Why Your Skillset is Critical for the Energy Transition

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What is Carbon Sequestration?

- **CCUS** – **C**arbon **C**apture, **U**se, & **S**equestration
  - Carbon – CO2
  - Capture – gathering CO2 from industrial processes, oil and gas production, or direct air capture
  - Use – usage of CO2 as industrial gas, or for Enhanced Oil/Gas Recovery
  - Sequestration – storing and containing CO2 in geological formations

- **SO MANY diverse skill sets and experiences are required for the CCUS industry to be successful. How do your skills apply?**

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Why CCUS?

- CCUS is an important technological option for reducing CO2 emissions in the energy sector and will be essential to achieving the goal of net-zero emissions
- As a country, 79% of US energy consumption is from fossil fuels[1]
  - If we hope to decarbonize, CCUS isn't an option, it's a requirement
- The global theoretical capacity for storing CO_2 in deep geological formations far exceeds that required to reach net-zero emissions.
  - Total global storage capacity has been estimated at between 8,000 Gt and 55,000 Gt

1. Data source: U.S. Energy Information Administration, Monthly Energy Review, Table 1.3 and 10.1, April 2023, preliminary data

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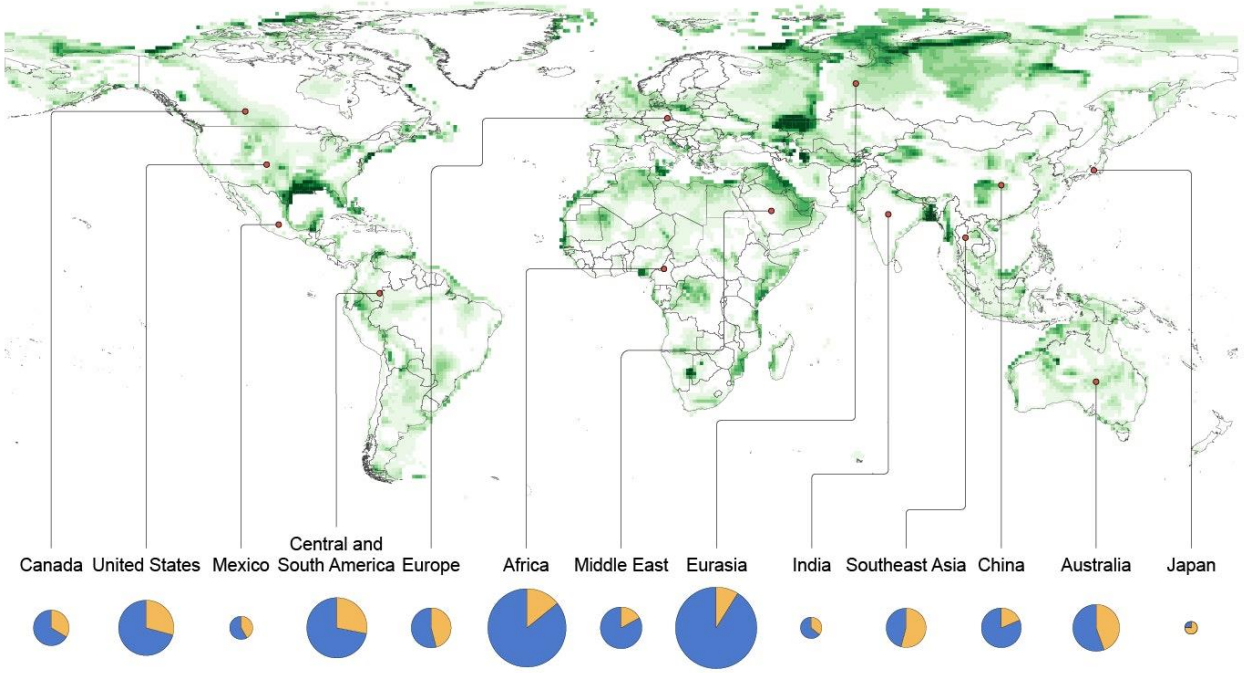
Global Theoretical Geological CO2 Storage Capacity



https://www.iea.org/reports/ccus-in-clean-energy-transitions/ccus-technology-innovation

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Where Are We Now?

July 2023 Global Status of CCUS Report

- 49 Mtpa (Million tonnes per annum) of CO2 capture capacity in operation
  - 32 Mtpa in construction, 280 Mtpa in development
- 41 facilities in operation
    - 26 in construction, 325 in development
- 198 new CCS facilities added to the project pipeline from prior year, and year-on-year growth has been >50% since 2020
- Significant policy incentives have been created that have driven growth, especially in North America and Europe
- 3 US states have gained Class VI primacy from EPA – ND, WY, LA

Despite this growth, the rate of development is not keeping pace with potential future demand, even in leading jurisdictions.

https://www.globalccsinstitute.com

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How Do We Get There?

- Projects must be commercialized – historically projects have been proof of concept and first movers
- Industries and companies must collaborate, even among competitors, to get to common solutions and standard practices
- Offshore sequestration is a must to access capacity needed
- Projects face significant regulatory hurdles
  - Fossil fuels can be harnessed to achieve very low carbon intensity products when combined with CCUS
- EIA's Net Zero case requires 50-100% scale up in workforce, especially highly skilled workers (**YOU!**)

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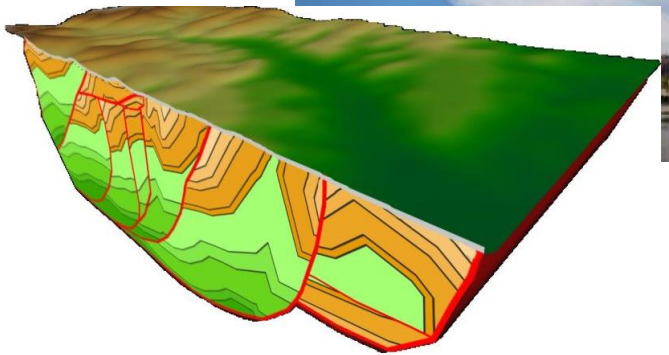
Basic Steps of CCUS Projects

- Identify a source of CO2
- Identify a sequestration reservoir
- Geological and Geophysical evaluation
- Gather well information – test wells and legacy wells
- Sequestration site permitting
- Design and build pipeline
- Design and construct injection and monitor wells
- Sequester CO2 (operations phase)
- Long-term monitoring and site closure

Project Feasibility Phase

- Identification of source – where is CO2 coming from?
  - Business development
- Design and engineering for capture method
  - Mechanical engineering
  - Chemical engineering
- Identification of sequestration site
  - Geology
  - Geophysics
  - Reservoir engineering
  - Land & Legal considerations



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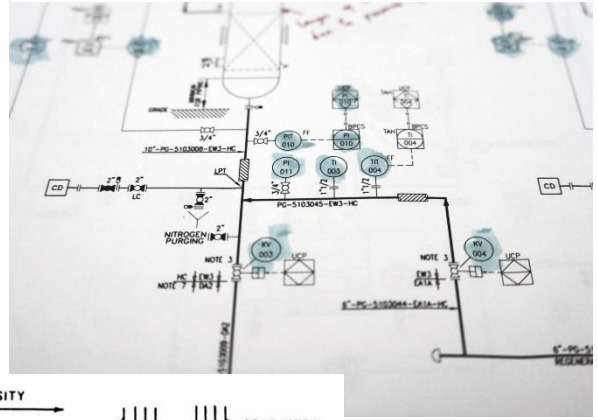
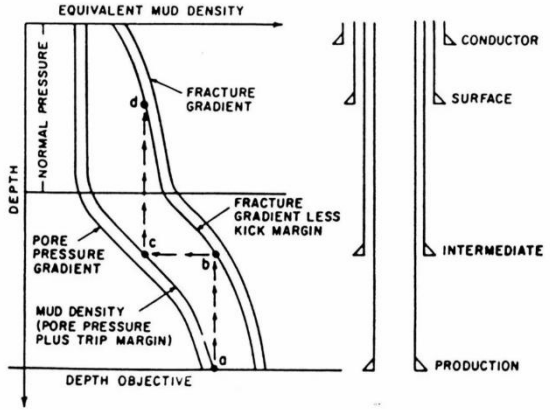
Project Design Phase

- Capture Facility
  - Construction
  - Mechanical Engineering
  - Chemical Engineering
  - EH&S
- CO2 Transportation – Pipelines
  - Materials/Metallurgy
  - Flow Assurance (ensure CO2 remains in desired state)
  - Facilities Engineering
  - Environmental Engineering
- Well Planning and Design
  - Geology & Geophysics
  - Drilling & Completions Engineering
  - Materials/Metallurgy



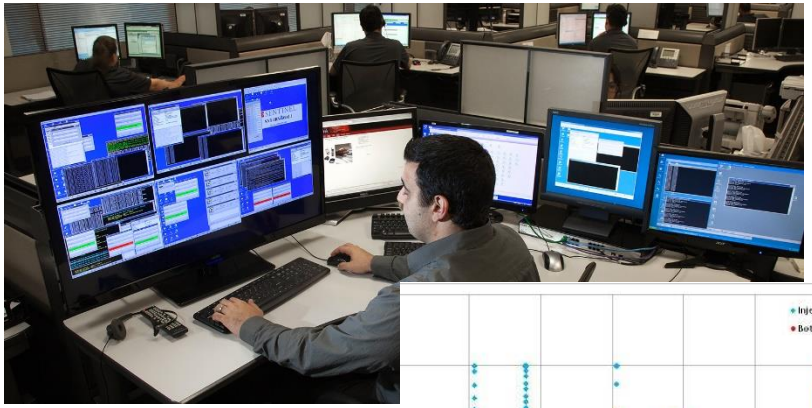


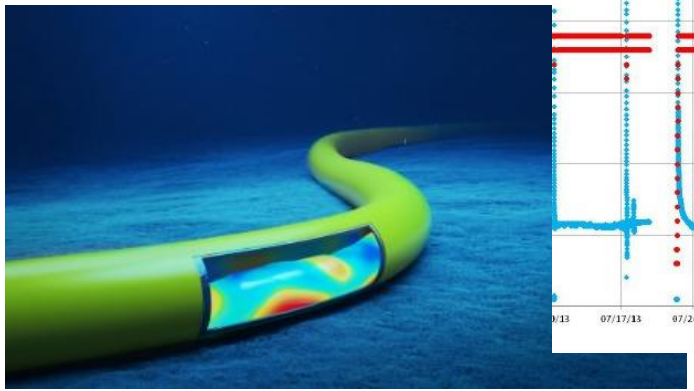
Project Development Phase

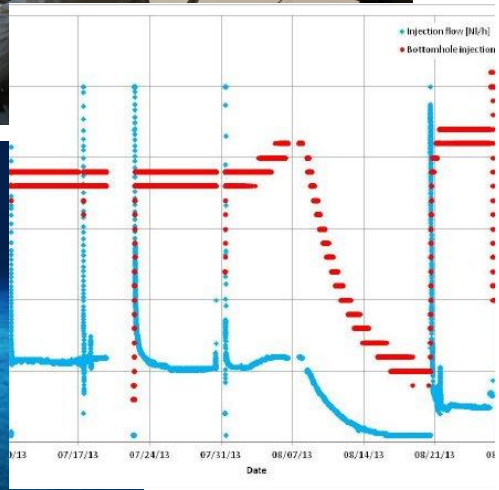
- Facility and Pipeline Construction
  - Construction Management
  - EH&S
  - Mechanical Engineering
  - Controls and Automation
- Well Construction
  - Drilling & Completions Engineering
  - Geology
  - EH&S
  - Data Management
  - Regulatory Management

Sequestration Operations

- Well Monitoring and Injection Optimization
  - Petroleum Engineering – Operations and Reservoir
  - Geology and Geophysics
  - Data Management
- Permitting and Reporting
  - Regulatory Management
  - Land and Legal Management
  - Petroleum Engineering
  - Environmental Engineering
- Interventions
  - Petroleum Engineering
  - EH&S
  - Materials and Metallurgical Engineering
  - Chemical Engineering
  - Geology and Geophysics

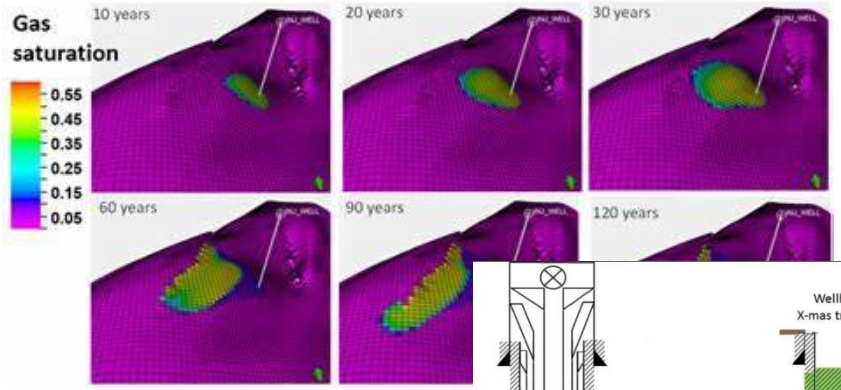


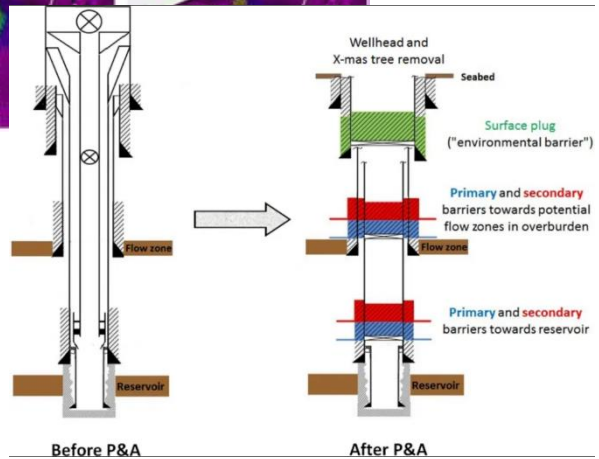




Post Injection Site Care and Closure

- Long-term Monitoring (50+ years)
  - Petroleum Engineering
  - Geology and Geophysics
  - Data Management
  - Environmental Engineering
- Permitting and Reporting
  - Regulatory Management
  - Land and Legal Management
  - Petroleum Engineering
- Plug and Abandonment & Site Restoration
  - Petroleum Engineering
  - Regulatory Management
  - Land & Legal Management
  - Data Management





Thank you
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