


**HALLIBURTON**

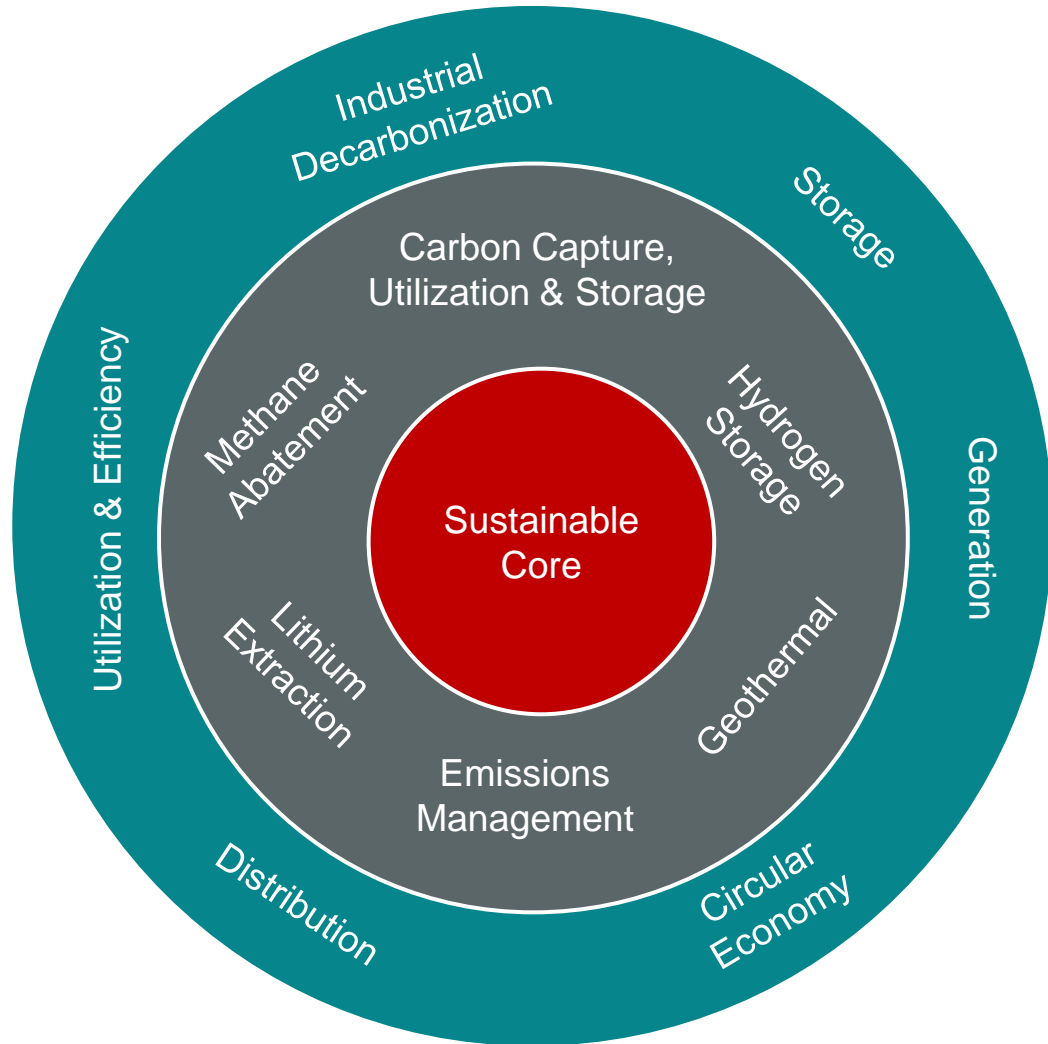


# CCUS: CO<sub>2</sub> Storage Assurance Solutions

ANP Workshop

December 2023

# Halliburton's Approach to Decarbonization



## Decarbonize Core Operations

Quantifiable low impact solutions across the well lifecycle

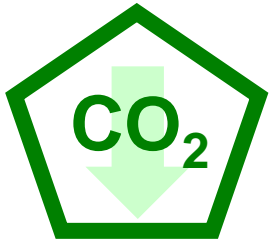
## Advance Low Carbon Solutions

Applied expertise across adjacent spaces, including CCUS, Geothermal, and other New Energy applications

## Accelerate Emerging Energy Technology

Collaborative environment to scale novel clean energy solutions through Halliburton Labs

# Customers are Finding their Approach to Decarbonization



## Core Business Decarbonization

- What are my **baseline emissions**?
- How much can I reduce my **existing assets' carbon footprint**?
- What decarbonization levers help **deliver my targets**?



## New Business Portfolio

- What **adjacent businesses** do I **diversify** into?
- What **step-out business** do I invest in to create future value?



## Financial

- What are the **expected returns** from my portfolio (core and low-carbon) ?

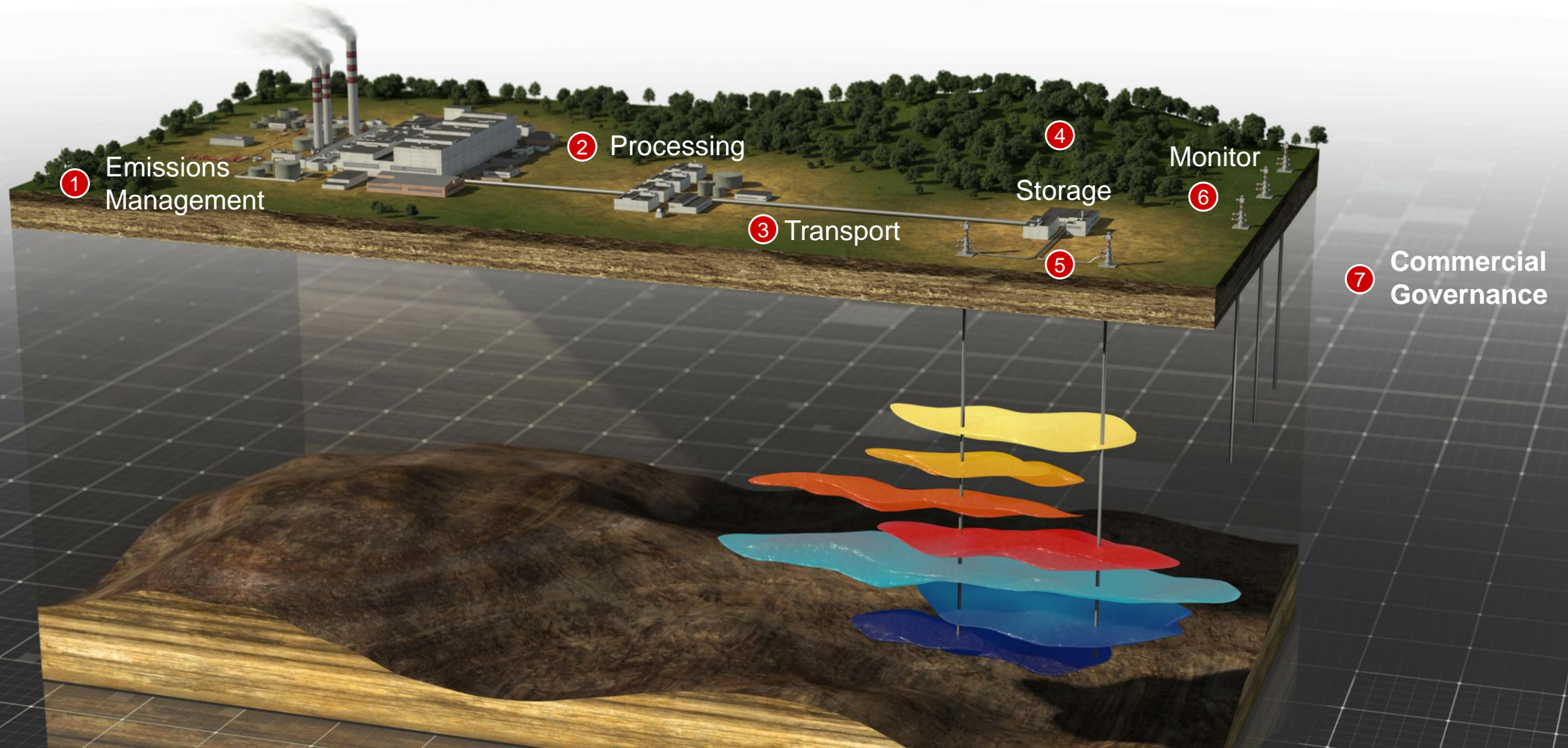


## Operating Model Transformation

- What **organizational changes** enable success?
- What is the optimal approach toward **investment and partnership**?

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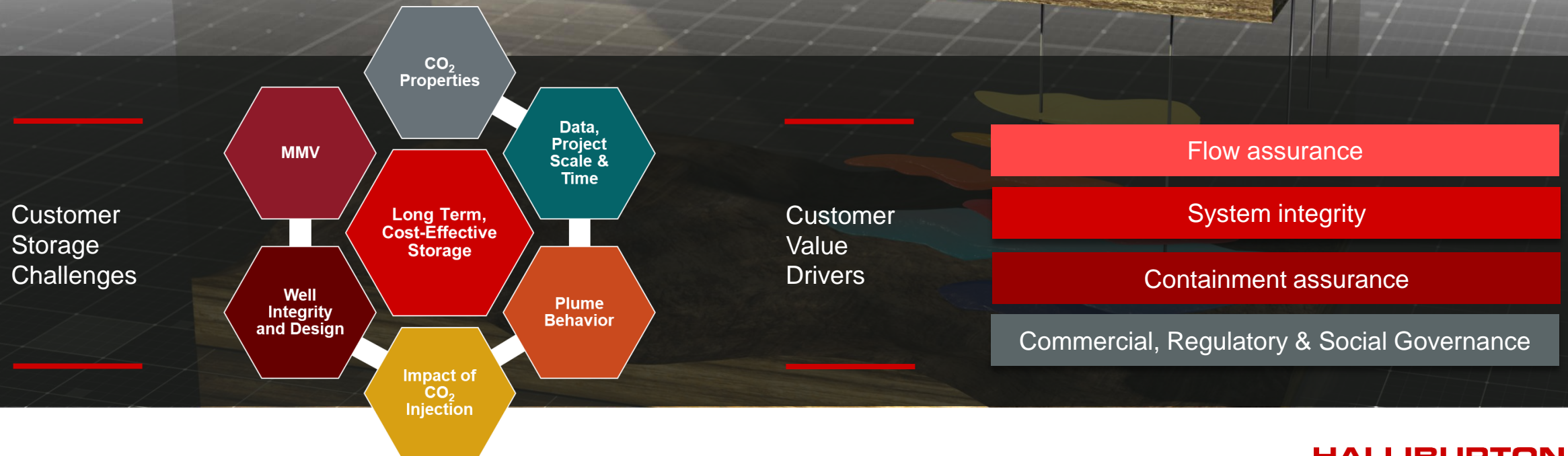
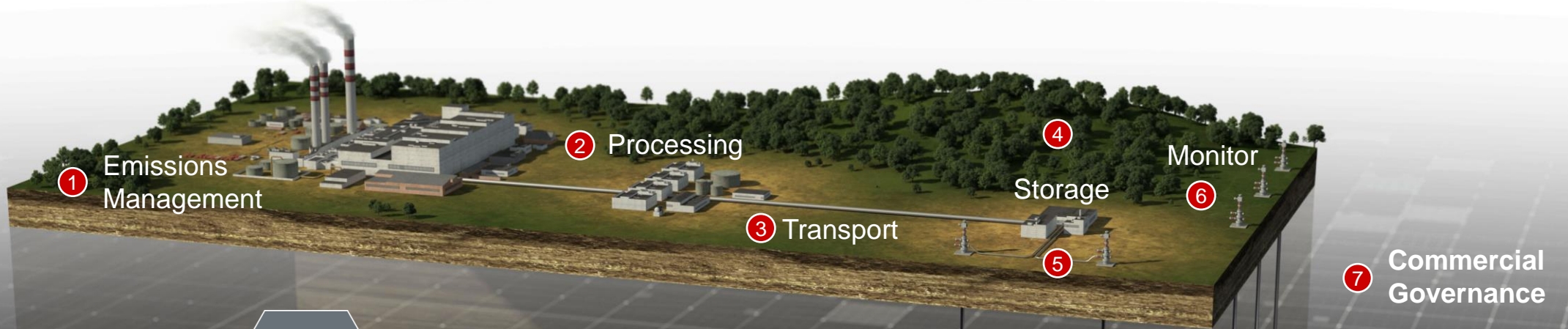
We collaborate and engineer solutions across the CCUS lifecycle





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## Project Conception

Understand regulatory requirements and commercial restraints to meet decarbonization goals



## Carbon capture

Assessed CO<sub>2</sub> source and selected most suitable capture technology



## Site Selection

Located storage site and modes of transport near emissions source



## Risk Management

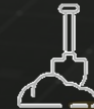
Screened reservoir for capacity, injectivity and containment.

Verified sequestered carbon will be stored safely in the subsurface.



## Governance

Developed storage design and abandonment plans that meet regulatory requirements



## Construction

Permits received and storage site construction is underway



## Processing & Transport

Waste stream cleaned, compressed and ready for injection



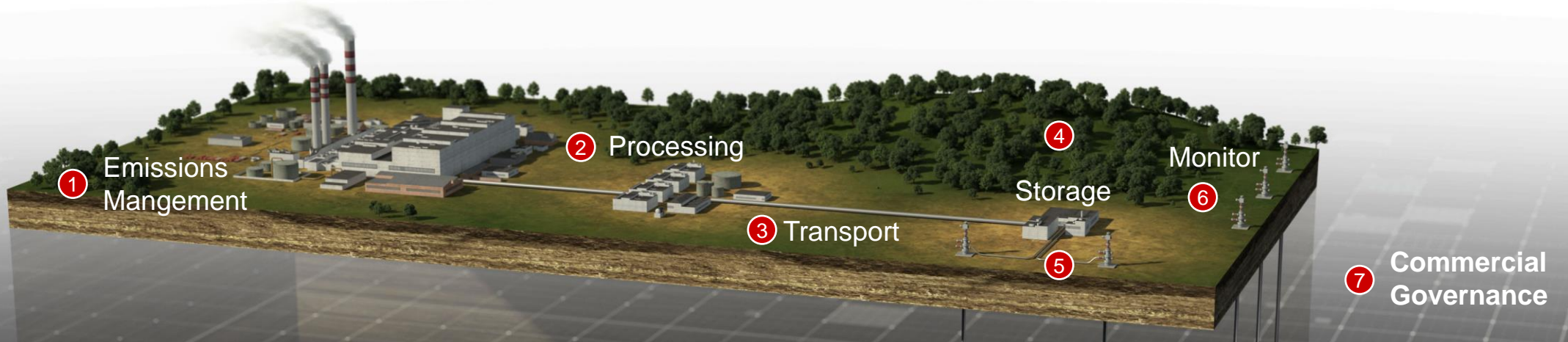
## Measurement, Monitoring & Verification

Validated CO<sub>2</sub> injected & stored as planned



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1

- Source assessment
- Storage site validation
- Project viability
- Pre-commission

2

- Metering
- Waste management

3

- Pipeline protection
- Pressure boosting
- Leak detection

4

- Reservoir mapping
- Injectivity testing
- Barrier selection
- Storage integrity

6

- Well integrity
- Risk assessment
- Safe subsurface operating envelope

7

- Auditable data stream

5

- Barrier placement
- Barrier evaluation
- Operations management


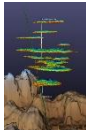
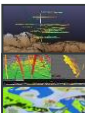
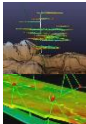
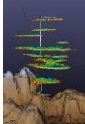
Halliburton  
Solutions

Project leadership from prospect screening to commercial viability

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# Site Screening: Challenges, Processes & Solutions

## Site Selection & Characterization (Risk Analysis)

	Where are suitable storage regions?	Where are suitable storage sites?	What are the geological controls?	Is there capacity for CO <sub>2</sub> injected?	Can we inject?	Can it be contained safely ?	How can I plan for monitoring?
Challenge	<p>↓</p> <p>Rapid screening for storage sites</p>	<p>↓</p> <p>Finding a suitable site</p>	<p>↓</p> <p>Site Characterization</p>	<p>↓</p> <p>Capacity Estimation</p>	<p>↓</p> <p>Planning injectivity and operations</p>	<p>↓</p> <p>Assessing risk of leak</p>	
Process	<p>Analyze key geological controls on CO<sub>2</sub> storage potential in any basin</p> <p>Create a portfolio of feasible storage options</p>	<p>Prospecting and assessing storage potential and risk</p> <p>Plan well placement</p>	<p>Detailed data interpretation to identify properties key to CO<sub>2</sub> behavior</p> <p>High resolution earth modeling for key properties on CO<sub>2</sub> behavior</p> <p>Plan for future monitoring strategies</p>	<p>Model migration of plume to full extent over geological time</p> <p>Model capacity with physics and PVT specific to CO<sub>2</sub></p> <p>Run full capacity models on multiple scenarios and sites</p>	<p>Designing and managing wells and surface infrastructure</p> <p>Establishing plume behavior in reservoir and seal properties</p> <p>Establishing near-well, local and regional pressure</p>	<p>Long term modelling for monitoring strategies</p> <p>Fully model and test caprock integrity</p>	
Solutions	 <p>CO<sub>2</sub> Storage Screen</p>	 <p>CO<sub>2</sub> Storage Plume</p>	 <p>CO<sub>2</sub> Storage Subsurface Well &amp; Plume</p>		 <p>CO<sub>2</sub> Storage Well CO<sub>2</sub> Storage Inject*</p>	 <p>CO<sub>2</sub> Storage Plume</p>	



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## Global CCUS Experience

- Source assessment
- Injection site screening
- Risk assessment & feasibility
- Storage design with legacy well planning
- Permitting support
- Waste management
- Transport & booster pump services
- Storage development & construction
- Measurement, monitoring & verification (MMV)
- Commercial governance

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THANK YOU FOR SHARING  
YOUR DECARBONIZATION JOURNEY