Carbon Capture Utilization and Storage: Challenges and Opportunities

Fred Eames, Partner
April 14, 2021

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Agenda

Status of CCUS

CCUS Threats

CCUS Opportunities

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The Status of CCUS

After two decades of policy groundwork, CCUS is hitting its stride, thanks to:

- Ingrained focus on climate change, transformation of energy economy
- Need for low-carbon, reliable operations
- Incentives
  - Section 45Q tax credit
  - Other incentives (e.g., California LCFS)

Evidence for "hitting its stride":

- CCUS project announcements
- Low-carbon ventures business units/investments

- Broad support across political spectrum
- Corporate low or net zero emissions commitments

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Threats: Opposition to Fossil and CCUS

Activist group letter to Congress, March 18

- 300+ signatories, including Friends of the Earth, Center for Biological Diversity, OilChange U.S., 350.org, Progressive Democrats of America
  - Carbon capture and storage (CCS) is not a climate solution. Technological carbon capture applied to highemitting sources like petrochemical or fossil fuel power plants acts as a license to continuing polluting. . . . Worse, CCS actually exacerbates the climate crisis when captured carbon is used to pump more oil out of the ground.

Greenpeace – E&E, March 21

- Demonstration projects for coal and natural gas [are] a "colossal waste of money," need to be disconnected from enhanced oil recovery activities. "If storage goes forward, the entire enterprise needs to be decoupled, in design and implementation, from the fossil fuel industry.“

CCS or CCUS?

CCS

Pros

- Higher 45Q tax credit amount ($50/ton vs. $35/ton)
- Broader support from environmental community
- Less interconnected project risk (offtakers don't need CO2, facility is down, etc.)

Cons

- More difficult regulatory structure; EPA lead
- Larger project footprint – property rights, public intervention
- Less well-known containment – liability risk?

CCUS

Pros

- Well-known low containment risks
- Much smaller storage footprint
- Lighter-handed regulatory structure (Class II vs. Class VI UIC program); State regulatory lead

Cons

- Interconnected project risk
- Lower 45Q tax credit amount (balanced by fee for CO2)
- Environmental community resistance
- Future fossil fuel production risk?

Offtakers may have dual capability

Regulatory Barriers

CCUS

- **Will there be efforts to make CO2-EOR regulation more difficult?**

CCS

- **If policy and markets push toward non-producing storage, these issues become more important:**
  - Class VI reform - Risk-based endangerment standard, risk-based monitoring, financial responsibility, post-injection site care period, area of review
  - Class VI primacy

CCUS and CCS

- Permitting generally, linear infrastructure in particular
  - Pipelines, Pore space
- Fluidity of the climate response

  Regulation is more stable than public opinion!
- "Dynamic" cost-benefit valuations

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Regulatory Barriers

Infrastructure permitting and approvals

- NEPA
- Endangered Species Act
- Migratory Bird Treaty Act
- Clean Water Act/Wetlands
- Air Permitting
- Environmental Justice

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Oil Field Utilization versus Dedicated CCS

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BASE CASE

- **Single gasification project producing 200 MMcf/d of CO_2**
- **30 year life**
- **Total CO_2 Utilization : 2.2 Tcf of CO_2**

CO_2 ENHANCED OIL RECOVERY OPERATIONS

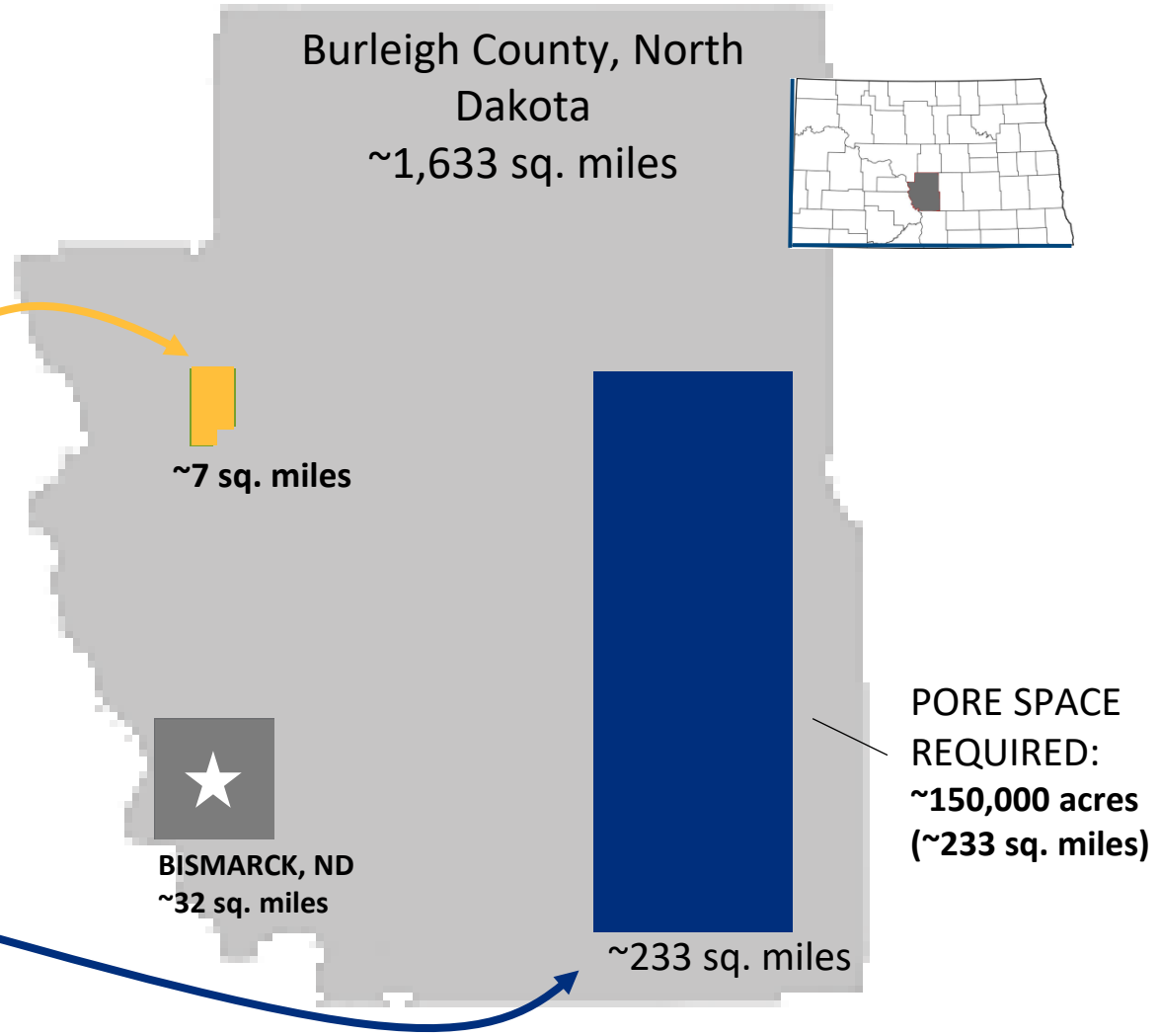
Oil Field Example (approximate values)

- 5,500'
- Reservoir Pressure: 2,500 psi
- Areal Extent: 4,600 acres
- Max CO_2 Utilization: 1.0 Tcf

DEDICATED CARBON CAPTURE & STORAGE

Saline Reservoir (approximate values)

- CO_2 to be stored: 2.2 Tcf
- 6,500'
- Reservoir Pressure: 3,000 psi
- Thickness: 125'
- Porosity: 20%
- Percent of pore space utilized: 4% (versus avg. 40% for EOR)



CCUS Opportunities

- Incentives Enhancements - Congress eager to provide additional incentives that will help reduce GHG emissions
  - Broad appreciation for the importance of CCUS to meeting climate goals
  - Extension and increase of 45Q tax credit
    - Proposed DAC credit increase
  - Direct pay for 45Q tax credit
  - Incentives for buildout of CO2 pipeline network
    - Federal eminent domain?
- Implementation of the USE IT Act - Reduce regulatory barriers
- State legal and regulatory improvements

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Fred Eames, Partner

Hunton Andrews Kurth
2200 Pennsylvania Ave., N.W.
Washington, D.C. 20037

202-778-2245
feames@hunton.com

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