Southwest Regional Direct Air Capture Hub

Julie Ann Wrigley Global Futures Laboratory
Arizona State University

Southwest Regional Direct Air Capture Hub (SWRDAC)

FE0032391

Gary Dirks
Arizona State University

2024 FECM/NETL Carbon Management Research Project Review Meeting
August 5 – 9, 2024

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Project Overview

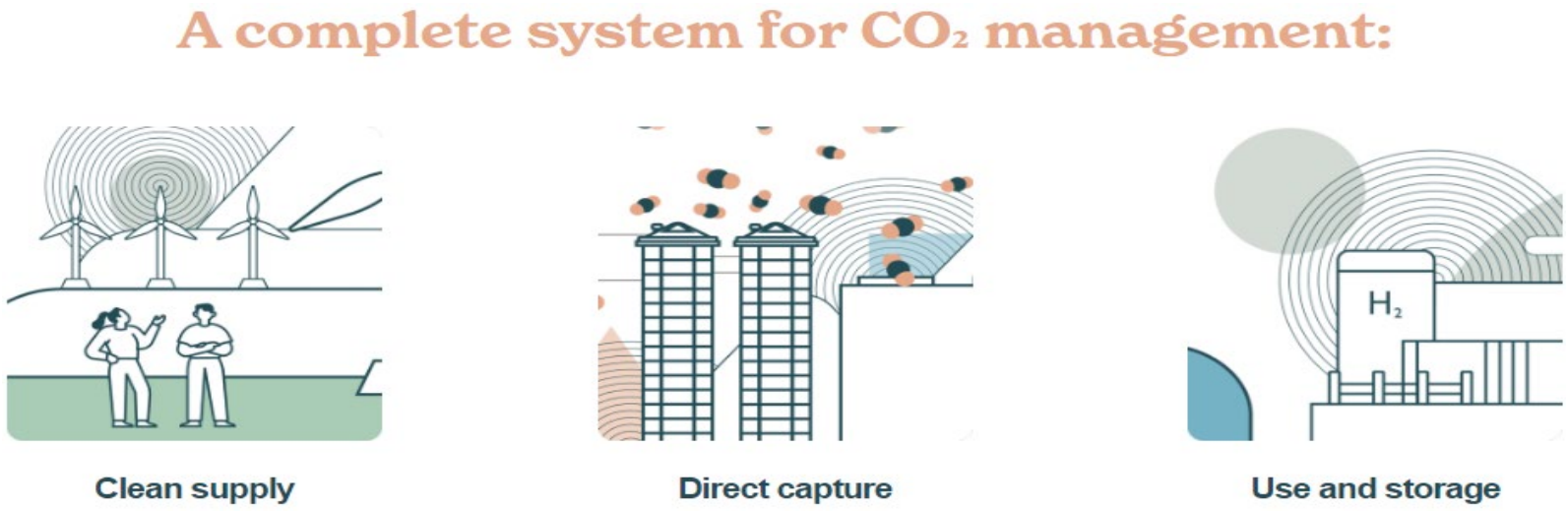
Funding: Federal-$11,266,392 Cost Share-$11,266,414

Project Participants

Lead Organization - Arizona State University

Key Partners:

- Black and Veatch
- CarbonCapture
- Carbon Collect
- New Mexico Tech
- University of Utah
- Proton Green
- Tallgrass
- Arizona Geological Survey
- Carbon Solutions



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Project Overview-Objectives

- **Develop a Scalable DAC Hub:** Design a DAC hub with an initial capture capacity of 50 KTA CO2, scalable to at least 1 MTA CO2.
- **Conduct FEED Studies:** Complete Front-End Engineering and Design studies for DAC systems and pre-FEED for Balance of Plant infrastructure.
- **Establish CO2 Storage Solutions:** Develop plans for long-term CO2 storage to support 12 years of operation with Class VI permits
- **Community Engagement and Education:** Enhance understanding of DAC technology within local communities and address their concerns

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Technology Background-DAC

Carbon Capture

- First to use structured sorbents
- First designed for mass manufacturing
- Each module is equipped with 12 DAC reactors
- Nominal capacity of 500 tons/year
- Generates a concentrated stream of CO2 at 95+% purity
- Each module is roughly the size of a shipping container

Carbon Collect

- First commercial scale demonstration deployed and operated at ASU
- Advantages
  - Passive Design: Negates the capex and opex for fans and blowers
  - Modular Design: Allows for flexible scaling to meet various capture requirements and harness mass manufacturing to accelerate scale-up
- Challenges
  - Optimizing water consumption and energy use

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Technology Background-Sites

San Juan Basin, NM

- The basin covers 7,500 sq.mi. (4.8 million acres) with hundreds of millions of tons storage capacity in saline formations

St. Johns Dome, AZ

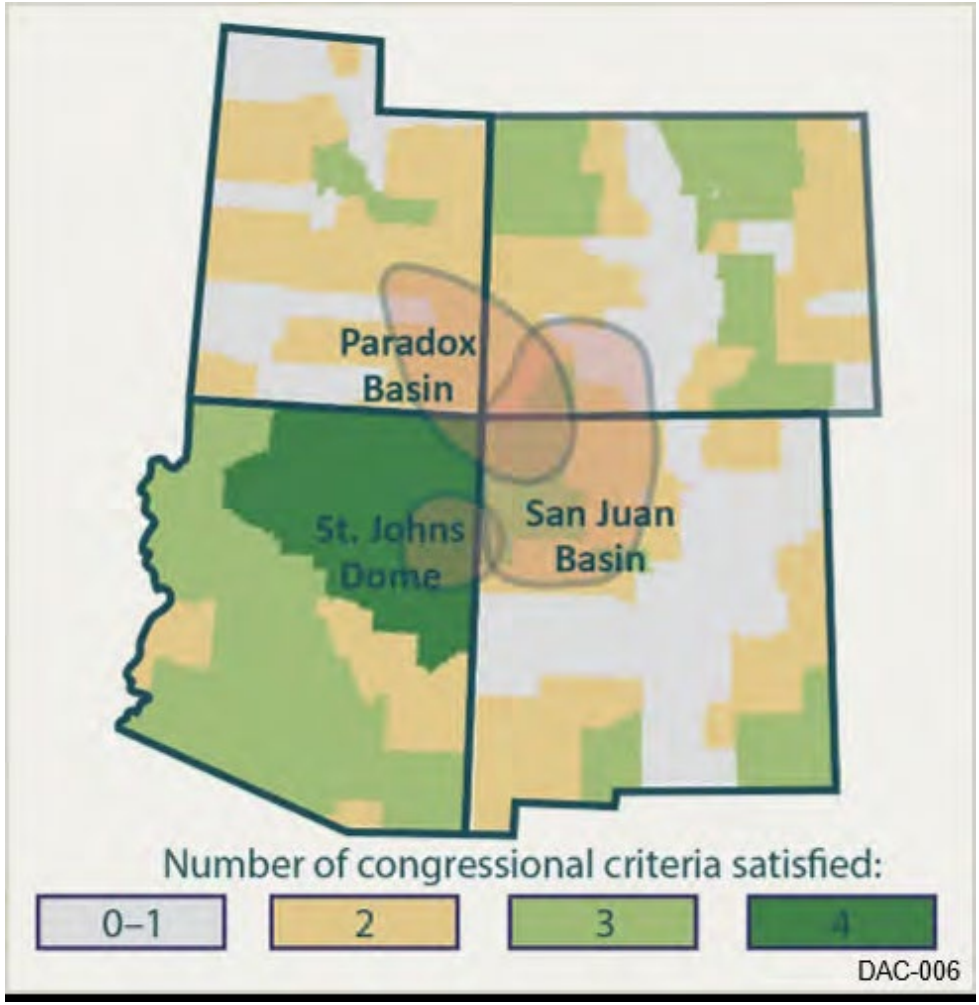
- The site is operated by Proton Green and covers roughly 152,000 acres
- SJD is predominately a natural CO2 reservoir containing ~1% helium and other non-hydrocarbon constituents
- It is a shallow reservoir (2,000-3,000 ft.) with estimated capacity of >200 million tonnes of CO2 storage capacity

Paradox Basin, UT

- Sedimentary basin approximately 33,000 sq.mi. (21 million acres)
- Available data shows significant storage opportunities in saline formations

Site Advantages:

- Renewable energy development
- Vast storage potential
- Transitioning fossil fuel industry
- Historically underserved communities/tribes



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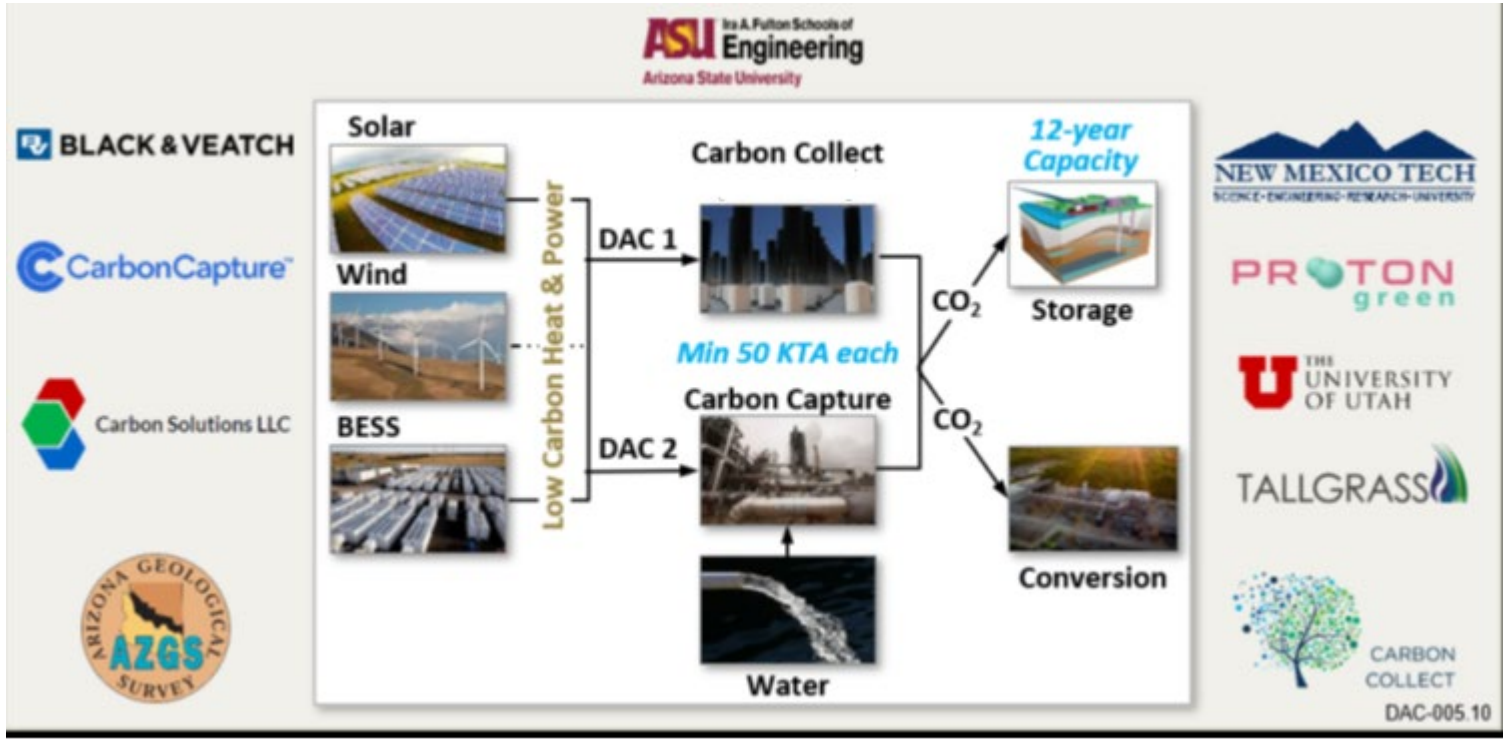
Technical Approach/Project Scope

Design:

- Two DAC companies (CarbonCapture & Carbon Collect)
- Three sites (AZ, NM & UT)
- EPC for BOP
- Community Partners
- Business and Finance Ecosystem



Project Steps:

- Conduct geospatial analysis to finalize site selection
- Develop FEED studies to refine DAC technical designs and pre-FEED for BOP
- Progress necessary permits & regulatory requirements-Class VI, NEPA, EH&S, etc.
- Engage communities to integrate local insights/needs into project plans

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Technical Approach/Project Scope

Project Milestones

- PMP
- Business & Financial Plans
- Technology Maturation Plan
- CBP
- BOP pre-FEED
- DAC FEEDs
- EH&S Analysis
- Class VI permit application
- EIV
- LCA
- Storage Field Development Plan
- IPS
- Hub Geospatial Analysis

Project Success Criteria

- Successful completion of FEED studies and permit submissions
- Positive outcomes from community engagement and stakeholder feedback

Project Risks & Mitigation Strategies

- Cost share commitments – Back up options
- Schedule Delays – Revise IPS
- Parallel Site Characterization & Class VI slowed – Secure additional funding
- DAC technology development – Plan and financing

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Progress and Current Status of Project

DAC Systems

CarbonCapture

- Field testing ton-scale 'Leo' unit-12 reactors, TRL 8, continuous cycling
- Gen 1 sorbent scaled to one ton, Gen 2 at that scale by Q1 2025

Carbon Collect

- Initial commercial demonstration complete
- Second, mass manufacturable unit in procurement
- Commercial utilization and offtake projects in development

Sites

San Juan Basin

- Class VI permit submitted (Tallgrass)
- Existing CarbonSAFE and CUSP projects

St. Johns Dome

- Developing relationships with local and regional utilities to create power solutions
- Continue discussions with White Mountain Economic Development and Apache County for community support

Paradox Basin

- Developing MRV plan for GNG Ventures for Class II and Class VI well permits
- Continue discussion with local utilities on power availability

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Summary of Community Benefits / Societal Considerations and Impacts (CB/SCI)

Community Benefits Plan (CBP)

- Analyze stakeholders and assess social characterization in 3 sites
- Establish partnerships with educational institutions, community members, unions, and industry to create good jobs
- Identify necessary training and reskilling programs and implement apprenticeship and training opportunities.
- Create DEIA committee and develop standards for recruiting and training to ensure diversity
- Assess impacted communities and groups
- Assess Hub benefits and negative impacts and where they flow
- Assess barriers to maximize benefits and minimize negative impacts

Progress Towards CB/SCI SMART Milestones

- Awarded $31,000 through SWSIE to compliment community benefits efforts with a community benefit focused techno-economic analysis of DAC in St. Johns-area.
- Planning a Community Benefits and Decarbonization symposium at ASU for November 8-9 to bring together communities, environmental groups, and governments to talk about how community benefits plans for direct air capture projects can be leveraged to benefit Arizona communities.

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Lessons Learned

- Early and frequent communication within the team facilitates responsiveness and effective coordination
- Rigorous data management and confidentiality facilitates transparency
- The diversity of technologies and sites creates good optionality
- Doubling down on existing storage infrastructure has largely removed an important area of uncertainty and we expect a financial viability

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Plans for Future Testing/Development/Commercialization

DAC Systems

CarbonCapture

- Deploying Gen 2 sorbent at ton scale and continue work with BASF on scale-up plan for Gen 3
- Building out manufacturing facility in AZ with co-located pilot scale facility
- Securing off-take agreements with utilization companies

Carbon Collect

- Sorbent and form factor testing to improve CO2 capture per cycle
- Implementing the development of the improved sorbent regeneration and compression and purification system to recover maximum heat and water.
- Implementing the 1,000 tons per year system for multiple CCUS projects to continue to improve modularity, fabrication, layout, and constructability in advance of the larger system implementation.
- Continue to simulate the impact of ambient conditions on capture and regeneration effectiveness for different sorbents.

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Plans for Future Testing/Development/Commercialization

Sites

San Juan Basin
- Finalize Class VI permit with EPA
- Continue the storage field development

St. Johns Dome
- Finalize permit application and submit to EPA
- Continue discussions with renewable power developers
- Continue the storage field development

Paradox Basin
- Continue characterization of the target formations and quantifying potential capacities
- Secure a sequestration partner
- Begin storage field development plan, including power
- Initiate community engagement

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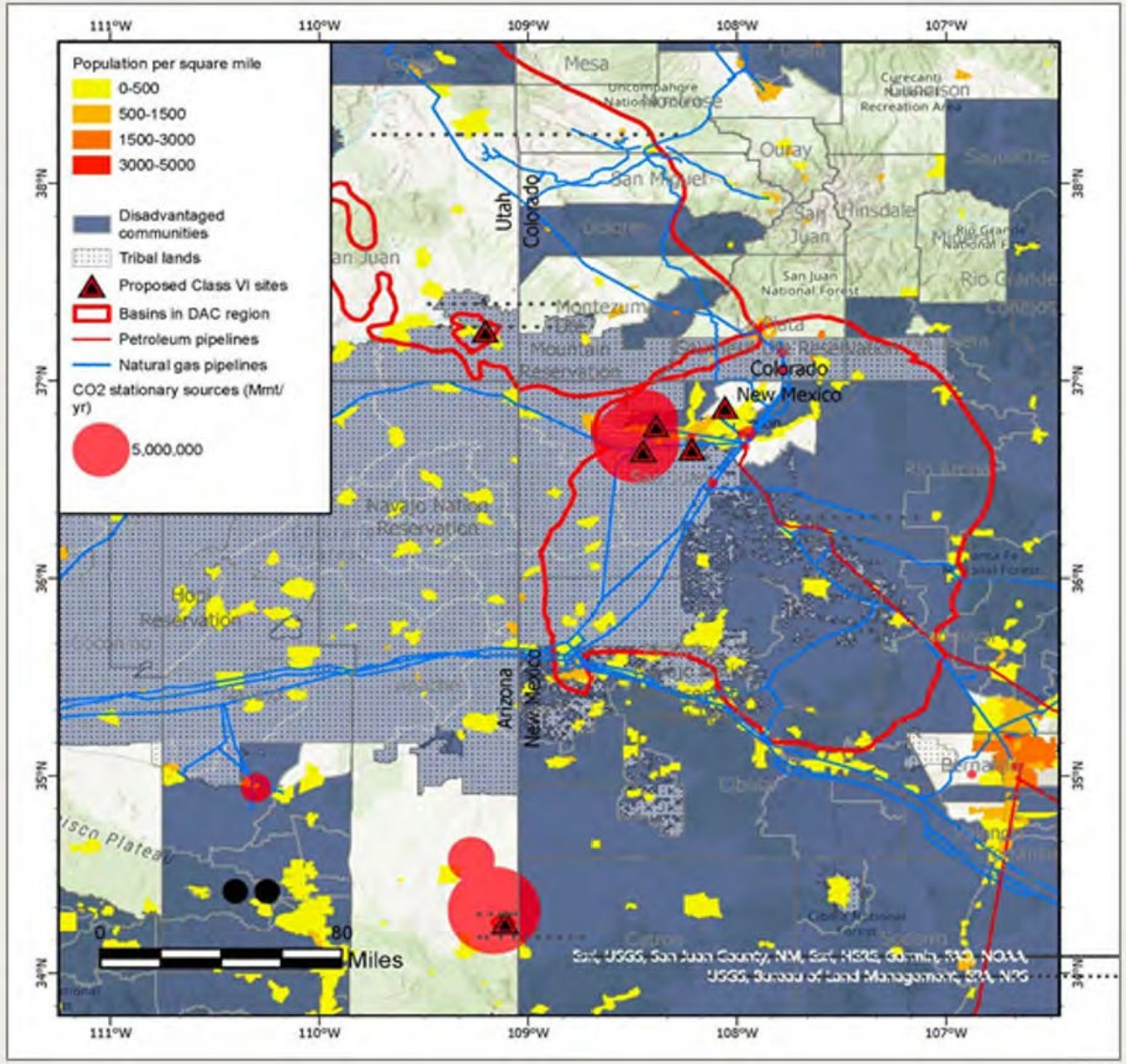

DAC-019

Summary Slide

- Two promising DAC technologies
- Three sites overlapping areas of disadvantaged communities, existing fossil industry, geologic storage and renewable power potential
- Climate conducive to DAC
- Proven implementation partners
- Watching for output from the RFI and information about the upcoming Hub FOA

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