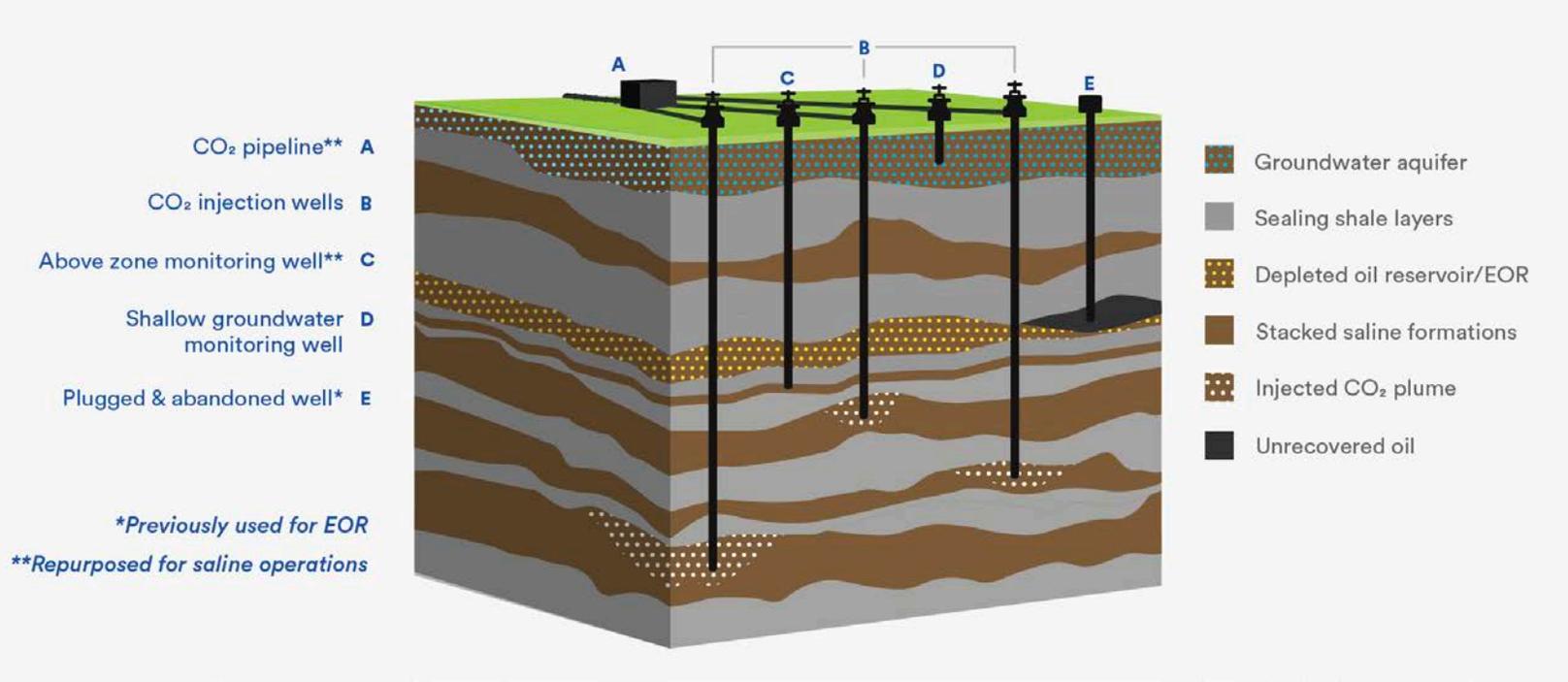
- This assumes equivalent oil displaced. If the dirtiest oil is displaced, there may be net negative emissions.

Source: IEA, "Storing CO₂ through Enhanced Oil Recovery," 2015,
https://www.iea.org/publications/insights/insightpublications/Storing_CO2_through_Enhanced_Oil_Recovery.pdf

EOR acts as a stepping stone towards wide-scale saline sequestration.

- **“Climate math” indicates we definitely need saline storage:** Even in the least optimistic scenario for CCUS, IPCC estimates 350 billion tons of CO₂ being stored through CCUS, which is greater than global EOR storage capacity estimate of 140 billion tons of CO₂.
- **EOR is relatively more profitable than saline projects today and are likely to be deployed more in response to 45Q.** 45Q can only be claimed for 12 years, after which the credit expires. CCUS projects storing CO₂ via EOR will continue to have revenue beyond the 12 year period, whereas saline projects can not access an equivalent revenue after the tax credits expire.
- **EOR will enable “learning by doing”** EOR is by far the biggest market for CO₂ and it will drive deployment of capture and storage projects such that the costs will reduce. Similar to how high demand for solar PV from Germany led to reductions in costs to manufacture solar PV.
- **EOR will drive private capital to building infrastructure for future saline use.** CO₂ pipelines and in some cases surface infrastructure and knowledge of sub-surface geology can be repurposed to perform saline sequestration, and EOR industry would have paid for it.

“Stacked” storage: Repeating saline reservoirs & shales could provide storage capacity in some depleted oil fields.



EOR may evolve to store more CO₂.

Currently, EOR operators seek to manage their operations to minimize the amount of CO₂ injected and stored per barrel of oil produced because CO₂ is a purchased commodity and cost to them. Public policy could incentivize EOR operators to innovate and to store much more CO₂ in the process of oil production than they do today, potentially leading to a higher net reduction in emissions or in net negative emissions.

Thank you.