



Energy & Geoscience Institute
AT THE UNIVERSITY OF UTAH



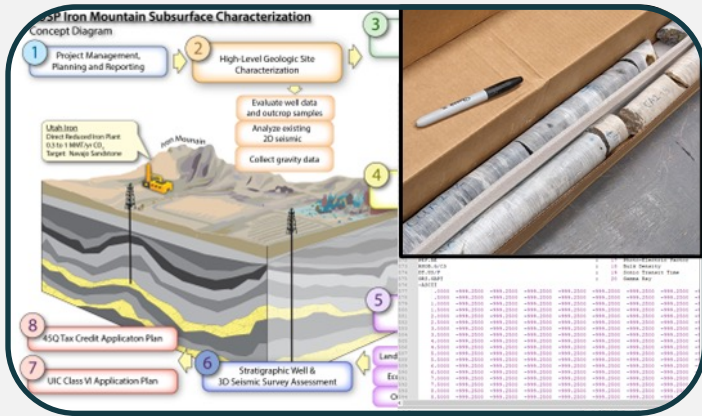
Science, Modeling & Better Policy

Dr. Nathan Moodie & Rob Simmons

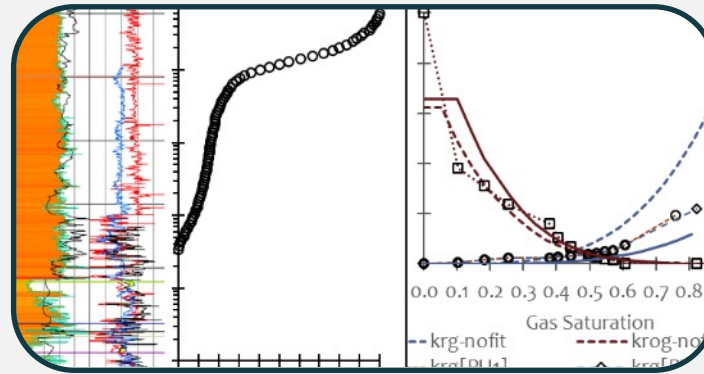
Concept to Execution

Modeling is integral at almost every step

Concept and Raw Data



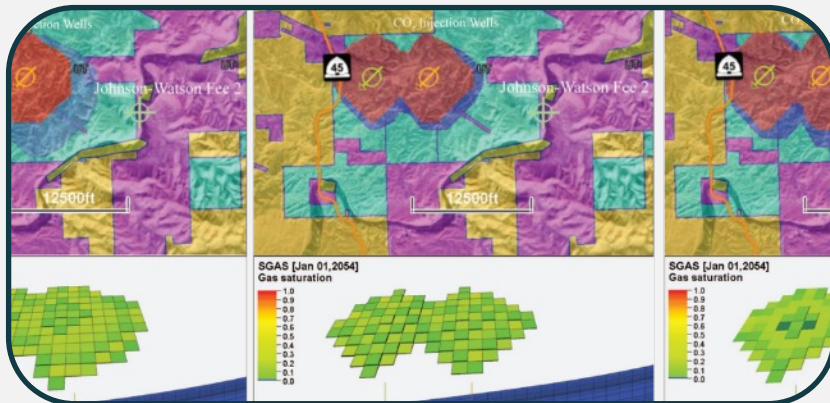
Derived Data



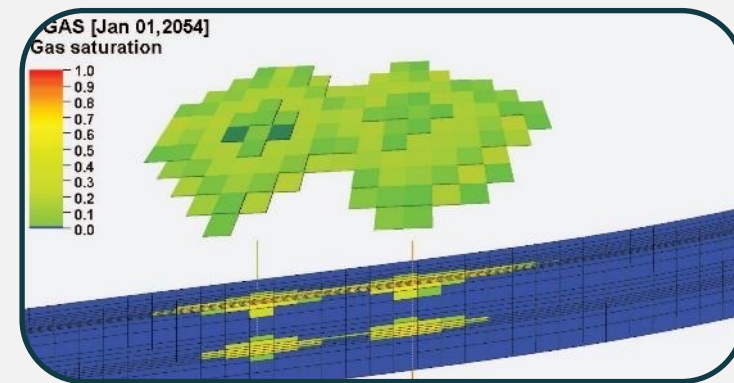
Characterization and Modeling



Data Presentation for Informed Decision Making

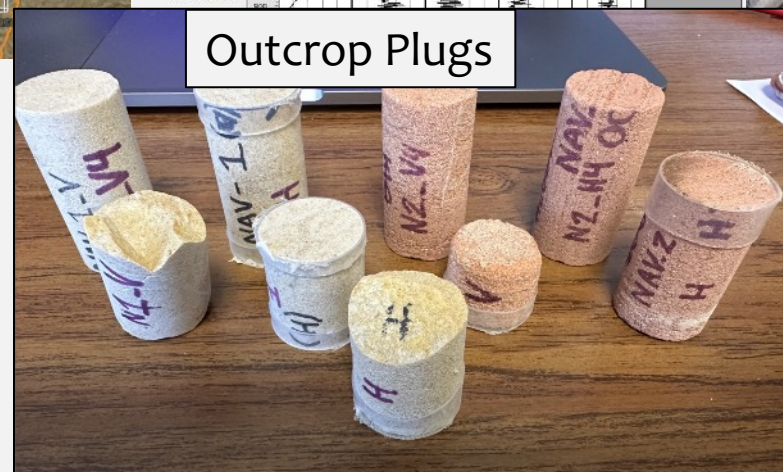
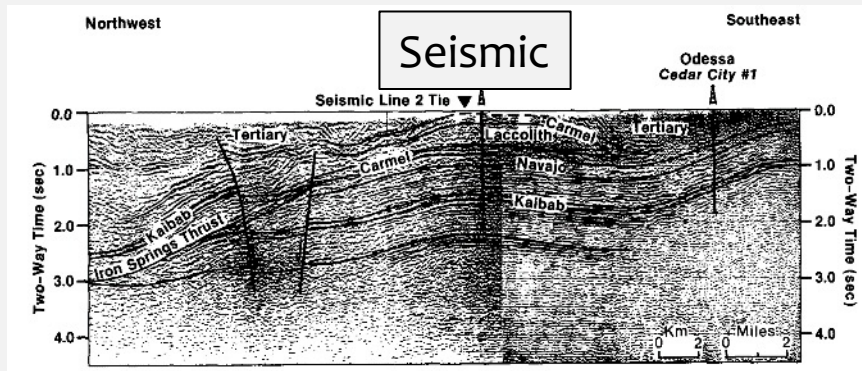
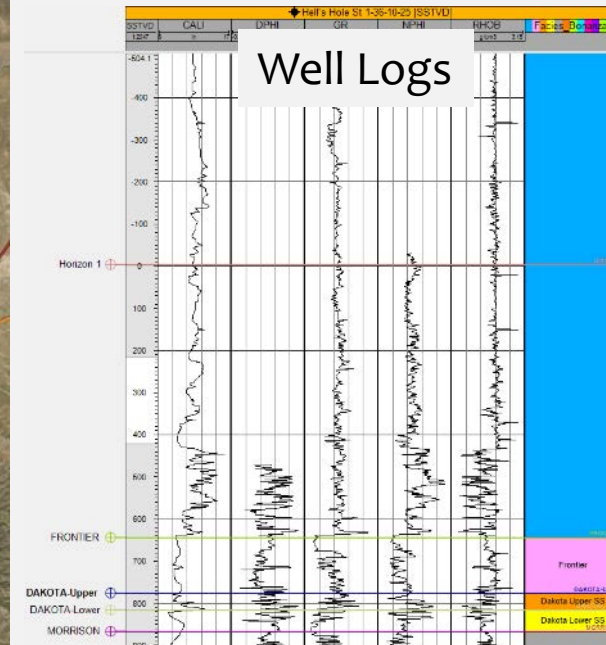
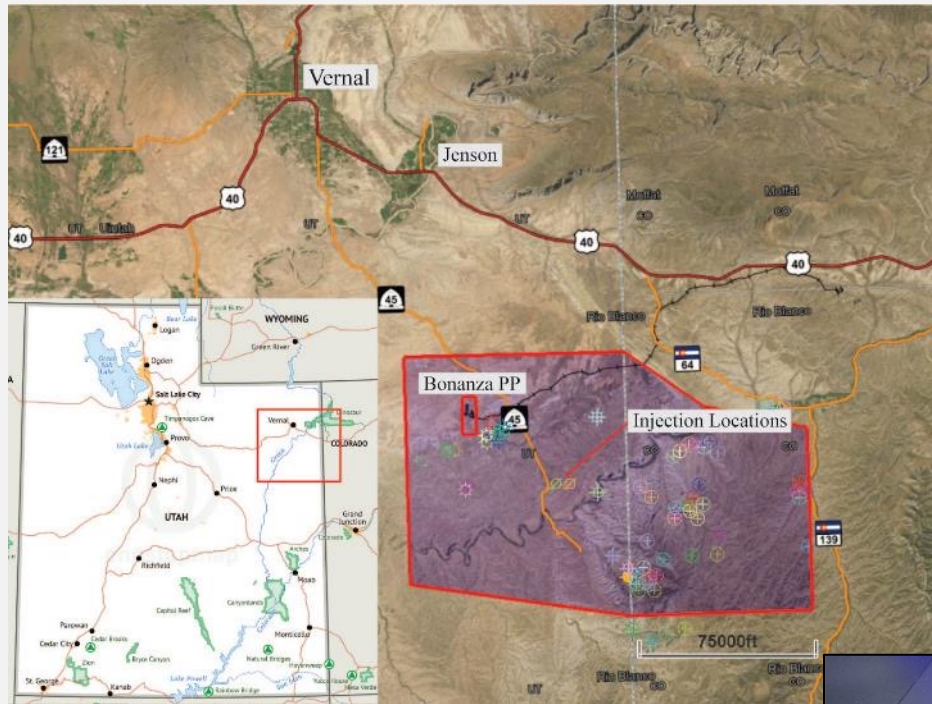


Numerical Analysis



Concept > Raw/Existing Data > Sample Collection

Area of Interest and Data Gathering



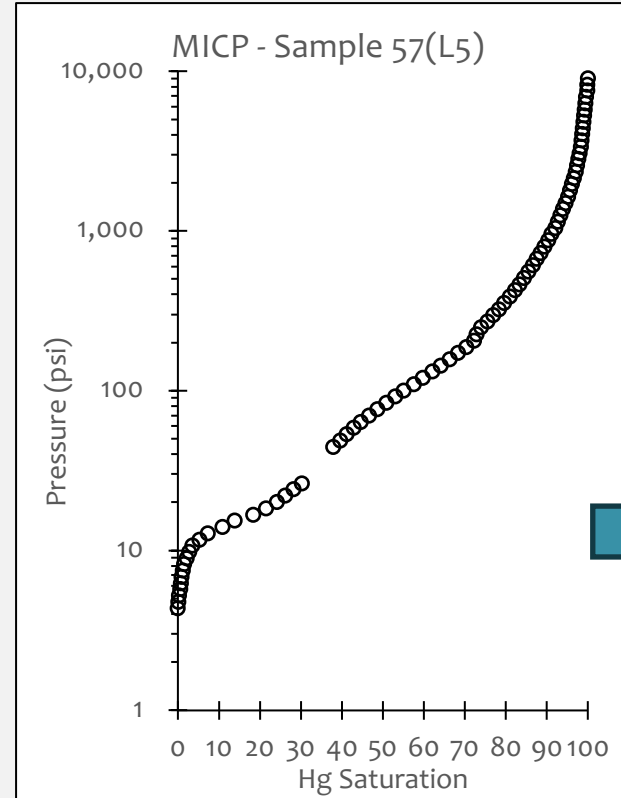
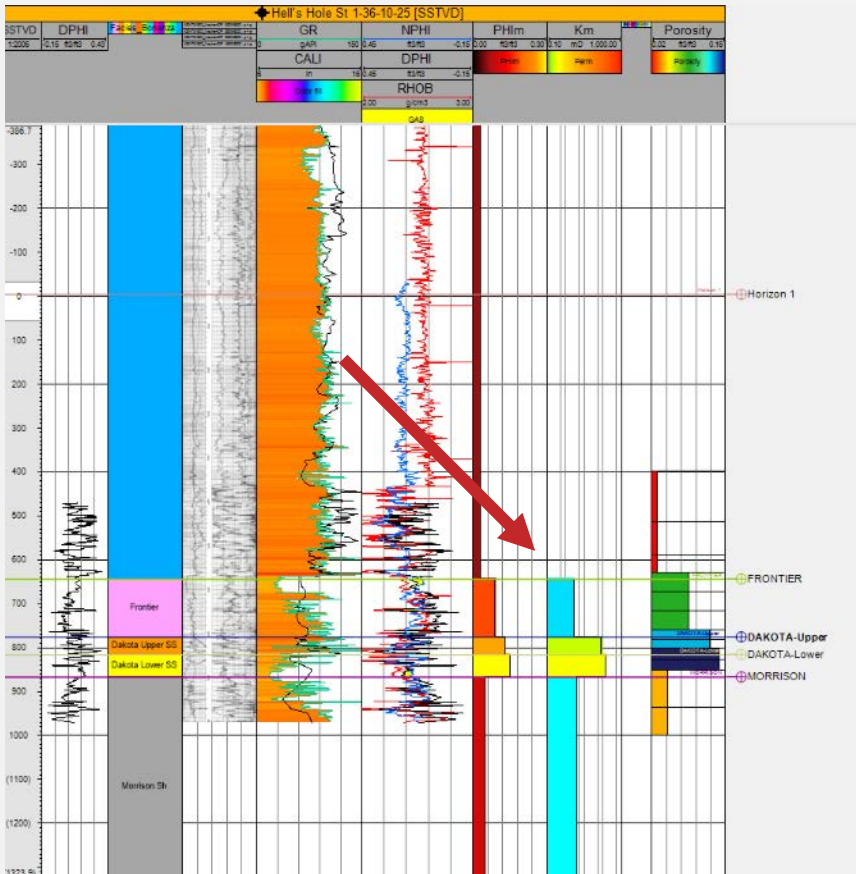
Derived Data & Laboratory Analysis

Models inform models

Models

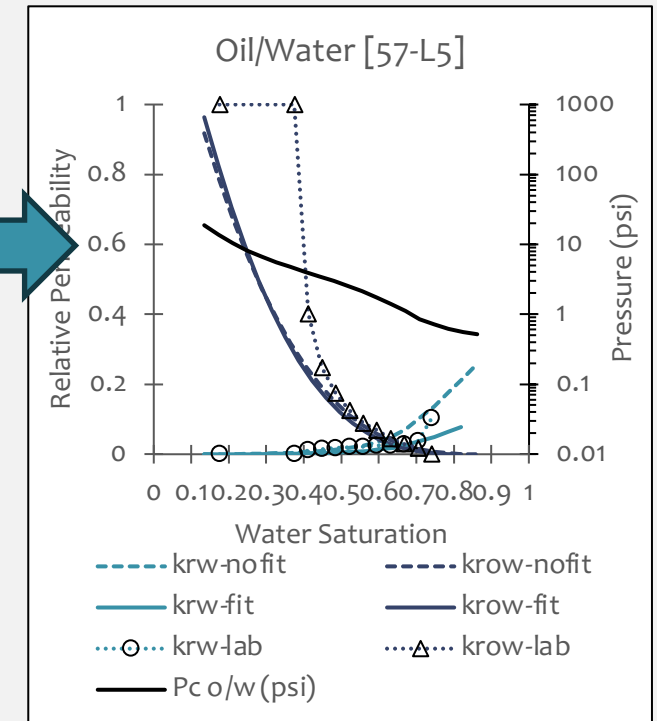
$$k = 250 * \frac{\Phi^3}{S_{wir}^2} [Morris\&Briggs]$$

$$\Phi_{nd} = \frac{\Phi_{den} + \Phi_n}{2} \text{ non-gas}$$



Model

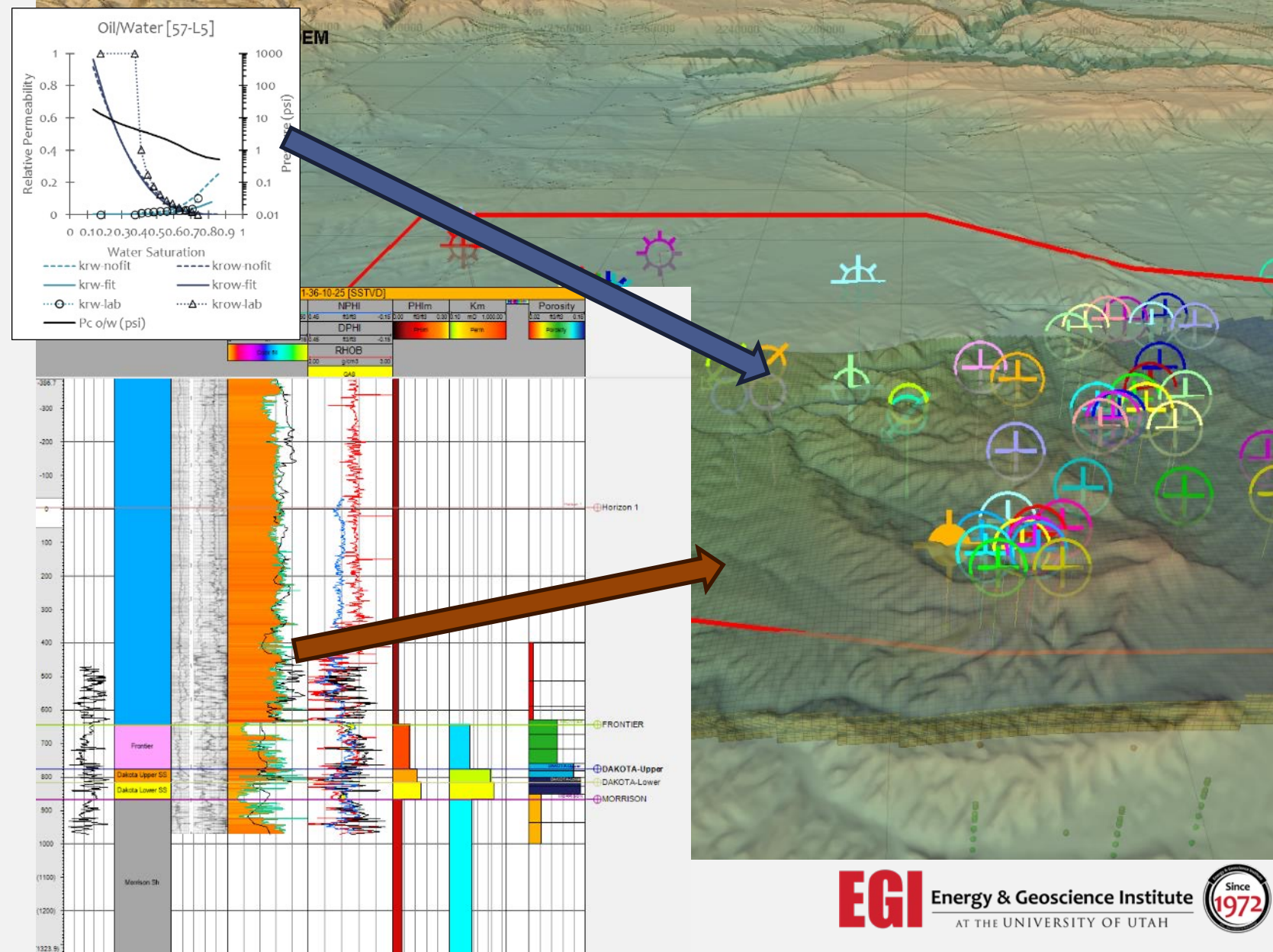
$$k_{rn} = \frac{\int_{S_w}^{S_{max}} \frac{dS_w}{P_c^{2+2b}}}{\int_{S_{wr}}^{S_{max}} \frac{dS_w}{P_c^{2+2b}}}$$



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



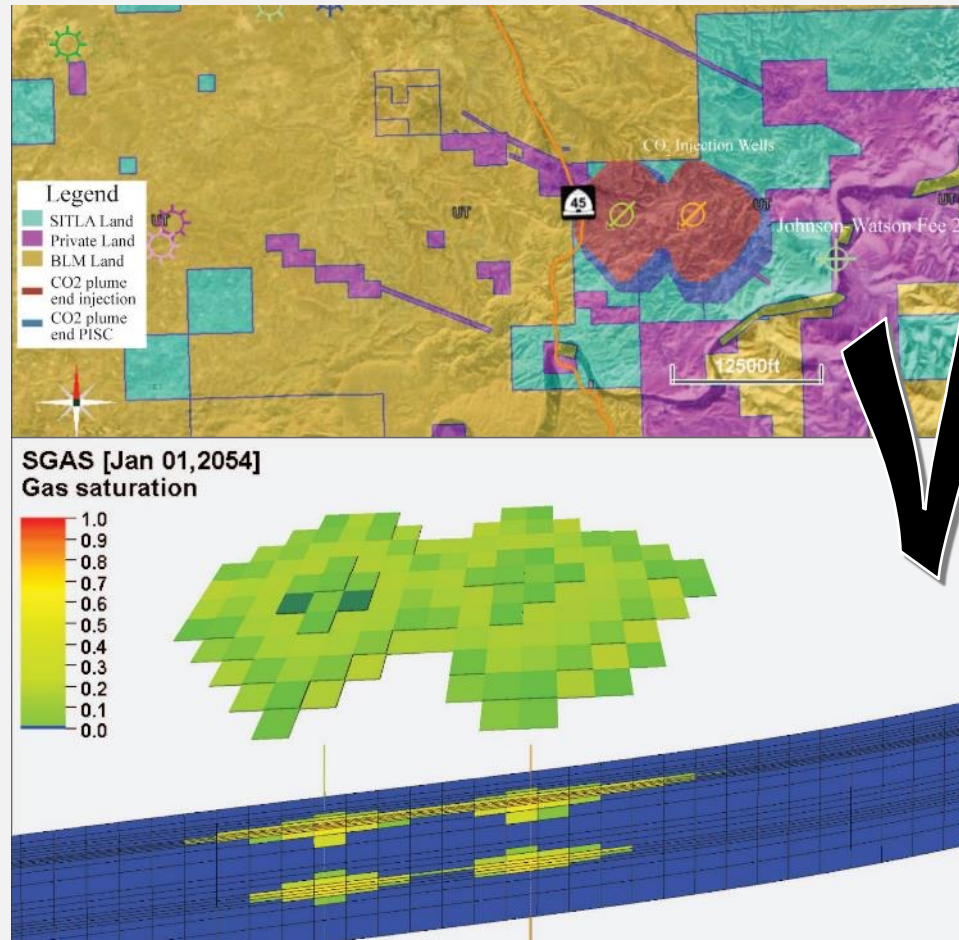
Numerical Analysis/Computation Simulation

Numerical analysis to test plausible scenarios and address risk and uncertainty

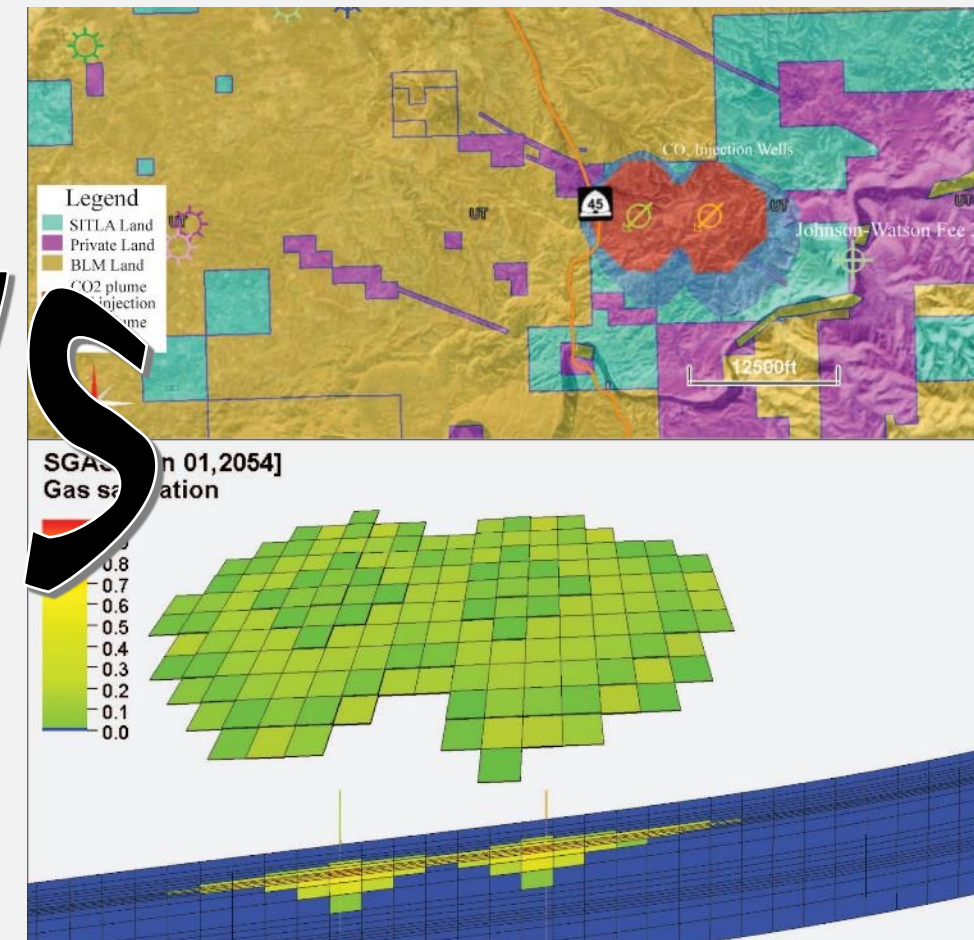
Numerical Analysis and Simulation

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

Stacked Storage



Single Formation Storage

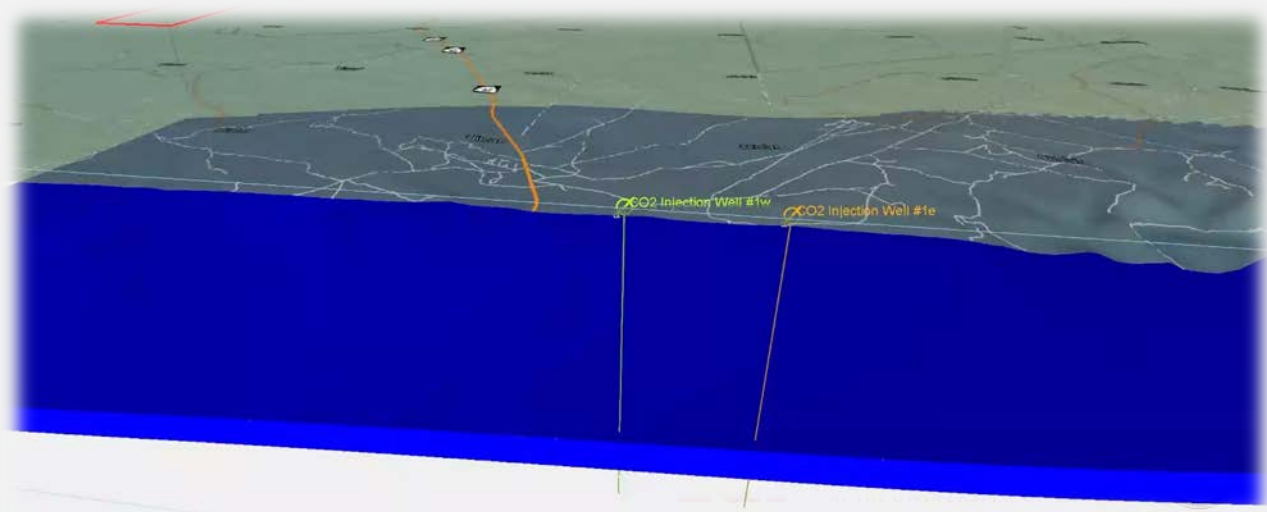
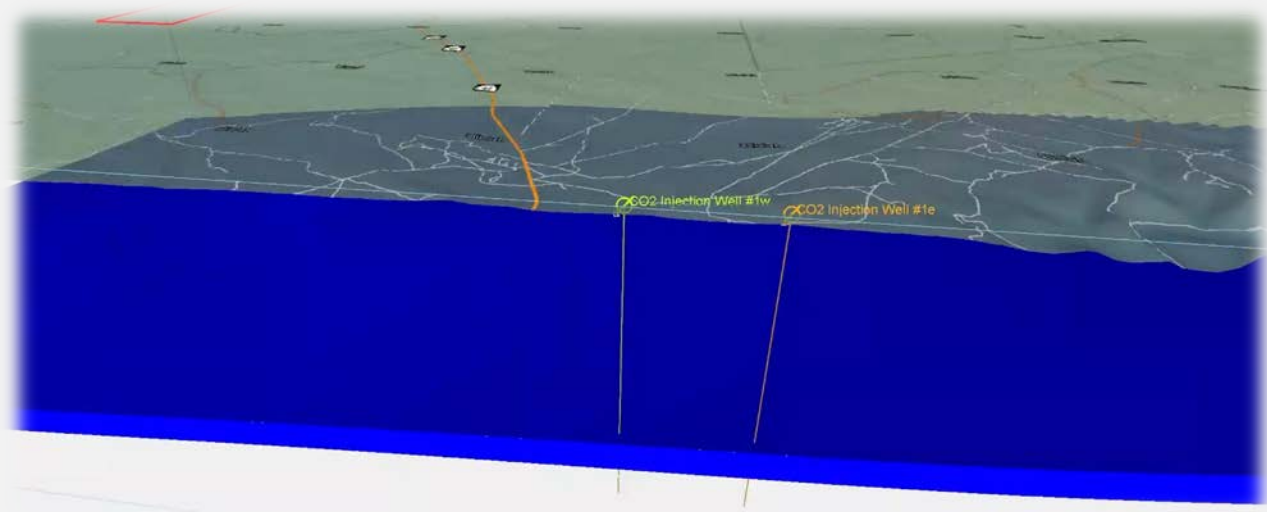
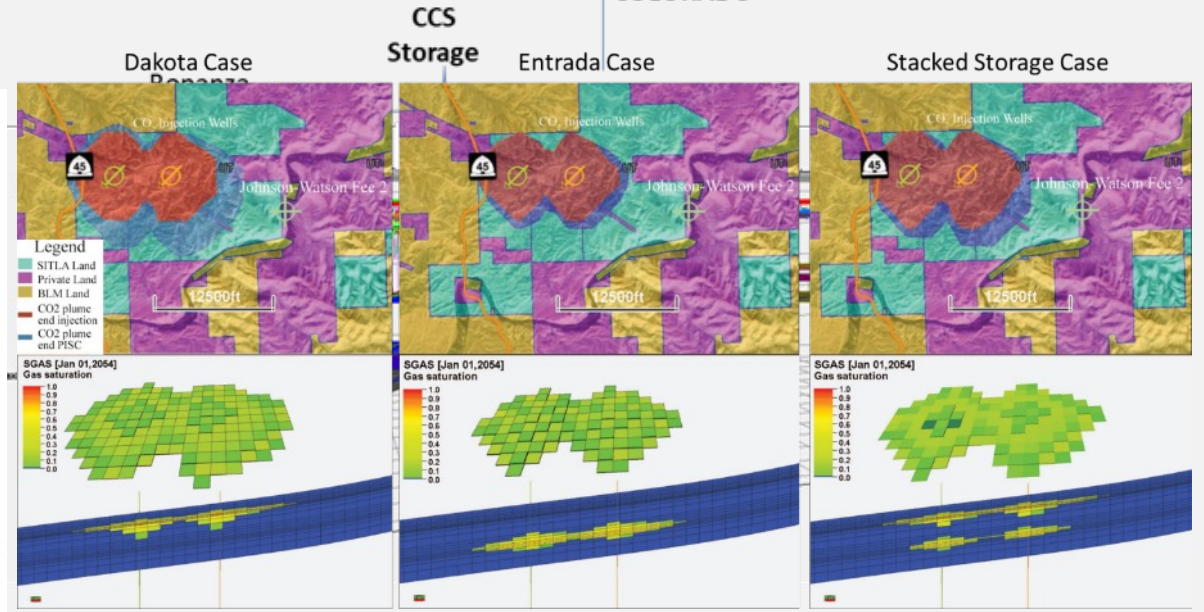
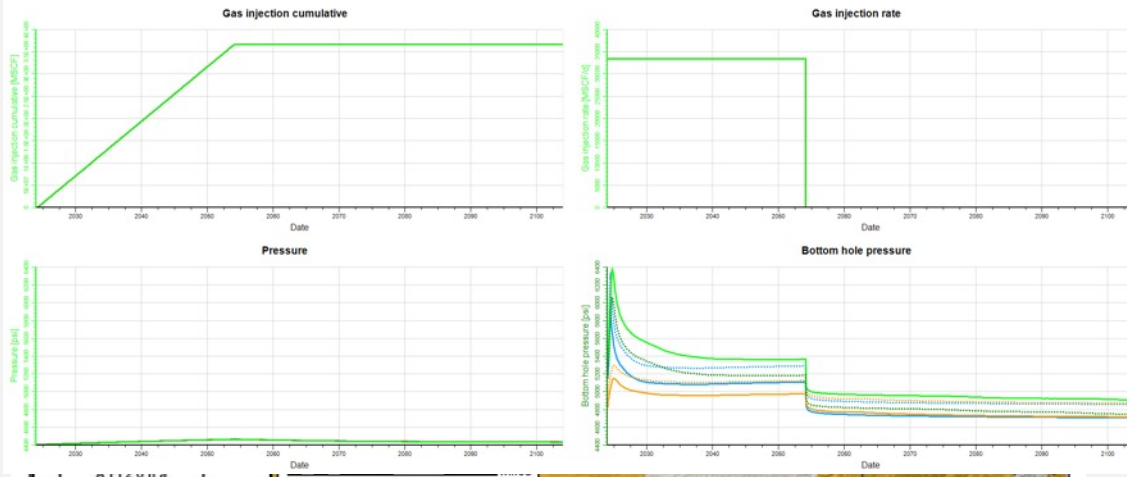
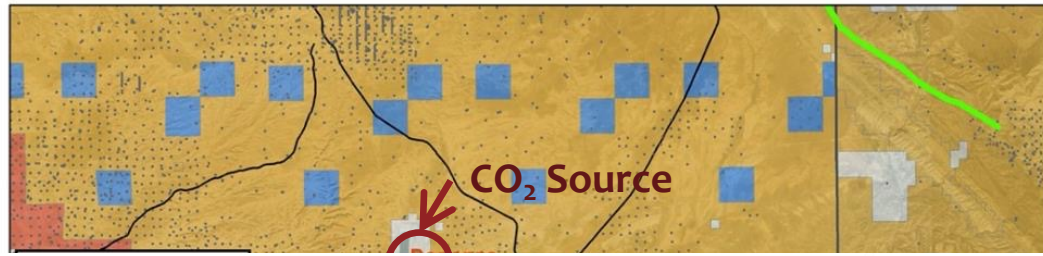


VS

Data Presentation for Informed Decision

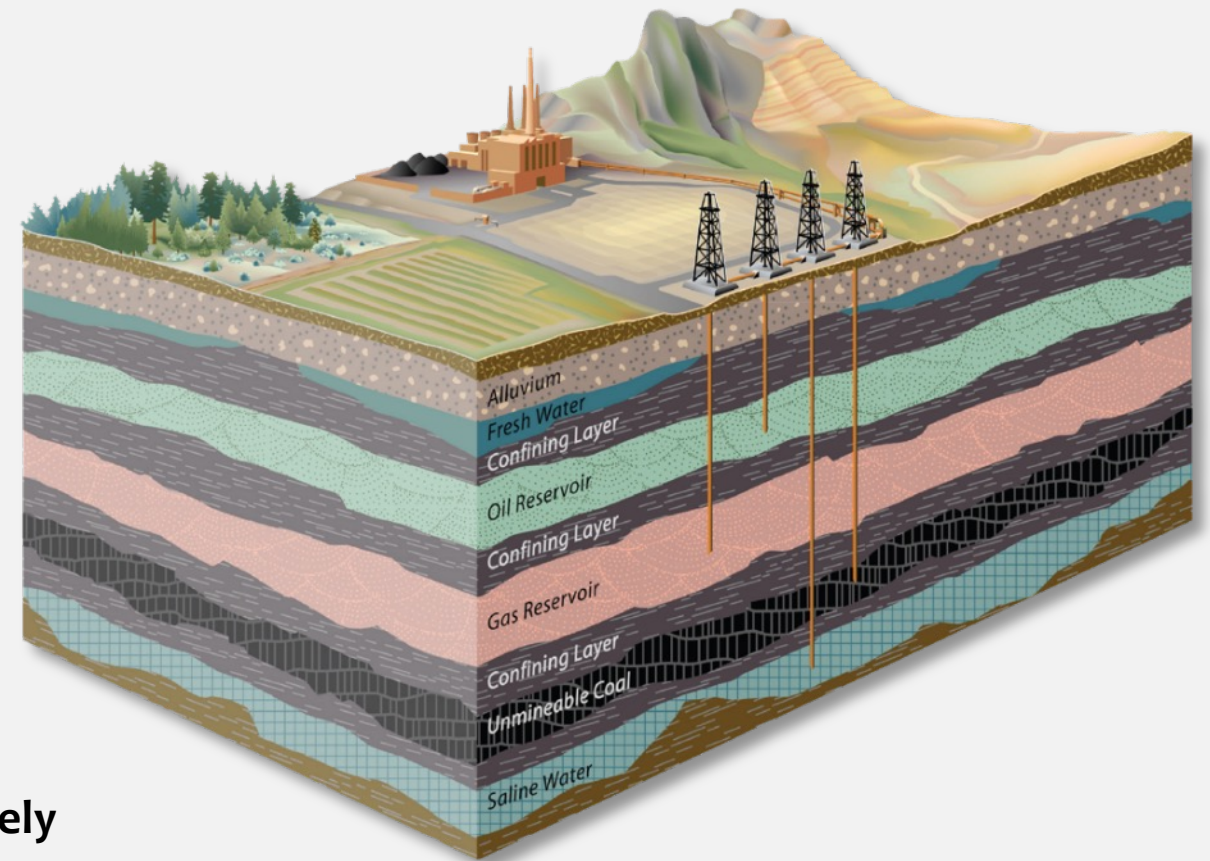
Making

UTAH COLORADO

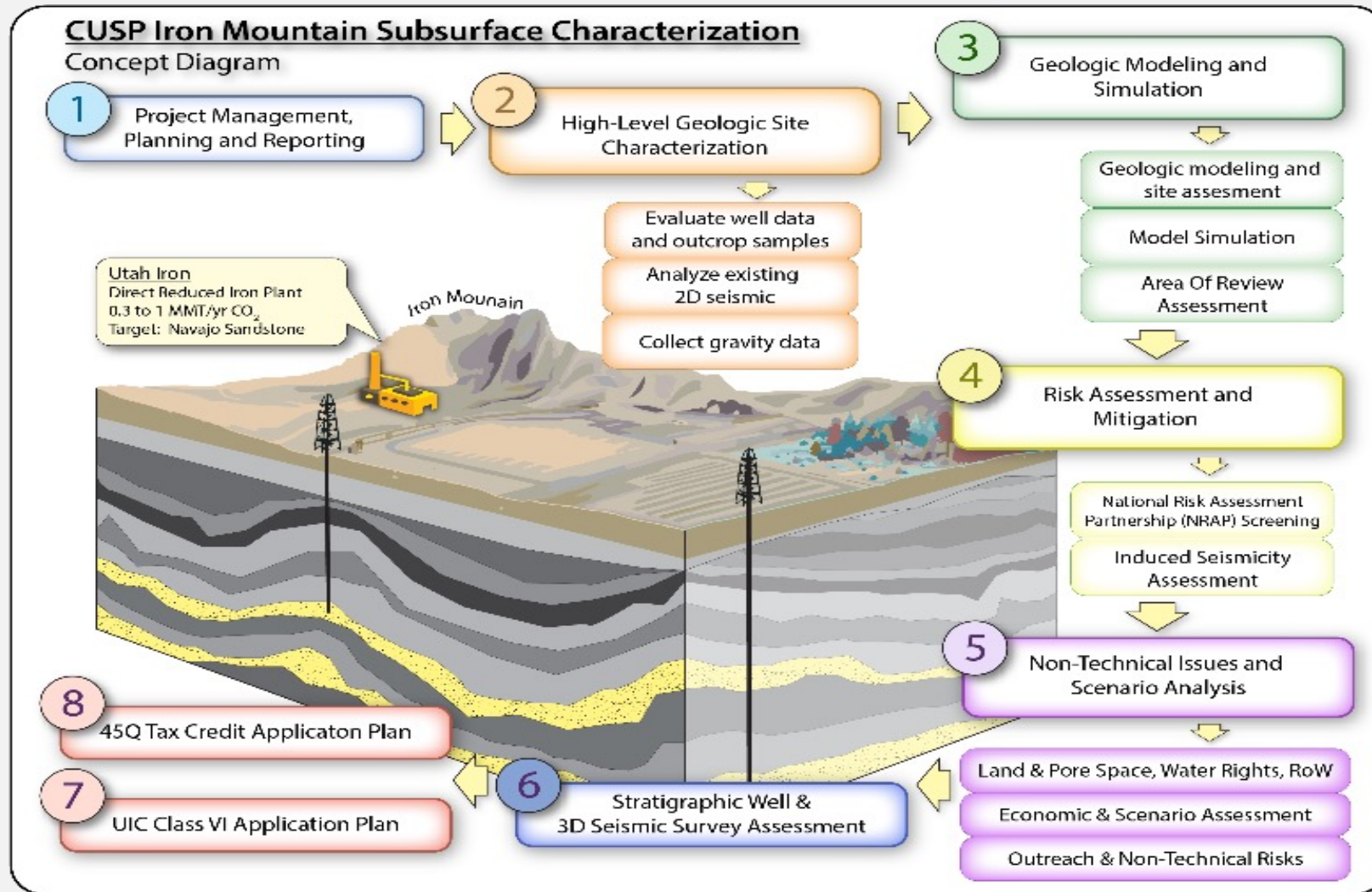


CCS & Global Policy Goals

- 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 green-house 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



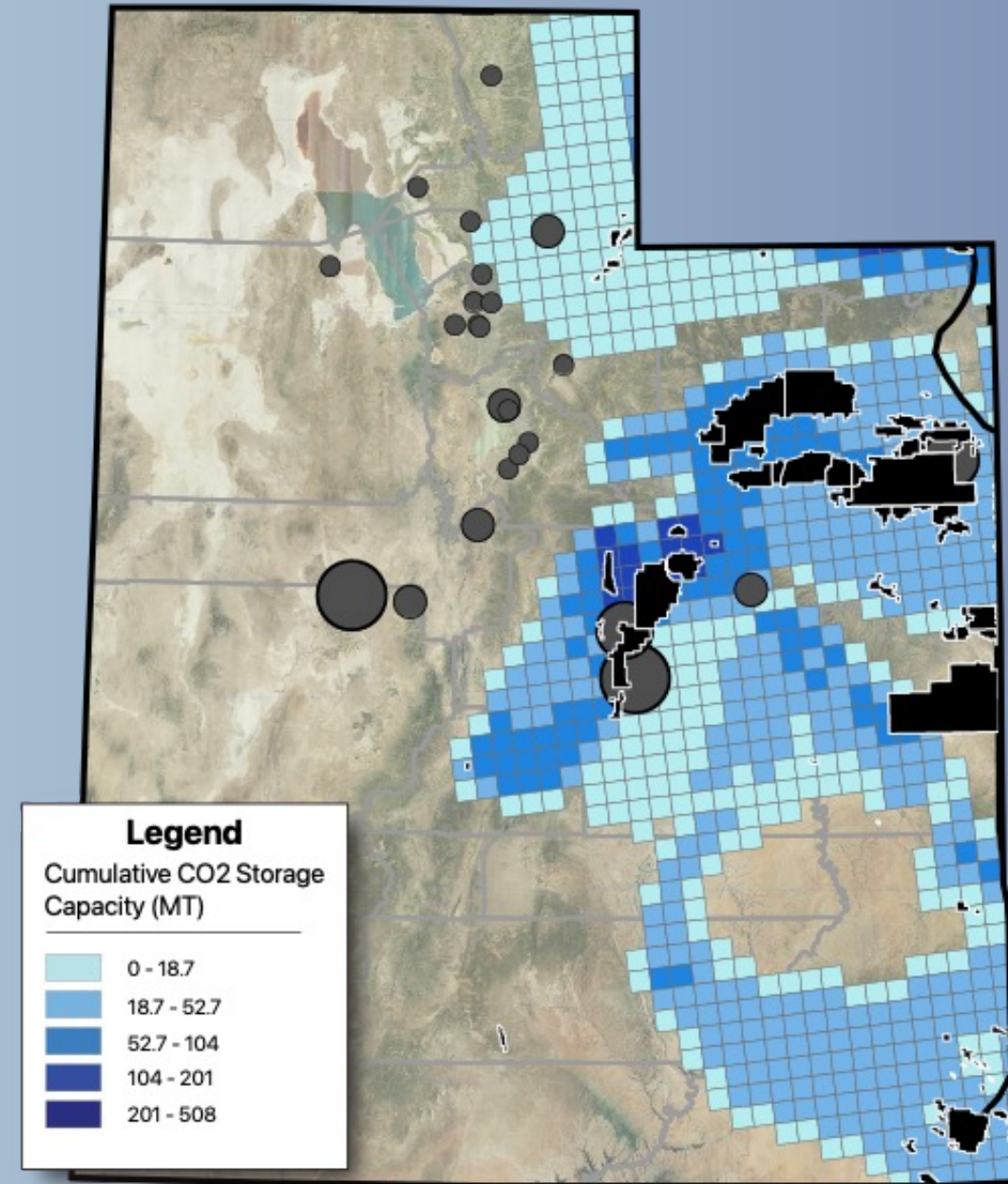
CCS Policy Carrots & Sticks

- ❑ 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



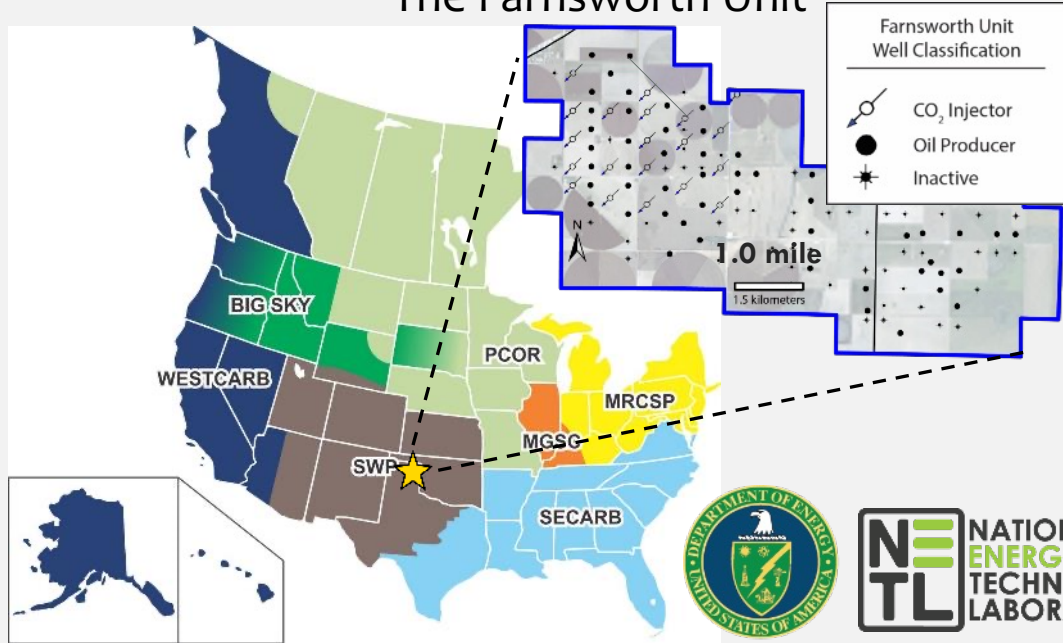
Utah Carbon Sequestration Opportunities

- ❑ 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

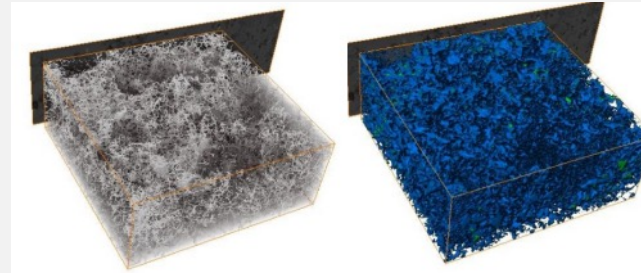


Reducing Technical & Policy Risks

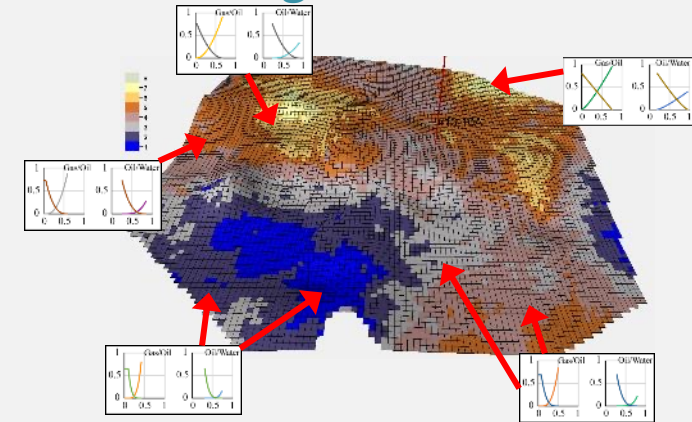
The Farnsworth Unit



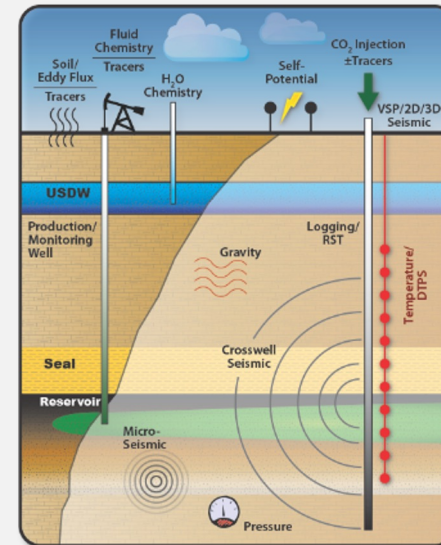
➤ Characterization



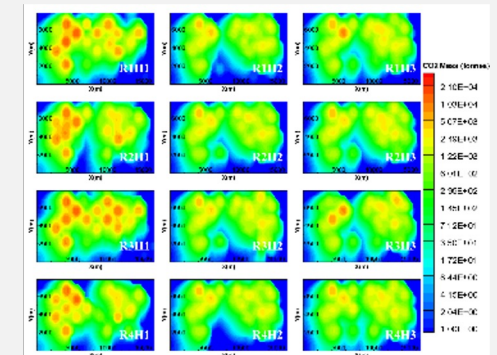
➤ Modeling & Simulations



➤ Monitoring, Verification, & Accounting



➤ Risks



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

H.B. 244 Geological Carbon Sequestration

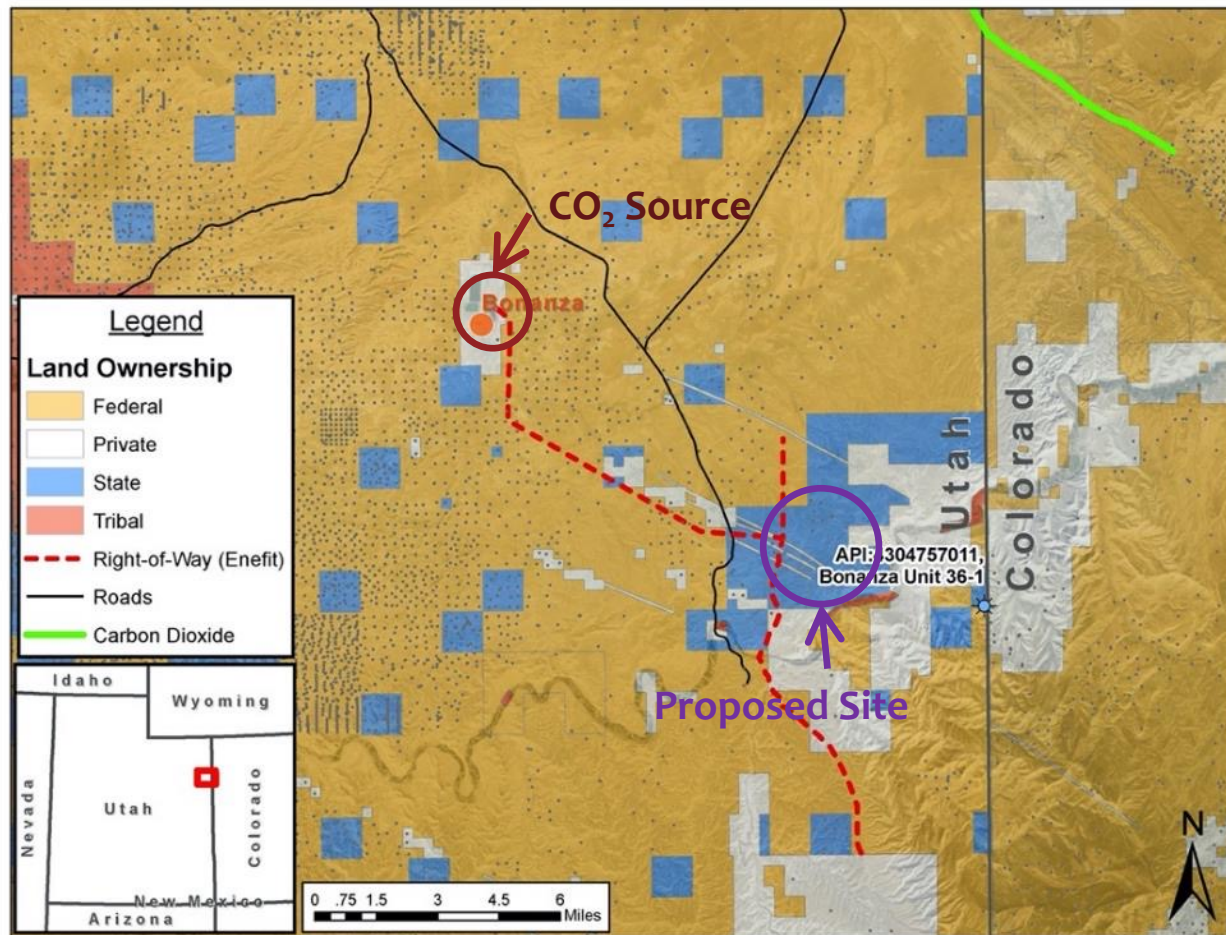
- ❑ **Passed During the 2022 Utah Legislative Session**
 - Sponsored by Representative Steve Handy
 - Sponsored in the Senate by Senator David Hinkins
- ❑ **Provides a policy pathway for Utah Division of Oil, Gas & Mining to establish a permitting program for commercial geologic carbon sequestration 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**



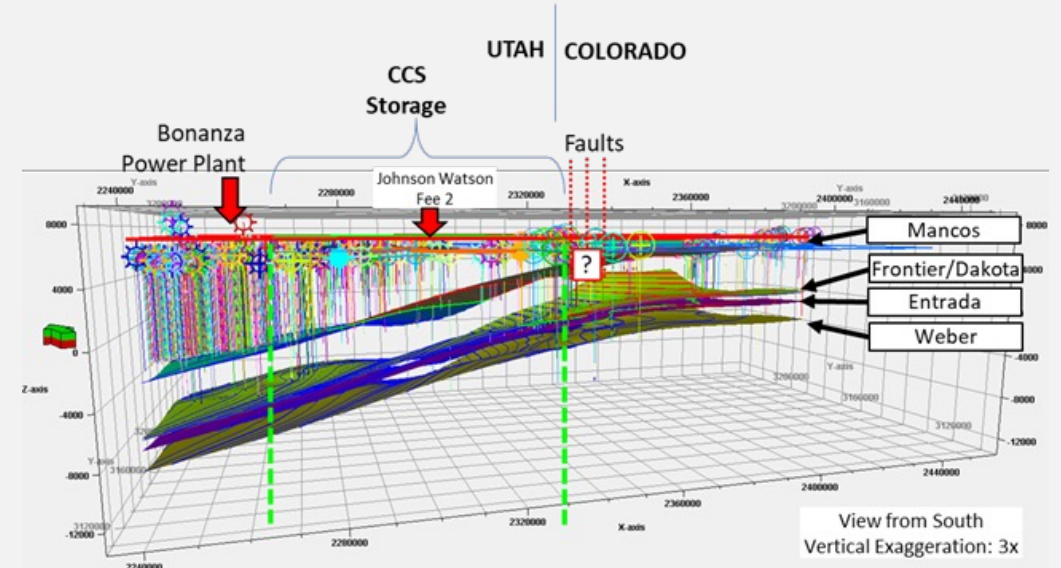
Uinta Basin CarbonSAFE Phase II

Primary Objective:

- To establish the feasibility of a commercial-scale CO₂ geological storage complex to sequester 50 million metric tons of captured CO₂ in 30 years.



Modeling Better Technical and Policy Solutions





Energy & Geoscience Institute

Since

1972

EGI... the science to find energy