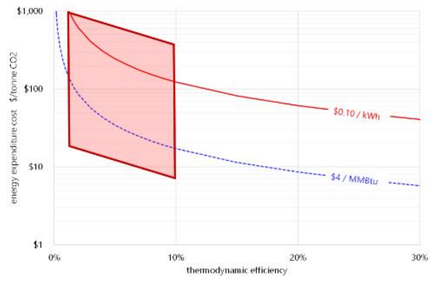
Direct Air Capture of CO_2 in a Circular Carbon Economy

DAC versus point source capture

- ✓ infinite feedstock reservoir
- ✓ unconstrained scale flexibility
- ✓ minimal contaminants
- ✓ location independence

DAC Challenges

DAC separation energy intensity



400 ppm → 1 atm @25°C

$\Delta G_{separation}$ = ~20 kJ/mol

<u>DAC requires</u>

Low cost energy source

and/or

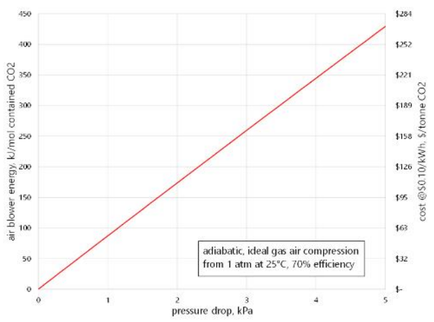
Step change in efficiency

Movement of air

forced air + typical ΔP
= $ + positive emissions

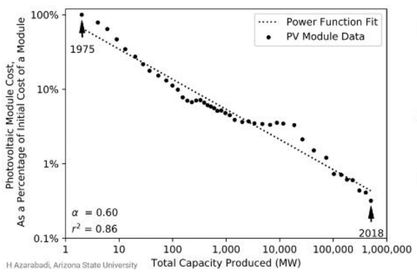
<u>DAC requires</u>

Very low pressure drop
and/or
low-cost, low-carbon energy



Capital Intensity

Mass production has a learning curve



Economies of mass production can win out over the economy of scales

Small scales shorten time to deployment

incremental capacity expansion minimizes investment risk and technology obsolence risk

Passive Direct Air Capture

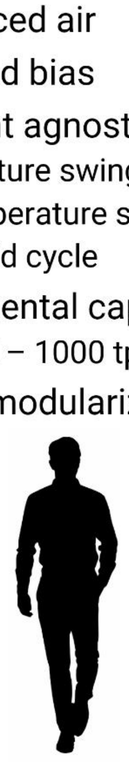
No forced air

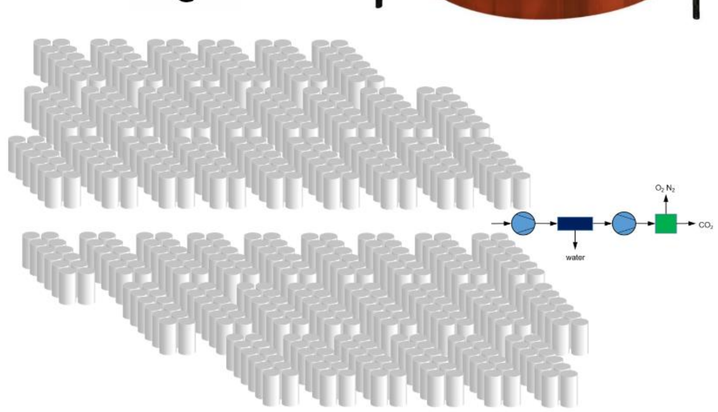
No wind bias

Sorbent agnostic
- Moisture swing
- Temperature swing
- Hybrid cycle

Incremental capacity
- 1 tpd – 1000 tpd

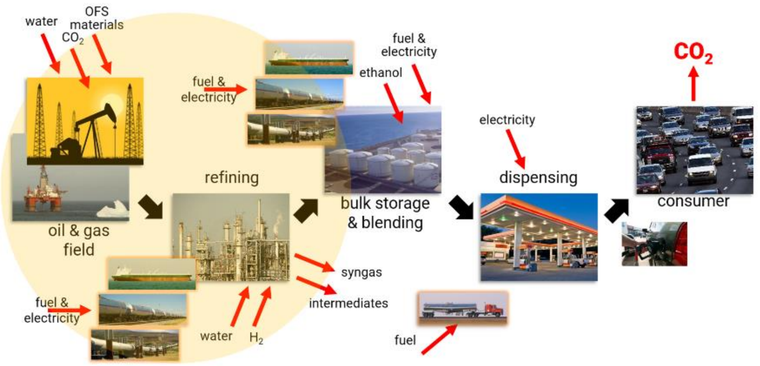
Mass modularization



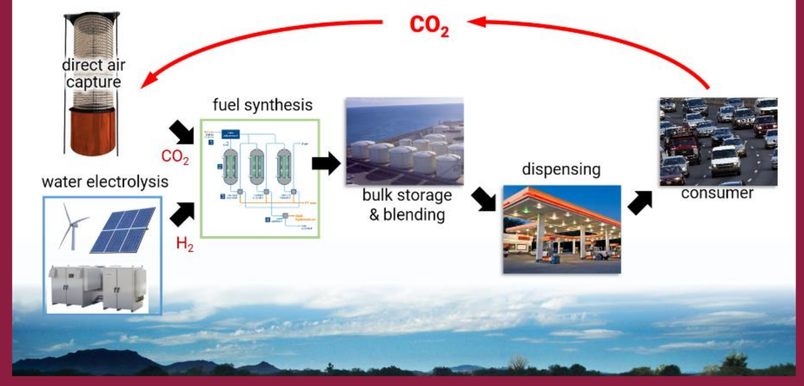


DAC Shift in the Supply Chain Paradigm

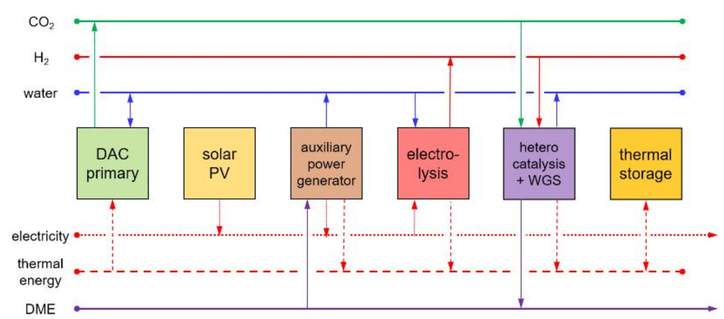
Traditional Transportation Fuel



Air-to-Fuel



Integration with Fuels & Chemicals



variable renewable energy source

coupled with primary stage DAC

thermal, electrical and chemical storage enables asynchronous capital utilization

methane, methanol, DME, syngas

Arizona State University

the **center** for **negative carbon emissions**