WY Regional DAC Hub

FE0032393

Patricia Loria
Saeb Besarati

CarbonCapture Inc.

2024 FECM/NETL Carbon Management Research Project Review Meeting

NETL
Aug 5-9, 2024

We develop and deploy DAC machines

- Based in Los Angeles
- Team of 65
- Deploying systems this year
- Presold >$26M in removal credits
- Four DOE DAC Hub awards
- Raised over $90M in funding:
  Prime Movers Lab, Amazon, Aramco Ventures, Siemens

Structure & Overall Project Objectives

Total Funding: $23,025,028
DOE: $11,512,619
Cost Share: $11,512,619
Work Period: 1 October 2024 – 30 April 2026

- A FEED study for a DAC facility that captures and stores 200,000 tonnes of CO_2/year
- A FEED study for a facility to produce low-carbon intensity sustainable aviation fuel (SAF) utilizing DAC CO_2 as a feedstock
- A pre-FEED study for the balance-of-plant (BOP) required to support a megaton-scale DAC + utilization facility
- A comprehensive community benefits plan (CBP) designed to ensure the region welcomes the growth of a DAC industry, and that economic and ancillary benefits of establishing a DAC hub in the region are widely distributed throughout impacted communities, including meeting the goals of the Justice40 Initiative
- A business and deployment plan for a multi-megaton DAC hub powered by new clean energy capacity, incorporating multiple DAC technologies, sites, and pathways for CO_2 storage and utilization

Organizational Chart

WY Regional DAC Hub Team

Hub Owner / Prime Recipient

CarbonCapture™

Leadership Team

Patricia Loria
Principal Investigator

Advisory Boards

Advocacy

Community / EJ

Technology

Hub Anchor Technology Partners

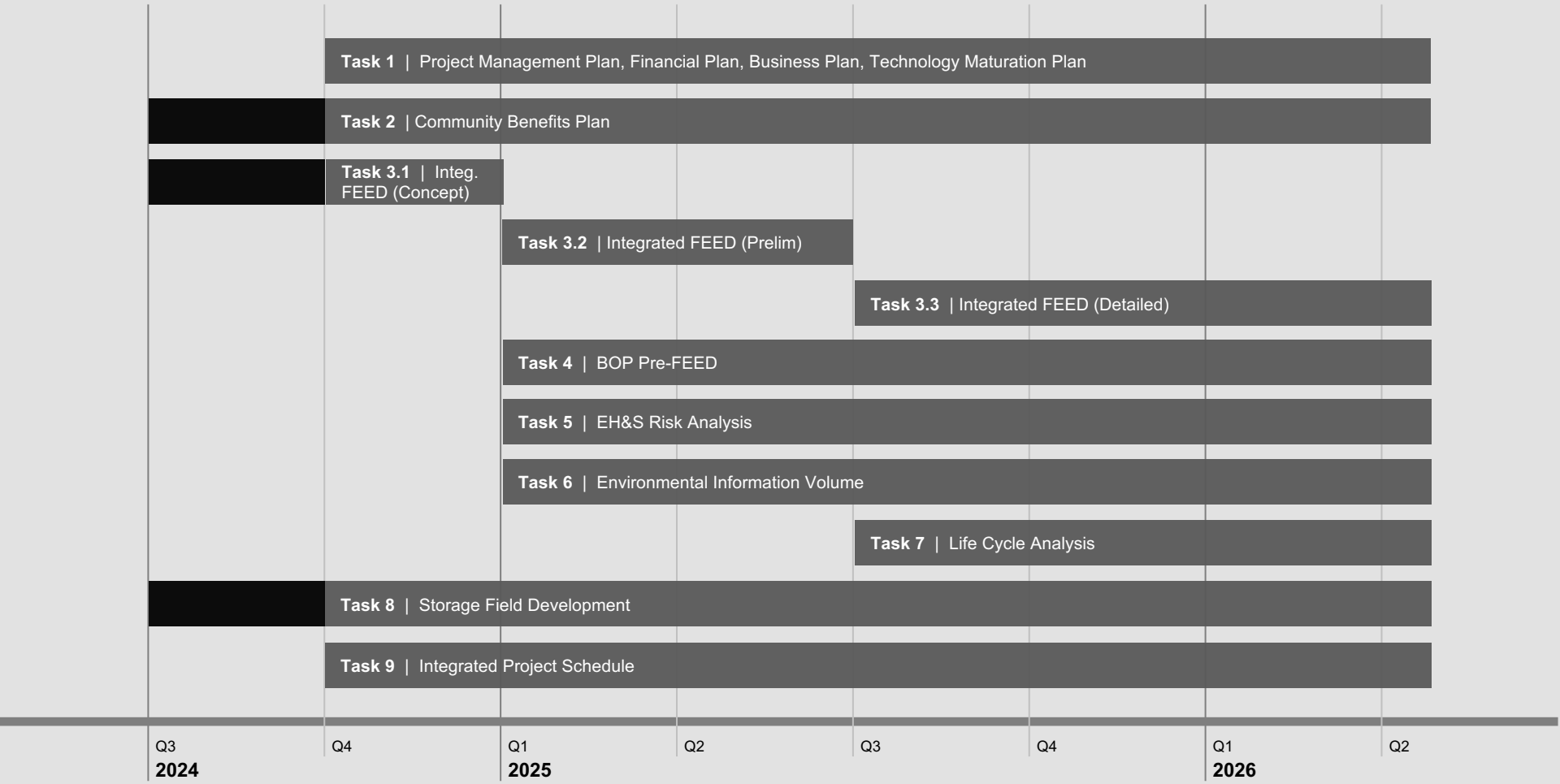
DAC	CO_2 Storage	CO_2 Utilization
CarbonCapture™	FRONTIER CARBON SOLUTIONS	twelve

Hub Vendors & Sub-recipients

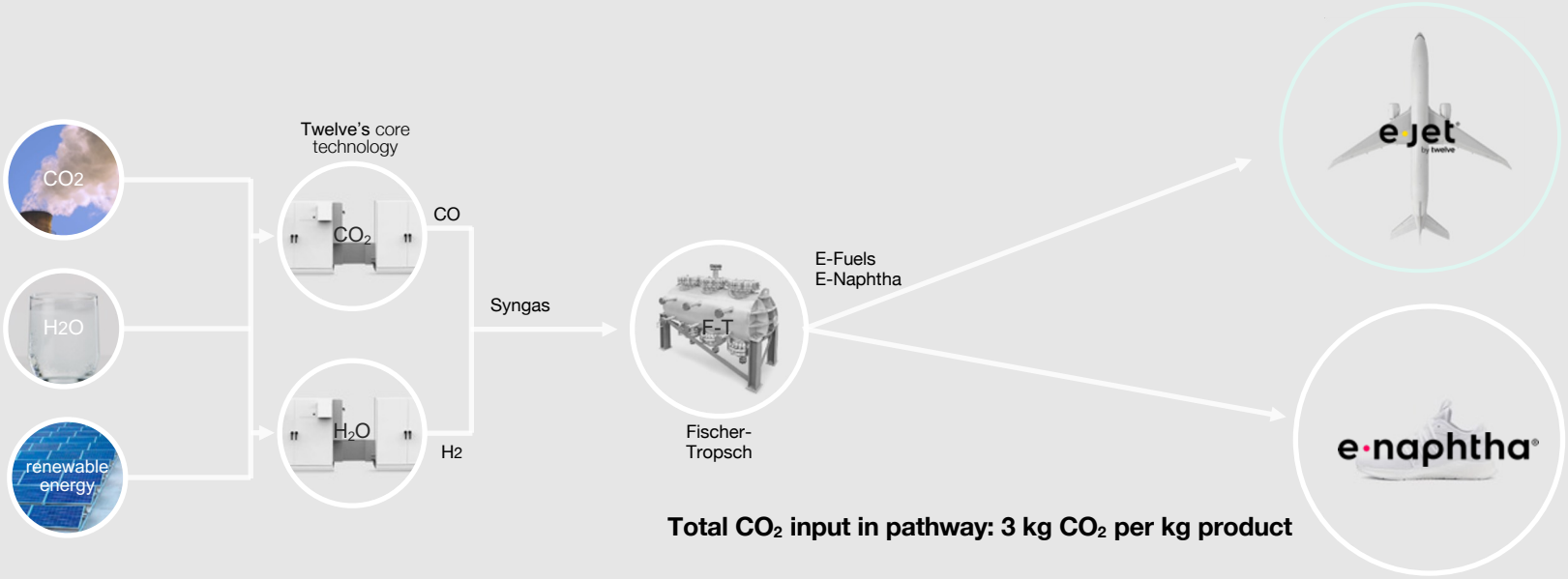
Community Benefits	Energy	EPC	Storage Development
University of Wyoming	EPRI	FLUOR	Carbon Solutions LLC

Business Plan	MRV	Energy Strategy	Energy
Carbon Direct	Icarus	NOVUS energy advisors	ROCKY MOUNTAIN POWER

Gantt Chart



Twelve's AirPlant™ turns CO_2 into fuels and building blocks for materials



Total CO_2 input in pathway: 3 kg CO_2 per kg product

1. Twelve combined proprietary low temperature CO_2 electrolysis with H_2O electrolysis to produce syngas from captured CO_2 and water

2. Syngas is used to produce naphtha and drop-in fuels via Fischer-Tropsch process

3. Twelve's products are identical to conventional products with zero new emissions, zero fossil fuels, and zero tradeoffs in quality and performance

Twelve: launching a new industry

2021
pilot scale

World's first CO2Made products, E-Jet® pilot

U.S. AIR FORCE

2022
industrial system

World's largest CO_2 electrolyzer

2023
industrial deployment

Commercial E-Jet® / E-Naphtha™ plant under construction

2025
takeoff

First E-Jet® route and initial production

Alaska AIRLINES · Microsoft · shopify · BCG BOSTON CONSULTING GROUP

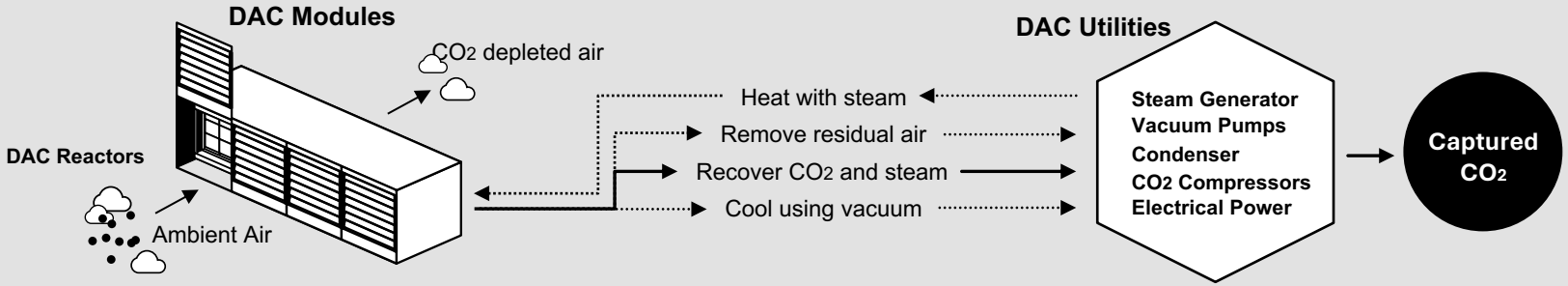
2026+
growth and scale

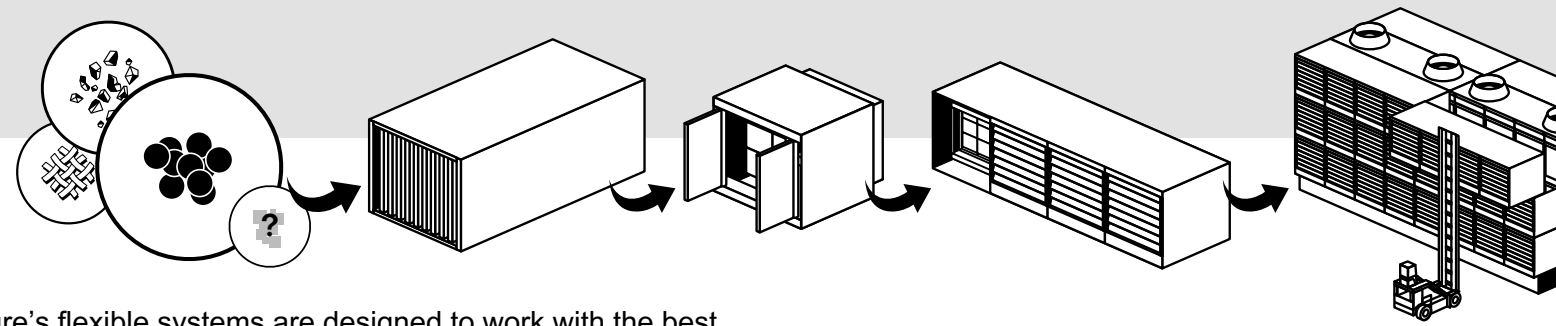
Scale up of E-Jet® / E-Naphtha™ capacity

IAG INTERNATIONALS AIRLINES GROUP · الإتحاد ETIHAD

CarbonCapture's DAC Technology

To capture CO_2 from ambient air, our technology uses structured solid sorbents and a temperature-vacuum swing adsorption (TVSA) process.



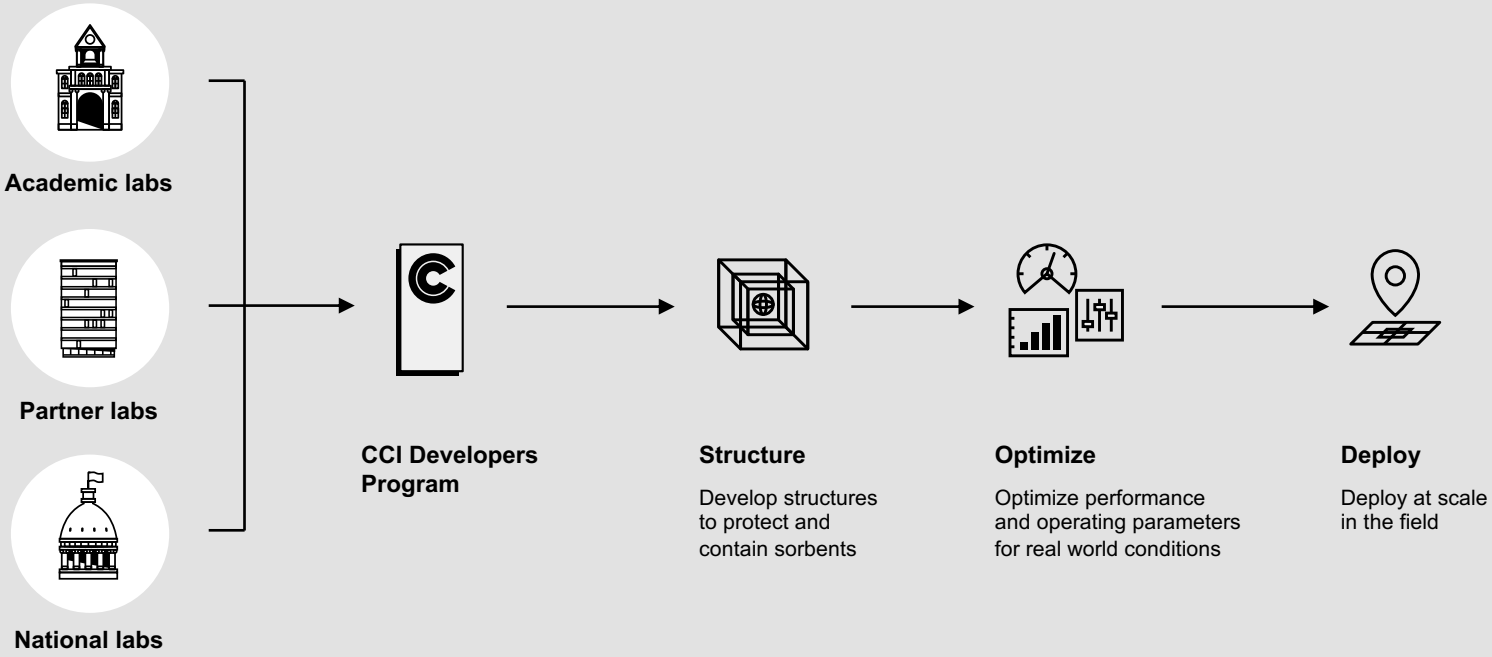


CarbonCapture's flexible systems are designed to work with the best performing DAC sorbents of today *and* tomorrow.

Using our **Modular Open Systems Architecture (MOSA)**, our hardware is designed to incorporate future sorbent innovation via plug and play cartridges. By being able to upgrade our systems with new sorbents as they are invented, we're able to future-proof our platform.

Sorbent Development & Testing

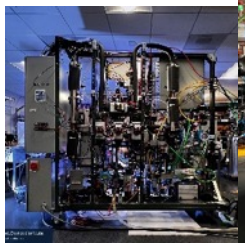
New sorbents for DAC are continually being developed by scientists in academic, corporate, and national labs around the world. We offer these developers a path to market, alongside our active in-house sorbent development program.



From mgs to tons

Evolution of our TRL and test platforms

~100g



Rocky

Environmental testing

-10°C up to 40°C
0% RH up to 90% RH

Arizona
Wyoming
Louisiana

Bullwinkle

Lifetime testing

Fully automated system
2 parallel reactors
Mobile unit

~10kg

Calvin

Production-scale sorbent testing

Fully automated system
Performance & lifetime testing
Mechanical/chemical stability

~100kg

Hobbes

Full reactor testing

Production-scale process unit
TRL 6
Hardware, sensors, & airflow

Ton-scale
structured sorbent

Leo

Field testing

12 reactors
TRL 8
Continuous cycling

Watch the full demonstration
from our event.

Leo Series DAC Modules

In June we unveiled our module series, breaking down industry barriers with our revolutionary approach to scale DAC through **mass manufacturing and materials science.**

- Each module is equipped with 12 DAC reactors
- At-scale deployment of structured sorbents
- Nominal capacity of 500 tons/year
- Generates a concentrated stream of CO_2 at >95% purity
- Each module is roughly the size of a shipping container

DAC Manufacturing Facility

We've signed the lease on the world's first DAC manufacturing facility in Mesa, Arizona

- At full capacity, the 83,000 sq.ft. facility will produce 4,000 modules per year
- Automated fabrication processes will reduce manpower load and result in a consistently higher quality product

"What CarbonCapture is doing with its modular approach underscores the indispensable role of the private sector in developing and deploying carbon management at a scale needed to achieve a clean energy and industrial future."

Brad Crabtree
Assistant Secretary for Fossil Energy & Carbon Management,U.S. Department of Energy

Upgradable

Seamless integration of new structured sorbents as they become available

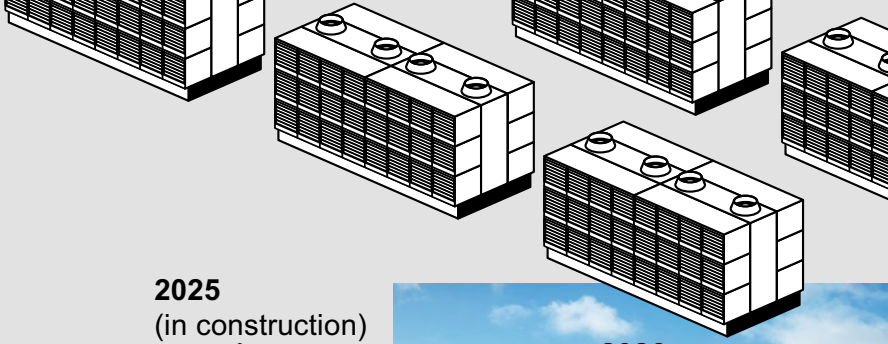
Manufacturable

A scaleable, repeatable, and cost-effective process

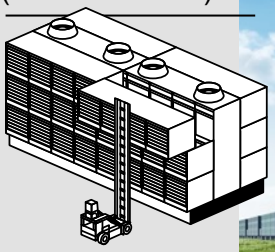
Maintainable

Minimal interruptions to system performance and low O&M costs

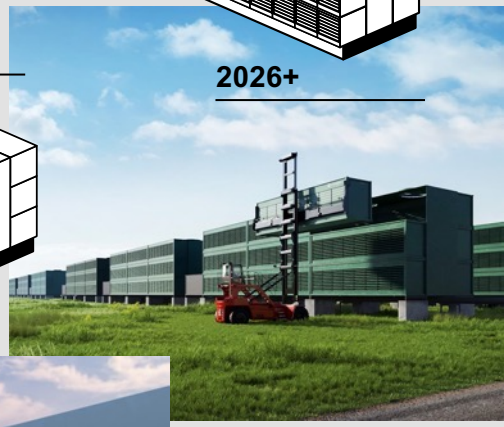
Deployment Progress



2025
(in construction)

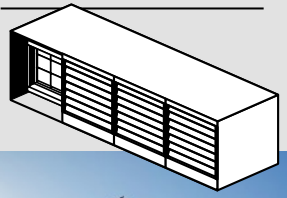


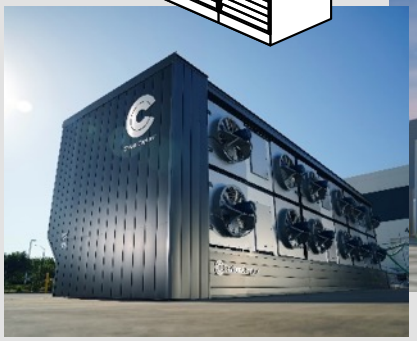
2026+



Commercial Scale Project

2024
(operational)





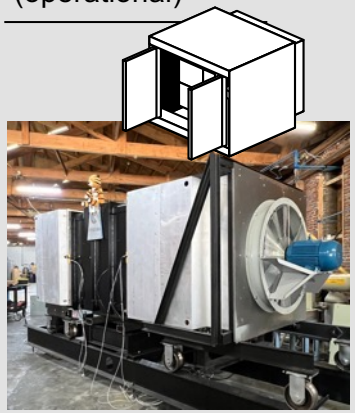
Commercial Scale Module
with structured sorbent

Los Angeles
Multi-reactor module
(500 tons/year)

Commercial Pilot

Multi-module cluster
(2000 tons/year)

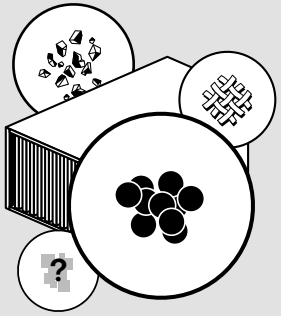
2022
(operational)



Commercial Scale Reactor
with structured sorbent

Los Angeles
Single reactor
(35 tons/year)

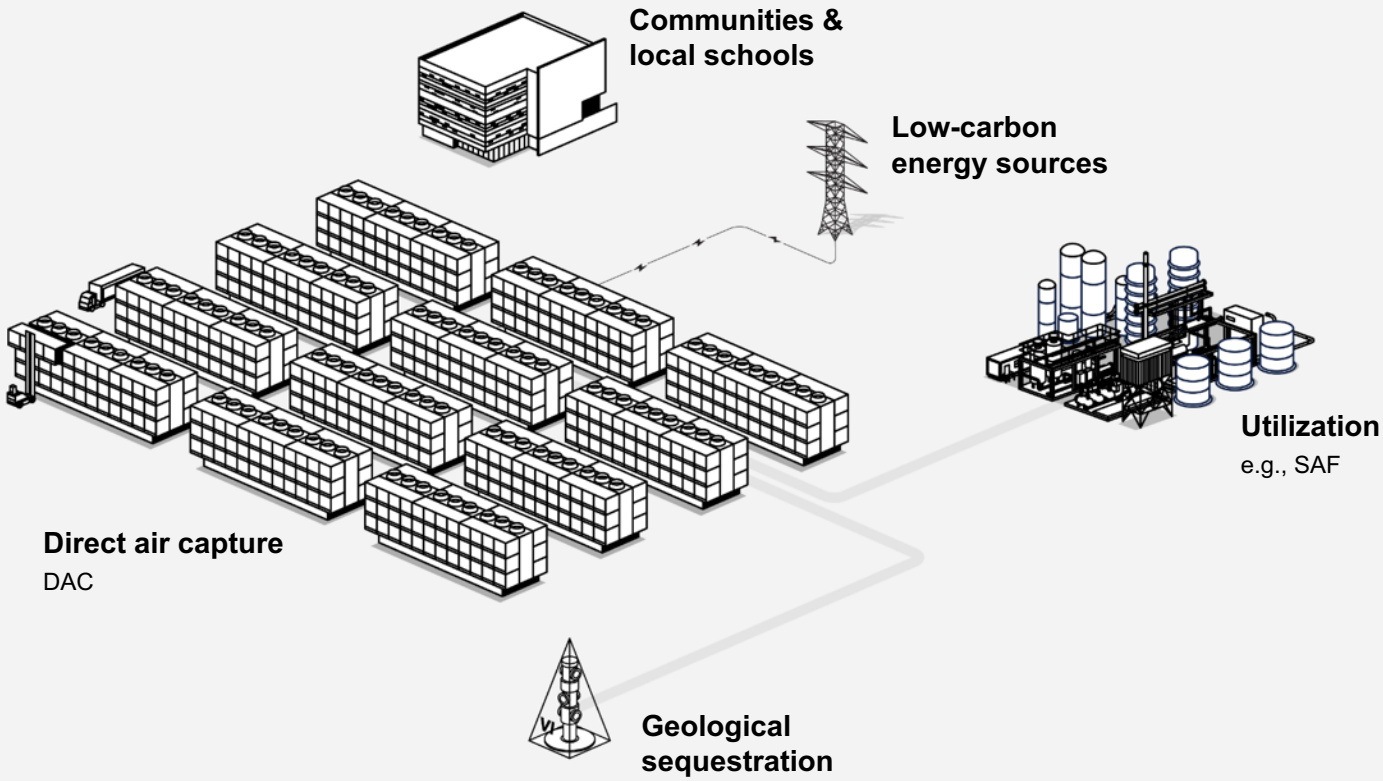
Ongoing



Structured Sorbent Development

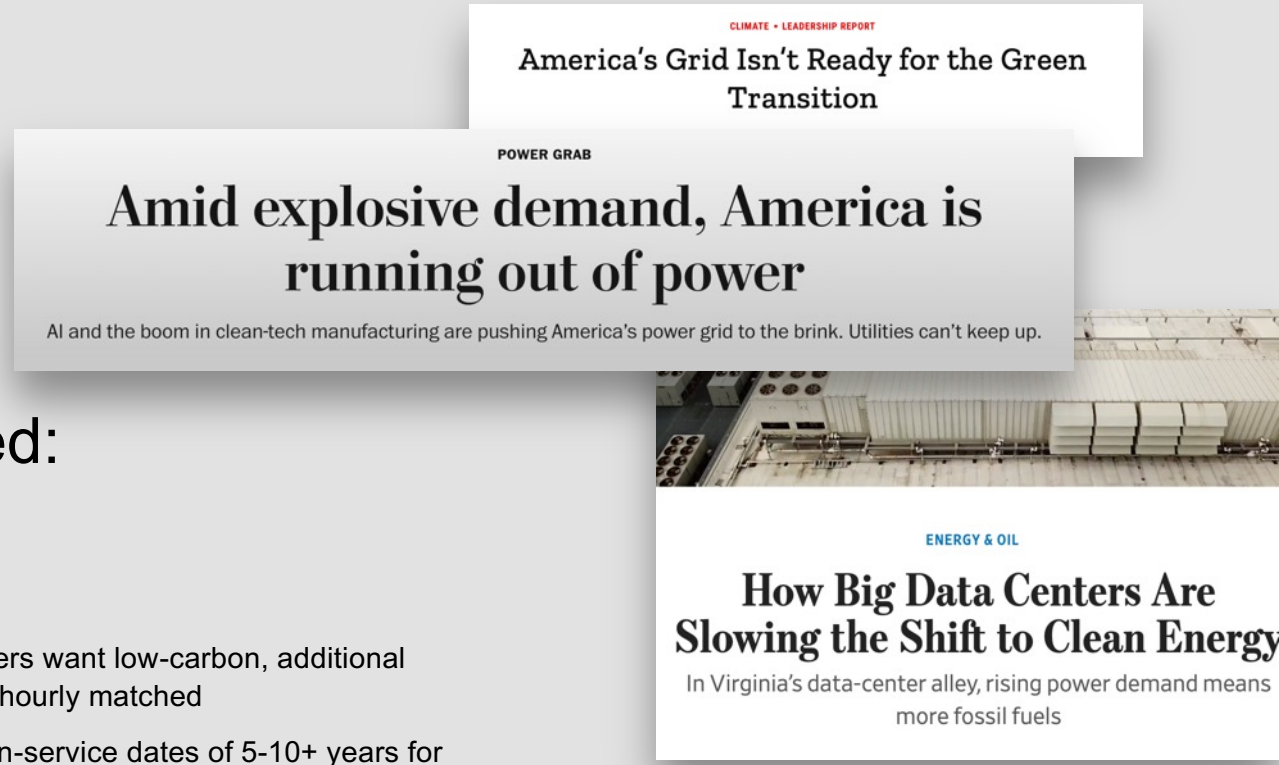
Getting to megaton-scale

All projects will require a similar set of building blocks to be successful. Co-location and / or resource sharing between DAC companies may alleviate cost and schedule risks.



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

- CBP structured around SMART actions: community and labor engagement, skilled workforce, DEIA, and Justice40
- Significant community learnings from Wyoming in the past 2 years
- Challenges with community fatigue—communities uncertain what they are supposed to expect from startup DAC companies
- Messaging is critical—TA-2 is a FEED study with uncertain FID
- Ensure two-way engagement guides the planning, construction, and operation stages but don't overpromise
- Every community is different – many communities value their oil & gas legacy, and we need to honor community values
- Tribes will have different values and more fatigue



Lessons Learned: **Energy**

- Carbon removal credit customers want low-carbon, additional energy generation that is 24/7 hourly matched
- Utility timelines are long, with in-service dates of 5-10+ years for medium-to-large projects in some regions
- DAC will struggle against more competitive options (e.g., data centers)
- Near-term behind-the-meter options using fossil fuels (e.g., fuel cells or natural gas combined cycle plus capture) may be necessary in the interim
- Proximity to energy options will need to be balance / optimized with proximity to permanent storage solutions

Appendix