Science, Modeling & Better Policy

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Concept to Execution

Modeling is integral at almost every step

Concept and Raw Data → Derived Data → Characterization and Modeling

Data Presentation for Informed Decision Making → Numerical Analysis
Concept > Raw/Existing Data > Sample Collection

Area of Interest and Data Gathering

- Well Logs
- Core
- Seismic
- Outcrop Plugs
Models inform models

Model

\[
 k_{rn} = \frac{\int_{S_{m ax}}^{S_{w r}} dS_w}{\int_{S_{m ax}}^{S_{w r}} P_c^{2+2b}}
\]

\[
 k_{n} = 250 \times \frac{\Phi^3}{S_{w r}^2} \quad [\text{Morris & Briggs}]
\]

\[
 \Phi_n = \frac{\Phi_{den} + \Phi_n}{2} \quad \text{non - gas}
\]
Characterization and Modeling

Data synthesis for site assessment

- Geologic characterization
  - Identify faults and other conductive pathways
  - Identify potential targets
  - Explore regional geologic properties and correlations

- Understand data gaps and uncertainty

- Plan simulation suite to address project/policy goals
Numerical Analysis/Computation Simulation

Numerical analysis to test plausible scenarios and address risk and uncertainty

Numerical Analysis and Simulation
- Site suitability
- Storage capacity and security
- Scenario analysis
- Risk identification and quantification

Stacked Storage vs Single Formation Storage
CCS & Global Policy Goals

- The United Nations Intergovernmental Panel on Climate Change & the International Energy Agency support CCS as a crucial low-carbon technology needed to achieve societal climate goals.

- CCS can reduce emissions at scale from critical industrial sectors, including cement, steel and fertilizer manufacturing, as well as power generation.

- Paris Climate Change Agreement commits to reducing greenhouse gases by 45% by 2030 & net zero by 2050.

- Of the roughly 40 billion metric tons of CO2 emitted globally last year, the U.S. was responsible for approximately 5 billion metric tons.
CCS Projects are Complex & Expensive

CUSP Iron Mountain Subsurface Characterization
Concept Diagram

1. Project Management, Planning and Reporting
2. High-Level Geologic Site Characterization
   - Evaluate well data and outcrop samples
   - Analyze existing 2D seismic
   - Collect gravity data
3. Geologic Modeling and Simulation
   - Geologic modeling and site assessment
   - Model Simulation
   - Area Of Review Assessment
4. Risk Assessment and Mitigation
   - National Risk Assessment Partnership (NRMP) Screening
   - Induced Seismicity Assessment
5. Non-Technical Issues and Scenario Analysis
   - Land & Pore Space, Water Rights, ReW
   - Economic & Scenario Assessment
   - Outreach & Non-Technical Risks
6. Stratigraphic Well & 3D Seismic Survey Assessment
7. UIC Class VI Application Plan
8. 45Q Tax Credit Application Plan
CCS Policy Carrots & Sticks

- EGI leader in the Carbon Utilization and Storage Partnership (CUSP)
- Jumpstart 45Q ready projects in the Western US
  - 45Q provides tax credits for geologic storage of Carbon Oxides (CO2)
    - $60/tonne of CO2 stored in EOR projects
    - $85/tonne of CO2 stored in other formations such as saline aquifers

- The U.S. Environmental Protection Agency has proposed a new rule that would require most fossil-fuel power plants to install CCS technology by 2035
Commercialization of Carbon Storage in Utah and beyond

- Significant storage capacity
  - Enhanced Oil & Gas Recovery
  - Saline Aquifers - Storage hub(s)
- Industry is ready to take advantage of 45Q – Iron, Cement, Fertilizer Manufacturing
  - EGI provides technical and policy expertise for acquiring 45Q tax credits
- Working with oil & gas companies on potential of CO2 sequestration beneath operating oil & gas fields
- Targeting injection sites beneath Utah School and Institutional Trust Lands benefiting Utah Schools
EGI’s Carbon Science Initiative has been addressing CCS technical issues for over 2 decades

Achievements:
• One million tons CO₂ storage
• Optimization of storage monitoring and risk assessment
• High resolution quantification of uncertainty
• Blueprint for CCUS in southwestern U.S.
Complex CCS Regulatory Landscape

- **Federal Laws Regulating Air Quality, Water Quality & Environmental Impact**
  - Clean Air Act
  - Safe Drinking Water Act
  - National Environmental Protection Act
    - Environmental Impact Statement
    - Environmental Assessment
  - Endangered Species Act
  - Energy Policy Act of 2020
  - Administered by federal agencies unless permission granted for state or tribal agencies to regulate

**State Lands**
- DOGM
- DEQ
- DWR

**Federal Lands**
- BLM
- EPA
- Fish & Wildlife

**Tribal Lands & Indian Country**
H.B. 244 Geological Carbon Sequestration

- Passed During the 2022 Utah Legislative Session
  - Sponsored by Representative Steve Handy
  - Sponsored in the Senate by Senator David Hinkins

- Provides a policy pathway for Utah Division of Oil, Gas & Mining to establish a permitting program for commercial geologic carbon sequestration projects
  - Safe Drinking Water Act – Underground Sources of Drinking Water
  - EPA Underground Injection Control Program – Class VI Well

- Addresses liability, ownership and other critical legal issues
Primary Objective:

- To establish the feasibility of a commercial-scale CO$_2$ geological storage complex to sequester 50 million metric tons of captured CO$_2$ in 30 years.

Modeling Better Technical and Policy Solutions