A Combined Water and CO₂ Direct Air Capture System

Project Number: DE-FE0031970

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National Energy Technology Laboratory
Direct Air Capture Kickoff Meeting
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Program Overview

a. Funding – $3.17 million
   a. DOE: $2.5 million
   b. Cost Share: $672,000

b. Overall Project Performance Dates – 10/1/2020 – 9/30/2023

c. Project Participants
   a. Awardee: IWVC, LLC
   b. Subawardees: PNNL, Barr Engineering
   c. Partners: SoCalGas, Siemens, U. North TX, RadMax Technologies

d. Overall Project Objectives – build 30t/y CO₂ capture demonstration system with simultaneous fresh water production, proving superior technical, economic, and environmental performance
Technology Background

- AWE process integrated with solid sorbent for CO₂ capture
  - Potable water and CO₂ production provide additional revenue and magnifies environmental benefits of DAC
  - Isothermal desiccant regeneration minimizes energy consumption for AWE

- Commercially proven CO₂ sorbent
  - Scaled-up application for DAC
  - Combined thermal and pressure swing regeneration
  - Internal heat recuperation

- Novel contactor design for both sorbents
  - Maximizes heat and mass transfer performance with minimum size, weight, and cost
  - Proven commercial pathway to scale-up
Technical Approach/Project Scope

a. Project work plan
   a. BP 1 – Design demo system (PNNL, Barr, IWVC, Siemens)
   b. BP 2 – Build demo system (Barr); Contactor assembly and condenser unit (PNNL); Supplemental CO$_2$ sorbent (UNT); Vacuum pump (RadMax); System TEA (IWVC)
   c. BP 3 – Operate demo system (IWVC, Barr, SoCalGas); System TEA (IWVC, Siemens)

b. Key project milestones
   a. 9/30/2021 – demo system (30t/y CO$_2$) design complete
   b. 12/31/2022 – demo system fabrication and shakedown complete
   c. 9/30/2023 – 9 months of demo system operations complete; complete TEA for commercial scale system

c. Project success criteria
   ✓ Demonstrate attainment of 30t/y CO$_2$, 1000L/d H$_2$O design capacity
   ✓ Validate modeled values for energy consumption and cost of CO$_2$
Team and Facilities

Will Kain – IWVC
Pete McGrail, Todd Schaef – PNNL
Ron Kent – SoCalGas
Dan Palo – Barr
Shenqian Ma – UNT
SoCalGas/SDSU-Brawley Site
Opportunities for Collaboration

a. Synergies from collaboration
   ▪ Collaborate with DAC project teams on CO₂ compression technologies/systems
   ▪ Heat management and recovery strategies to improve efficiency

b. Areas of complementary work
   ▪ CO₂ market opportunity analysis – identifying relevant areas for CO₂ utilization other than geologic sequestration
   ▪ Complementary design, engineering, and fabrication for dehumidification application (private investment)
   ▪ Engagement with organizations designing solid-sorbent systems for industrial CO₂ capture