CUSP
The Carbon Utilization and Storage Partnership of the Western US

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New Mexico Institute of Mining and Technology

U.S. Department of Energy
National Energy Technology Laboratory
Carbon Storage Project Review Meeting
September 8-11, 2020
Who is the CUSP?

- Parts of three of the original RCSPs: SWP, WESTCARB, and Big Sky
- States represented - through a survey, a university, or a research institute: AZ, CA, CO, ID, KS, NM, NV, MT, OK, OR, TX, UT, WA
- National Laboratories - Los Alamos, Pacific Northwest, and Sandia
- Additional collaboration with Indiana University for technical support (SIMCCS)
- Industry engagement: Schlumberger, Bright Energy, EDP, Lucid, and Enchant NM. Other states will be bringing in more interested parties
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Program Overview

- Funding ($10,000,000 DOE and ~$2,000,000 Cusp cash and in-kind cost-share)
- Performance Dates: November 2019-October 2024
- The CUSP is following all programmatic goals of the Regional Initiative Program and has evolved its goals in response to the additional funding added in FY20
CUSP Original Scope

• Focus is on collecting, synthesizing, and using existing data sets.
• Data will be incorporated into analytical and optimization models to evaluate CCUS potential and readiness. Goals include:
  – Identifying best prospects for commercial CCUS
  – Quantifying potential economic impacts
  – Developing Readiness Indices (w/ SimCCS) to identify best areas for short-term, mid-term, and long-term CCUS projects
• State organizations will assess, update, augment, and verify data used in data analysis and modeling
  – geological storage complexes (saline, stacked storage, ROZs)
  – CO₂ emission sources
  – existing infrastructure
• Strong emphasis on technology transfer
CUSP Expanded Scope

• Working on a modification to the budget to reflect an additional $5 million DOE funds
• While maintaining original scope and duration (3 years) we will be adding additional funds to each organization to cover tech transfer and education in the subsequent 2 years
• A portion of the new funds are set aside to support the Smart Initiative
• Additional funds will be set aside to jumpstart 45Q ready projects in the Western US
  – Early low hanging fruit is Lucid acid-gas and zero emissions strategy
  – Mid term plan to support some additional studies and work on the NW basalts
  – Other projects as they occur. Already evaluating projects in Kansas, Oklahoma, and Montana
Regional Storage is Diverse

Oil and Gas basins

Saline Aquifers

Basalts

* NatCarb Atlas V
Proven EOR Potential and Extensive Infrastructure
The SWP and Farnsworth Unit

Anthropogenic Supply:
500-600,000 Metric tons CO₂/year supply

Legend
- Utilization & Storage
- Carbon Capture
- Transportation
- Oil Fields

Other CO₂ Sources
- 0.1 to 0.7 MT/yr
- 0.7 to 1.8 MT/yr
- 1.8 to 4 MT/yr
- 4 to 10 MT/yr
- 10 to 20 MT/yr
Progress and Current Status of Project

a. The project team has done an initial survey of the region for opportunities and issues related to those opportunities  
b. Looking at Sources, Sinks, transportation pathways both existing and potential  
c. Have identified existing regional hubs  
d. Beginning process of refining Atlas style data  
e. Working towards integrating machine learning tools to analyze results.
## In the Midst of Down-selecting Sites for 45Q Support

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
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<tbody>
<tr>
<td>Arizona</td>
<td>Stacked storage in Paleozoic rocks of Colorado Plateau with possible EOR (northeastern AZ) Deep saline storage in several basins (south central AZ)</td>
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</tbody>
</table>
| California| Numerous potential opportunities for EOR/stacked storage in Central Valley - possible using CO2 captured from steam generation EOR  
Seismicity and public perception remain challenging |
| Colorado  | No specific targets yet identified but numerous opportunities on both western and eastern parts of state  
Already a significant supplier of natural CO2 so McElmo Dome could potentially take in TCF of CO2 if pipeline were reversed |
| Kansas    | EOR using CO2 from ethanol plants in southwestern KS  
Several potential reservoirs (EOR and deep saline) in the area around midstream facilities in central KS |
| Montana   | Significant point source at Colstrip power plant with good proximity to numerous oilfields  
Oxy-fuel Combustion-CCUS near Cutbank (northern MT) |
| Nevada    | Low potential for EOR, some potential for deep saline storage primarily northwestern NV  
Alternative CO2 storage potential in deep evaporite deposits in southern NV |
| New Mexico| Stacked storage in Mesozoic rocks of San Juan Basin – Midstream operations already storing CO2 in the Permian  
Abundant opportunities for EOR and associated stacked saline aquifers in Permian Basin |
| Oklahoma  | Conventional CO2 EOR storage in Paleozoic age rocks in oil fields of western OK  
Sequestration potential in unconventional shale gas systems in central OK (Woodford, Anadarko Basin central OK) |
# In the Midst of Down-selecting Sites for 45Q Support

<table>
<thead>
<tr>
<th>State</th>
<th>Details</th>
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<tbody>
<tr>
<td>Texas</td>
<td>Too many opportunities to count for conventional EOR in Permian Basin ROZs in San Andres and other formations has excellent potential for CCUS</td>
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<tr>
<td>Utah</td>
<td>CO2 EOR potential in Paradox and Uinta basins of eastern UT Possible saline storage in Uinta basin</td>
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<td>Washington</td>
<td>Columbia River basalts in eastern part of state for geological storage Eocene sandstones and coals in western WA (Bellingham basin, Kummer anticline, Chehalis basin)</td>
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<td>Wyoming</td>
<td>Focused on source ID and economic analysis region-wide</td>
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<td>Indiana</td>
<td>Working on SimCCS part of project</td>
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<td>PNNL</td>
<td>Identification of deep saline reservoirs unique to the Pacific Northwest (basalts) Application the NRAP tools to reservoirs selected by various states</td>
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<tr>
<td>SNL</td>
<td>SNL will assist with New Mexico microeconomic and state-scale economic impact analysis as a proof of concept and template for other regions</td>
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<tr>
<td>LANL</td>
<td>Assists with development and application of NRAP tools Leads the SimCCS effort at improving tools, adding data, and technology transfer</td>
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</table>
Case Study – Lucid Energy

a. The team is finalizing a contractual relationship with Lucid Energy Group
b. The project is to permit and get 45Q credits allowed for a new acid gas disposal well in SE New Mexico
c. Working with Lucid to develop an MRV plan
d. Economics analysis for what could be a disruptive technology in waste gas handling in the Permian basin and beyond.
Appendix

– These slides will not be discussed during the presentation, **but** are mandatory.
Organization Chart
Note: this Gantt chart covers years 1-3 which was the original planned performance period

<table>
<thead>
<tr>
<th>Task</th>
<th>Title</th>
<th>2019 Q3</th>
<th>2019 Q4</th>
<th>2020 Q1</th>
<th>2020 Q2</th>
<th>2020 Q3</th>
<th>2020 Q4</th>
<th>2021 Q1</th>
<th>2021 Q2</th>
<th>2021 Q3</th>
<th>2021 Q4</th>
<th>2022 Q1</th>
<th>2022 Q2</th>
<th>2022 Q3</th>
<th>2022 Q4</th>
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<tbody>
<tr>
<td>2</td>
<td>Addressing Key Technical Challenges</td>
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<td>2.1</td>
<td>Expand characterization of stacked and unconventional storage</td>
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<td>2.2</td>
<td>Develop collaborations for key technologies</td>
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<td>2.3</td>
<td>Collaborate with industrial partners for monitoring/verification strategies</td>
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<td>2.4</td>
<td>Development &amp; validation of risk assessment/mitigation strategies for CCUS sites</td>
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<td>3</td>
<td>Facilitating Data Collection, Sharing, and Analysis</td>
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<td>3.1</td>
<td>Engaging with national laboratories</td>
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<tr>
<td>3.1.1</td>
<td>Identify data requirements &amp; needs</td>
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<td>3.1.2</td>
<td>Update geologic data for CCUS Assessment</td>
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<td>3.1.3</td>
<td>Update USDW data from all public sources</td>
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<td>3.1.4</td>
<td>Gather and catalog CO2 emissions (point) source database</td>
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<td>3.2</td>
<td>Apply NRAP tools to assess geologic risks</td>
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<td>3.3</td>
<td>Provide synthesized data to DOE’s machine learning initiative</td>
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<td>4</td>
<td>Evaluating Regional Infrastructure</td>
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<td>4.1</td>
<td>Catalog, map, and evaluate extant and near-term CO2 distribution network</td>
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<td>4.2</td>
<td>Identify and add rights-of-way for new pipelines (main lines and otherwise).</td>
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<td>Regulatory/policy impact assessment</td>
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<td>Economic assessment</td>
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<td>4.5</td>
<td>Focused scenario analysis</td>
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<td>4.6</td>
<td>Develop regional readiness indices</td>
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<td>5</td>
<td>Promoting Regional Technology Transfer</td>
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<td>5.1</td>
<td>Development of regional readiness indices maps</td>
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<td>5.2</td>
<td>Technology transfer forums</td>
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<td>Targeted network development</td>
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