Dual Function Materials for Direct Air Capture of CO_2

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Susteon Inc.

U.S. Department of Energy

National Energy Technology Laboratory

Direct Air Capture Kickoff Meeting

February 24-25, 2021

Program Overview

a. Funding: $250,000

b. Overall Project Performance Dates: 07/2020 – 03/2021

c. Project Participants:

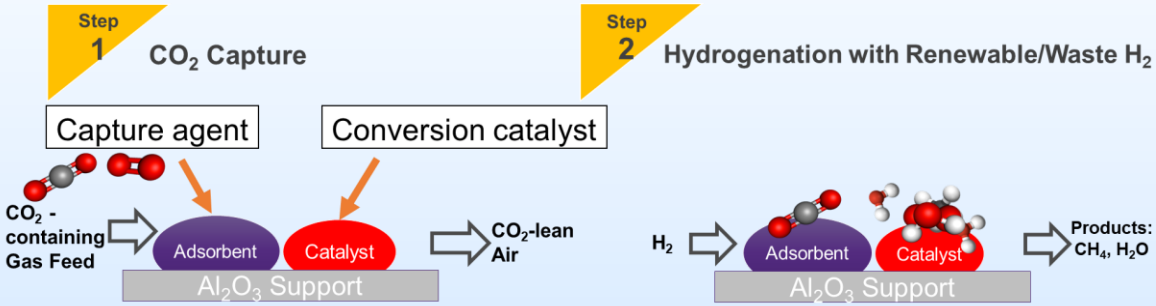
   a. Susteon Inc. (Prime)

   b. Columbia University (Professor Robert Farrauto)

d. Overall Project Objectives: Development of Dual Function Materials (DFM) for CO_2 capture from air (DAC) and subsequent conversion to renewable natural gas (RNG)

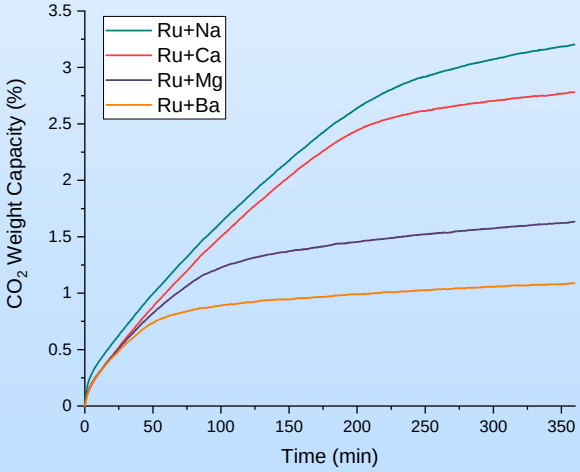
Technology Background

a. Reactive DAC Technology: Capture CO_2 directly from air at ambient condition on $Ru/Na_2O/Al_2O_3$, followed by *in-situ* methanation at 120-300°C with waste H_2 to enable a cyclic operation.

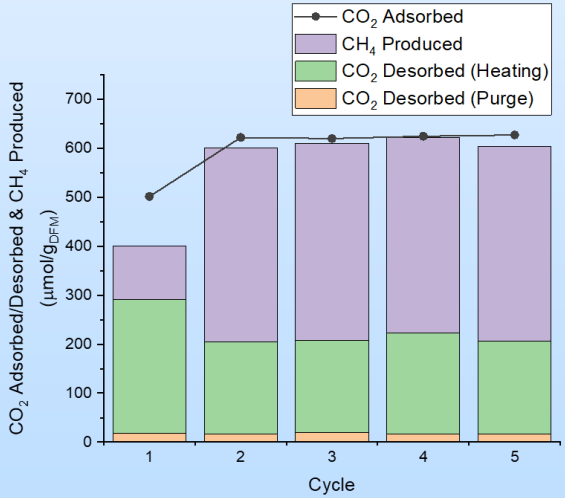


Overall reaction:

$CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$



TGA: Adsorption @ 25°C on 1% Ru, 10% sorbent/Al_2O_3 granules with 375 ppm CO_2/air

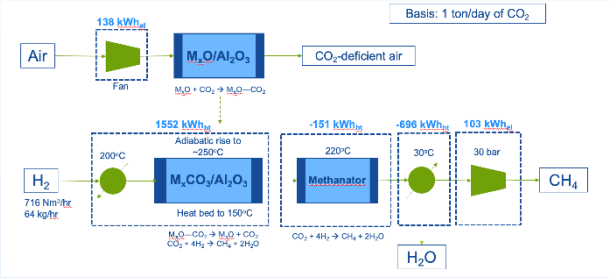


Cyclic packed bed: Adsorption @ 25°C and methanation at 300°C on 1% Ru, 10% Na_2O/Al_2O_3 granules

Technical Approach/Project Scope

a. Experimental design and work plan

- Optimized DFM composition and test parameters
- Established kinetics with specified process conditions
- Conducting cyclic aging studies with ambient air
- Developing a process design and TEA model



b. Project schedule

Milestones:

1. Identify sorbent candidates
2. Develop a process design

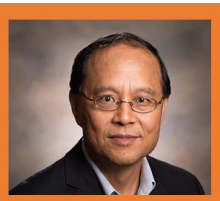
Tasks / Dates	07/20	08/20	09/20	10/20	11/20	12/20	01/21	02/21	03/21
Task 1. Project management and planning									
Task 2.1. Experimental Setup									
Task 2.2. Aging Studies for DAC									
Task 2.3. CO_2/Air Adsorption/Desorption Rate Studies									
Task 3. Data Processing and TEA									

c. Project success criteria

- Multicycle performance of DFM materials for their CO_2 capture rate, CO_2 capacity, regenerability to produce RNG.
- Development of a process design and TEA

Team and Facilities

Raghubir Gupta
President



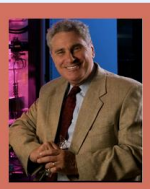
S. James Zhou
Senior Director

Jian Zheng
Sr. Engineer

Cory Sanderson
Process Technologist

Vasudev Haribal
Research Chem. Engineer

Susteon



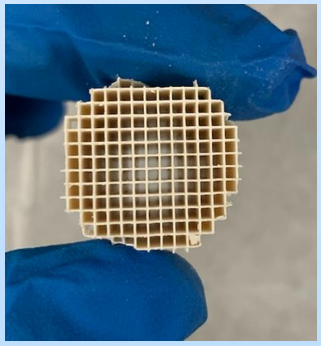
Robert Farrauto
Professor

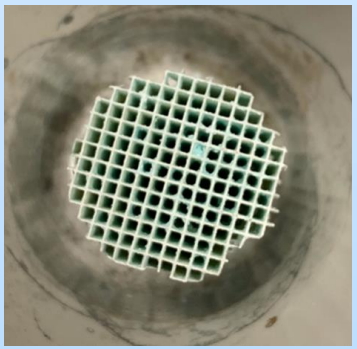
Chae Jeong-Potter
Ph.D. Candidate

Monica Abdallah
Ph.D. Candidate

Columbia University

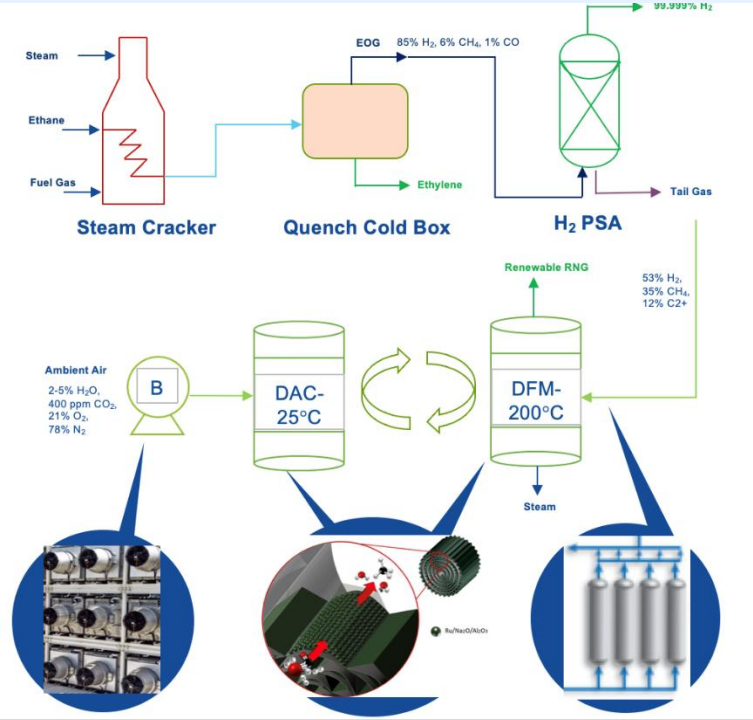
Industrial Partners
Anglo-American
Con Edison
Riogen

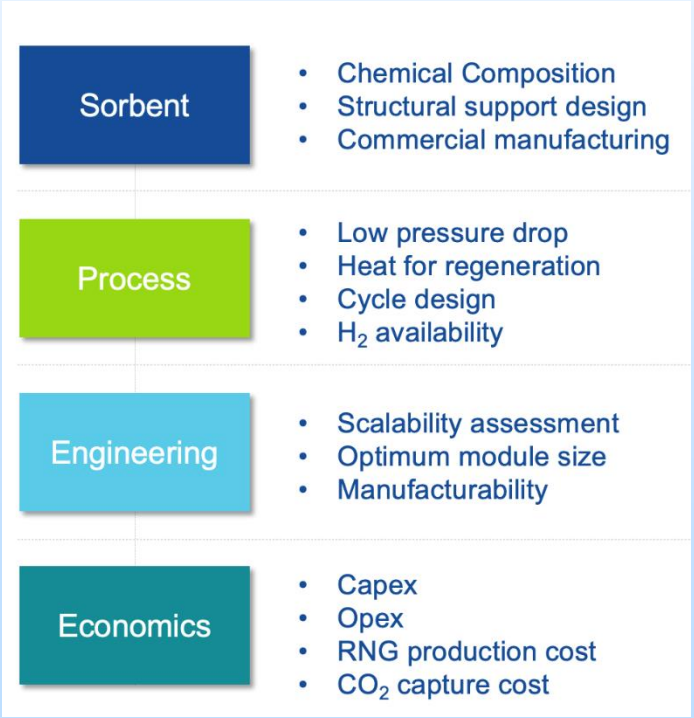




Progress and Current Status of Project

a. Completed screening of DFM to identify leading candidate
b. Evaluated various process cycle designs
c. Initiated techno-economic analysis





Opportunities for Collaboration

- Partnership for developing structured materials
- Identification of a waste hydrogen source – refinery and petrochemical plants
- Identification of engineering partners for scale-up and manufacturing

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