CARBON CAPTURE AND STORAGE

International Energy Agency

CO_2-EOR for Storage: Issues and Actions

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2008 WEO on CO_2-EOR

- *"Prospects for O&G production and climate change":*
  - Estimated worldwide potential: 160-300 billion bbl incremental production to 2030 (7-14% of 2008 conventional reserves)
    - 80-130 bn bbl in ME region
    - 20-90 bn bbl in N Am
    - higher if greater uptake leads to lower cost (~500 bbl)
  - $22-70 barrel marginal production costs
    - Base case: 9.8 Gt CO_2 stored through CO_2-EOR by 2030. Would equal most of CCS Roadmap estimate for deployment over period
  - Carbon pricing will significantly alter cost curve for EOR

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CO_2-EOR for storage: what does it mean?

Technical Modifications	Energy Policy	Climate Policy
• Increase net CO_2 utilization through changes to design and operation (?) • Monitoring, measurement, and verification of similar stringency to that applied to saline aquifers • Abandonment to ensure long-term retention of stored CO_2	• Law and regulation to enable CO_2-EOR as a oil recovery process • Regulation to ensure that CO_2-EOR is undertaken safely for humans and the environment	• Measurable emissions reduction goals and accompanying policy • Laws and regulation enabling CO_2-EOR as climate change mitigation option • Accounting rules that accurately award credit for emissions avoided

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CO2-EOR for storage @ IEA

- First IEA effort to undertake a comprehensive bottom-up analysis of the role of CO2-EOR for storage
- Builds on three subthemes: technology, economics, policy&regulations
- Objectives
  1. Quantify global potential for CO_2-EOR to contribute to emissions reductions
  2. Identify gaps and barriers preventing project deployment
  3. Develop policy options to enable CO_2-EOR for storage

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Screening the opportunity

CO_2-EOR practice	*Description*	*Incremental recovery, % of OOIP*	*Net CO_2 utilization, mscf/bbl (t/bbl)*	*Technical potential, 10^9 bbl oil ($GtCO_2$)*
Conventional	• Miscible flooding • Typical WAG flood • Typically used CO_2 EOR techniques	6.5	5.7 (0.3)	187 (60)
EOR+	• Miscible flooding • "Next-" and "second-generation" approaches • Well control schemes¤ • Extension of miscibility range	13	11.3 (0.6)	375 (240)
Maximum storage	• Miscible flooding • Additional investments focused on increasing CO_2 storage • Removal of water from reservoir to increase pore volume • Zero life cycle emissions	13	17.0 (0.9)	375 (360)

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Main messages

- CO2-EOR could increase global liquids production by up to 430 billion bbl, or 25 % next 50 years
  - Total technical potential from abandoned fields, producing fields, field with expected start up before 2025
- CO2-EOR could increase amount CO2 stored globally by up to 390 Gt, more than three times the IEA 2DS requirement.
- Areas with highest storage potential have lower density of CO2 sources.
  - 75% of potential in ME, Russia, N. Africa, Central Asia

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Next Steps

1. Develop supply curves

- Correlate cost of production with reservoir location and geophysics
- Modify IEA supply course to include production from CO2-EOR under the three scenarios

2. Develop demand curves

- Develop long-run demand curves for different carbon pricing trajectories

3. Integrate supply and demand in modeling framework

- Examine changes in market equilibrium and overall emissions under different EOR scenarios

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Next Steps

4. Quantify cost penalty for CO2-EOR storage in relation to conventional CO2-EOR projects

5. Policies to promote CO2-EOR for storage?

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