

Tools to accelerate the DAC ecosystem from ORNL

David Sholl

Director, ORNL Transformational Decarbonization Initiative

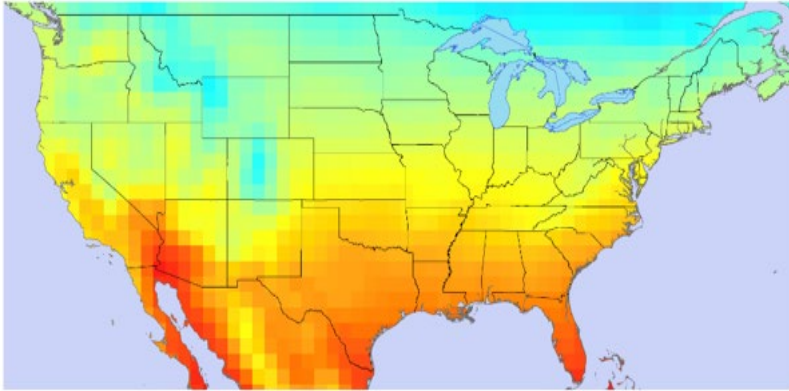
shollds@ornl.gov

ORNL is managed by UT-Battelle LLC for the US Department of Energy

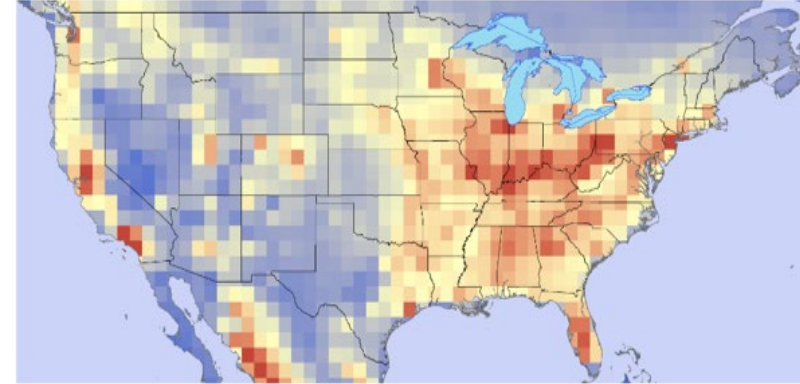
Impacts of Meteorological Conditions on DAC Siting (*Contact: David Sholl, sholl@ornl.gov*)

Regional variations exist in CO₂ availability from air and ambient T, P, RH

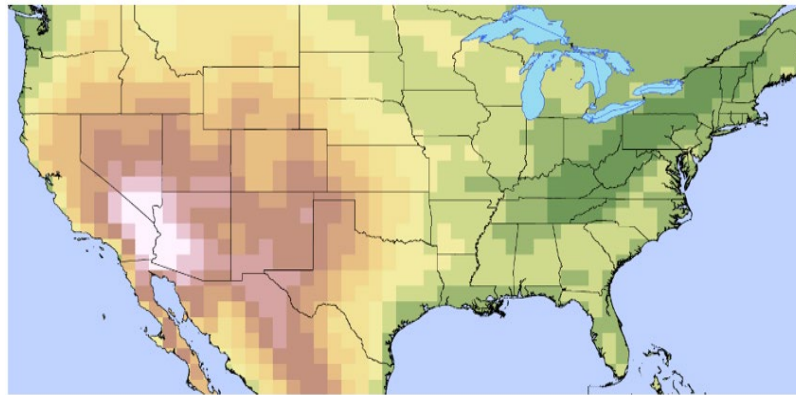
Temperature



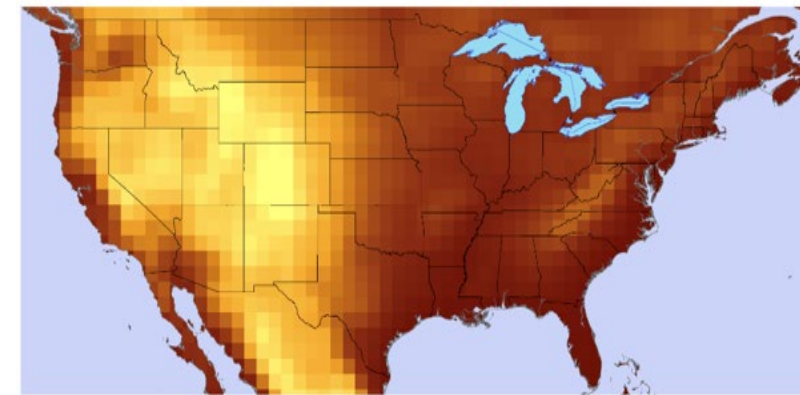
CO₂ ppm



Humidity



Pressure

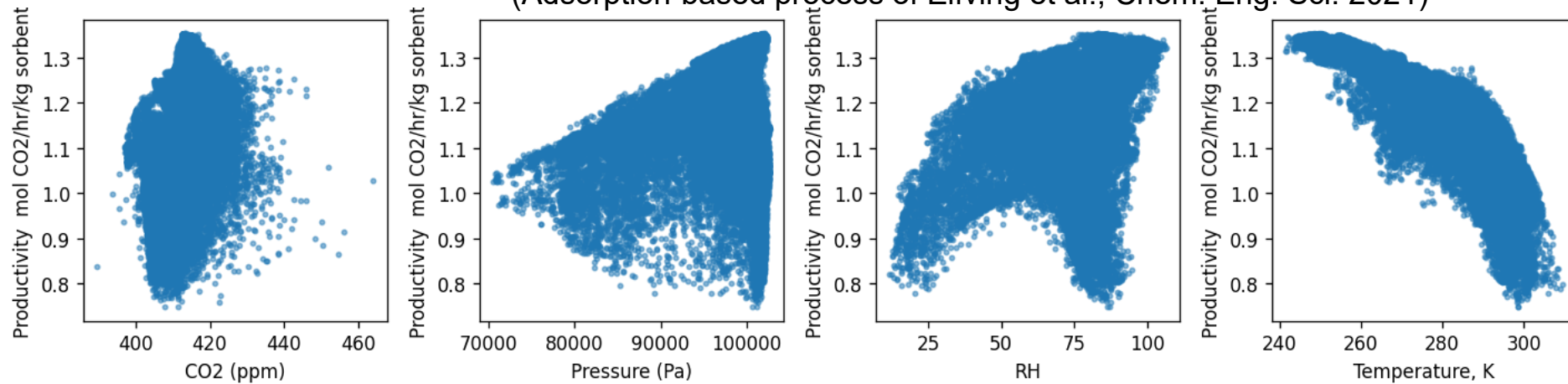


All data 2018 annual averages

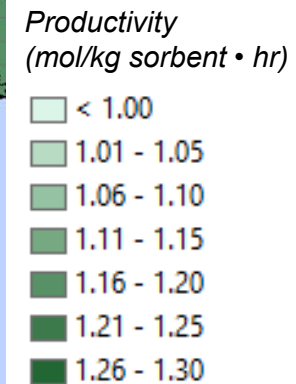
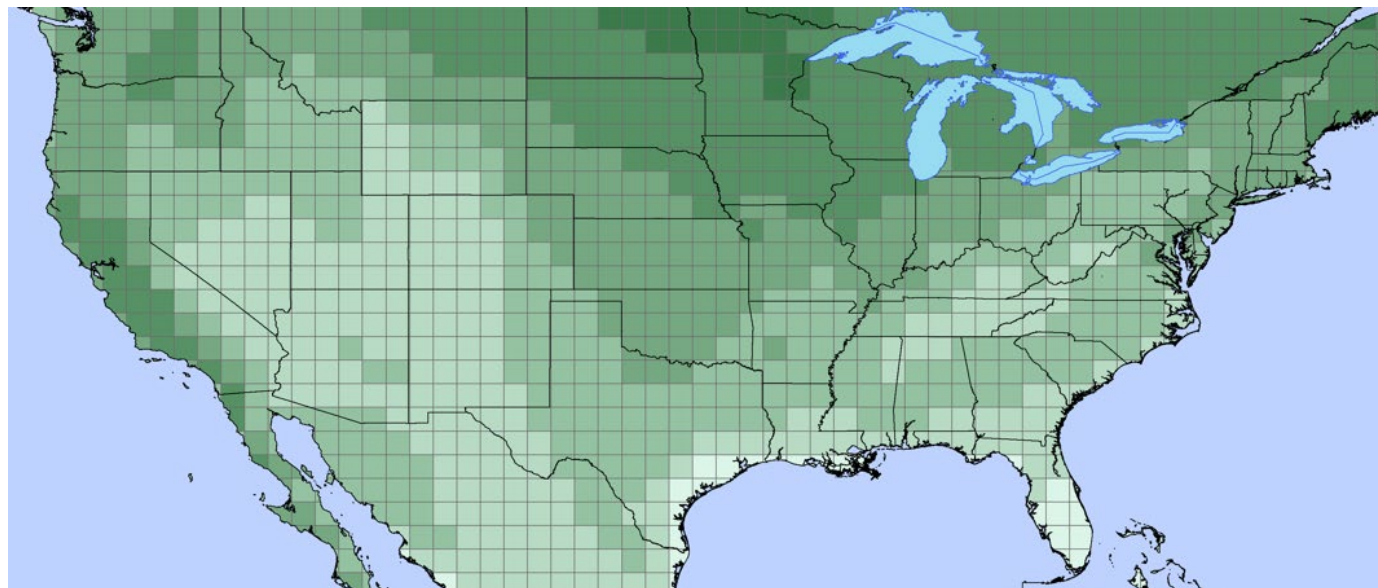
Impacts of Meterological Conditions on DAC Siting (*Contact: David Sholl, shollids@ornl.gov*)

DAC Performance for Fixed Process Conditions

(Adsorption-based process of Elfving et al., Chem. Eng. Sci. 2021)



Each data point from gPROMS process simulation of cyclic steady state

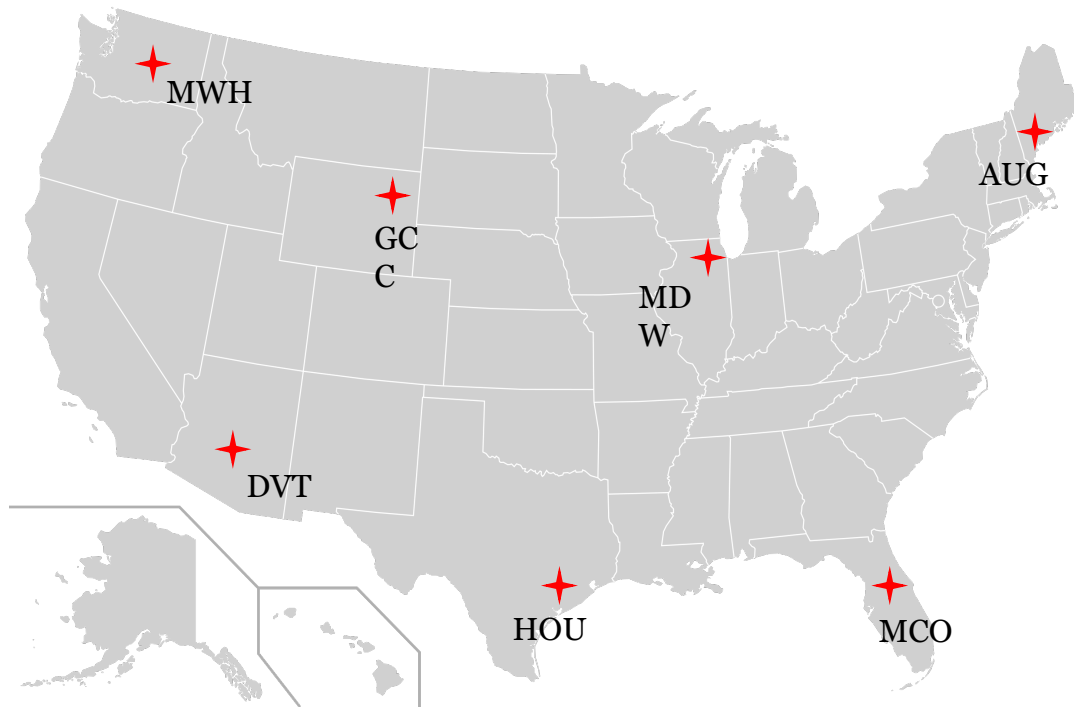


Impacts of Meterological Conditions on DAC Siting (Contact: David Sholl, shollids@ornl.gov)

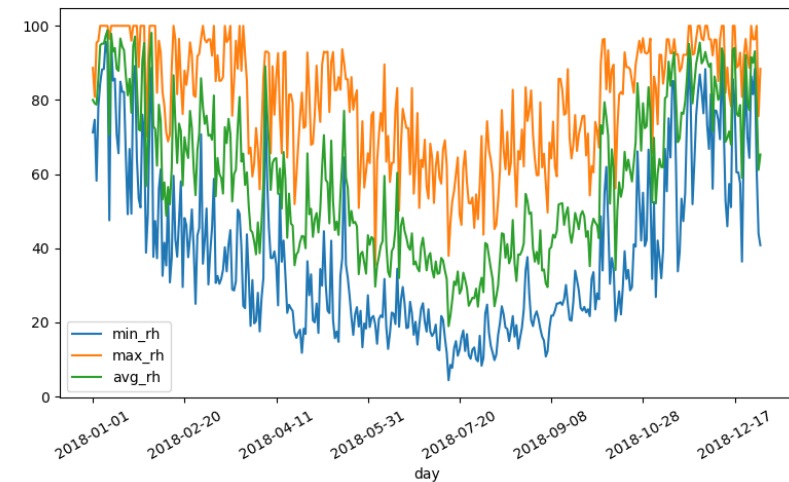
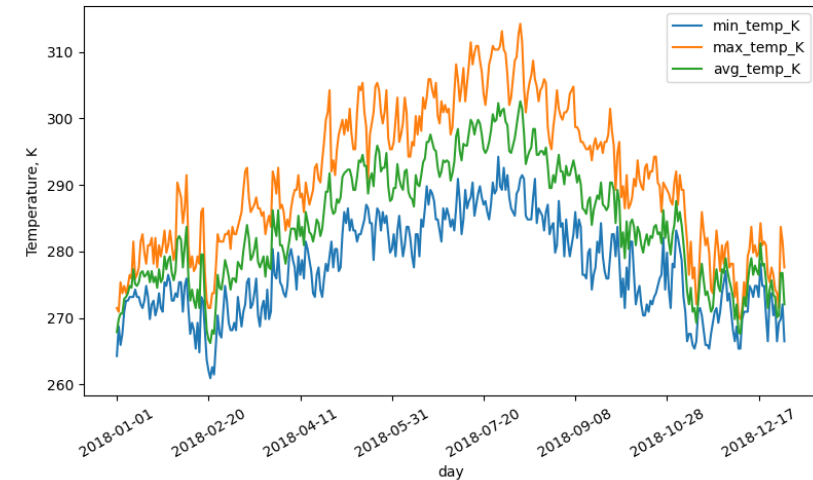
Site- and Date-based Process Optimization

(Adsorption-based process of Elfving et al., Chem. Eng. Sci. 2021)

Input: Daily T/RH + Monthly Avg CO_2/P_{atm}

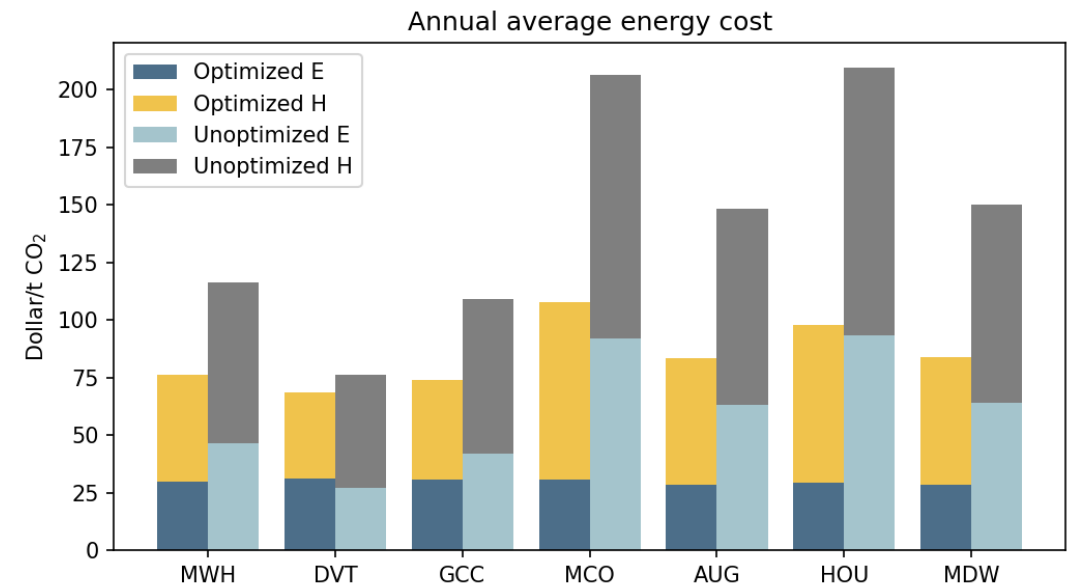
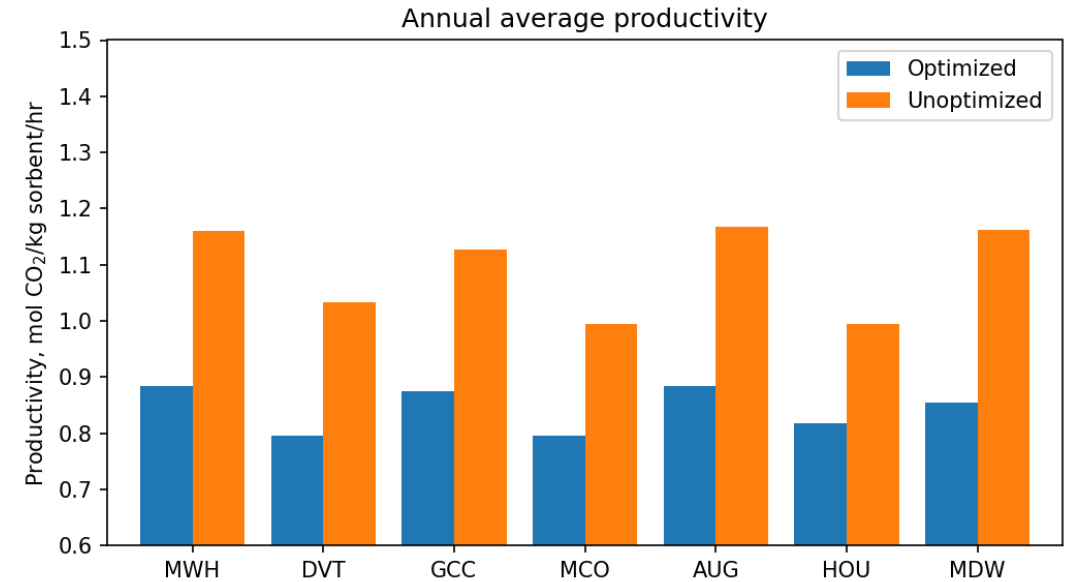
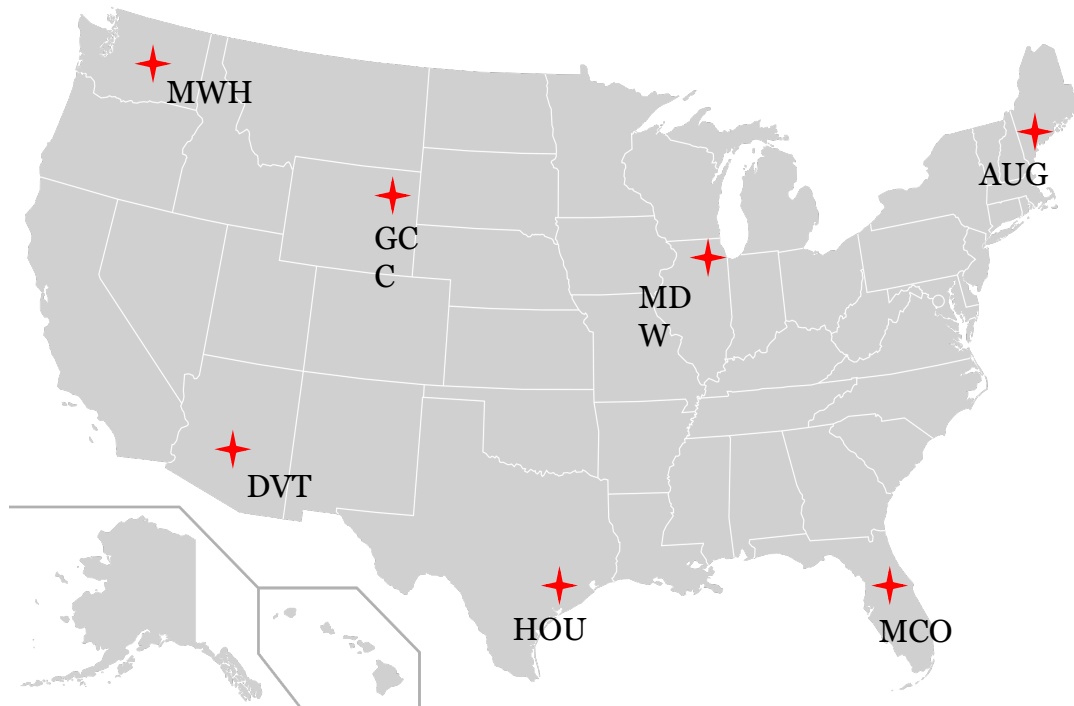


MWH, WA, Humid-Cold



Impacts of Meterological Conditions on DAC Siting (*Contact: David Sholl, shollids@ornl.gov*)

Site- and Date-based Process Optimization
 (Adsorption-based process of Elfving et al., Chem. Eng. Sci. 2021)



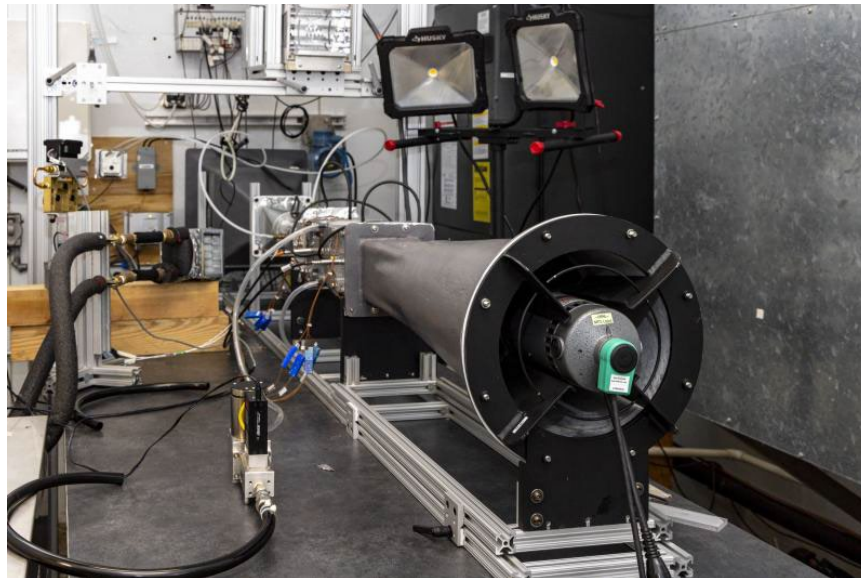
User Facility for Site-based DAC Performance *(Contact: David Sholl, shollds@ornl.gov; Kashif Nawaz, nawazk@ornl.gov)*



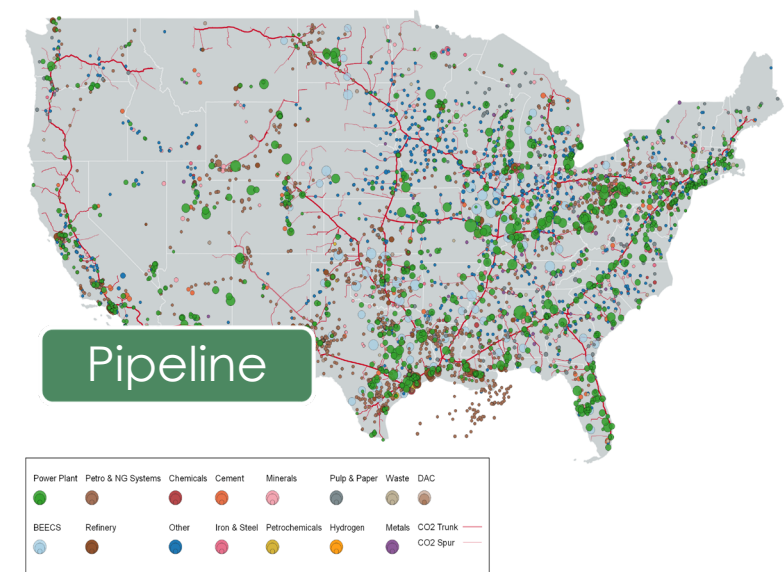
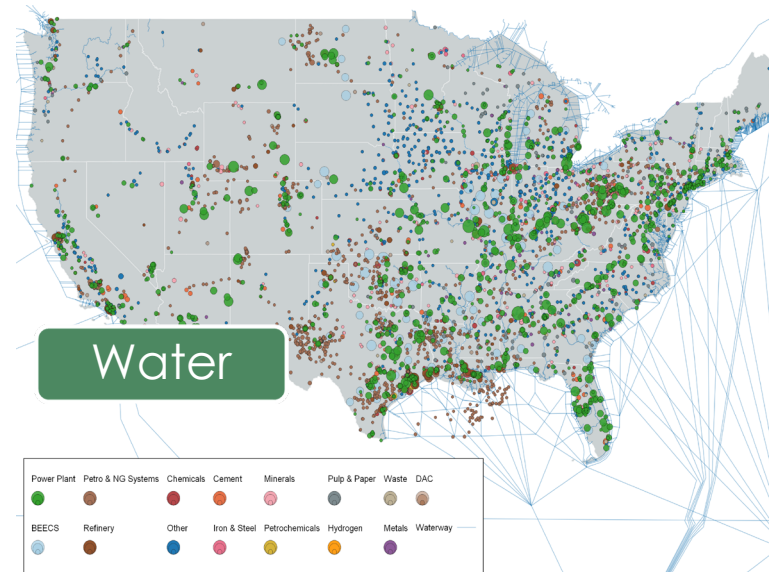
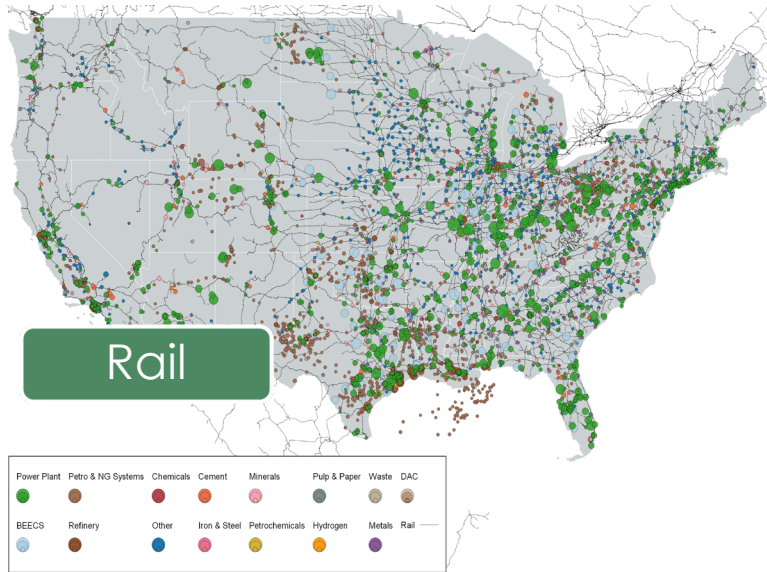
Building Technologies Research and Integration Center (BTRIC)

User facility operated by ORNL for DOE

Multiple climate controlled chambers to mimic seasonal variations for all US climate zones (used in e.g. DOE Cold Climate Heat Pump Challenge)



Coupling DAC and Transportation Networks (Contacts: David Sholl, shollds@ornl.gov; Majbah Uddin, uddinm@ornl.gov)



- Power plants and industrial sites are from EPA FLIGHT², BECCS sites are from the DOE Billion-Ton report³, and DAC sites are selected from the Atlas of DAC report⁴.
- Rail network is from USDOT⁵, water network is from USACE⁶, and pipeline network is from the Net Zero America study⁷.

² <https://ghgdata.epa.gov/ghgp/main.do>

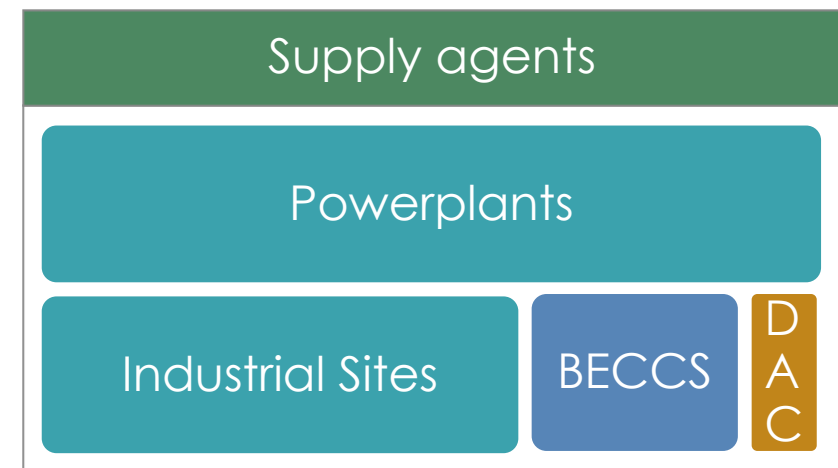
³ <https://bioenergykdf.net/content/data-and-interactive-visualization-economic-accessibility-co2-sequestration-through>

⁴ <https://carboncaptureready.betterenergy.org/wp-content/uploads/2023/03/DAC-Hubs-Atlas-2023.pdf>

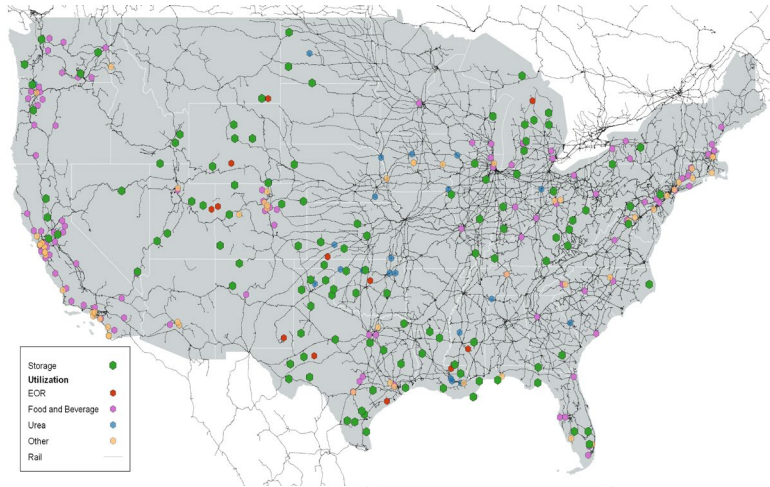
⁵ <https://geodata.bts.gov/datasets/usdot::north-american-rail-network-lines/about>

⁶ <https://data-usdot.opendata.arcgis.com/datasets/usdot::navigable-waterway-network-lines/>

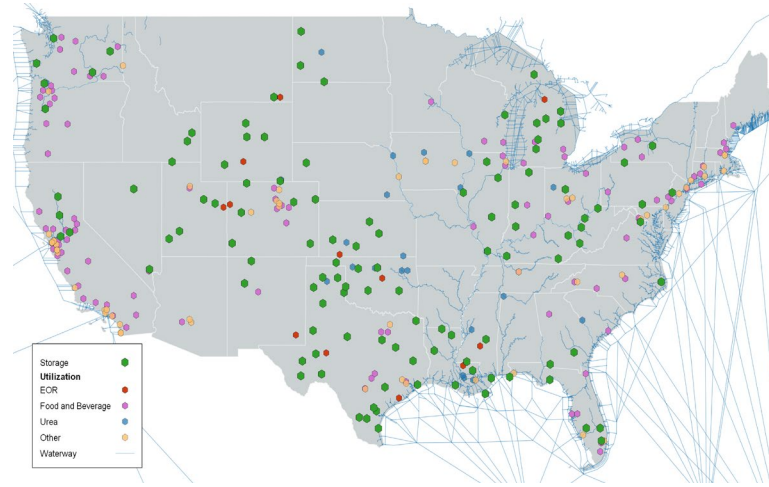
⁷ <https://maps.princeton.edu/catalog/princeton-9s161f569>



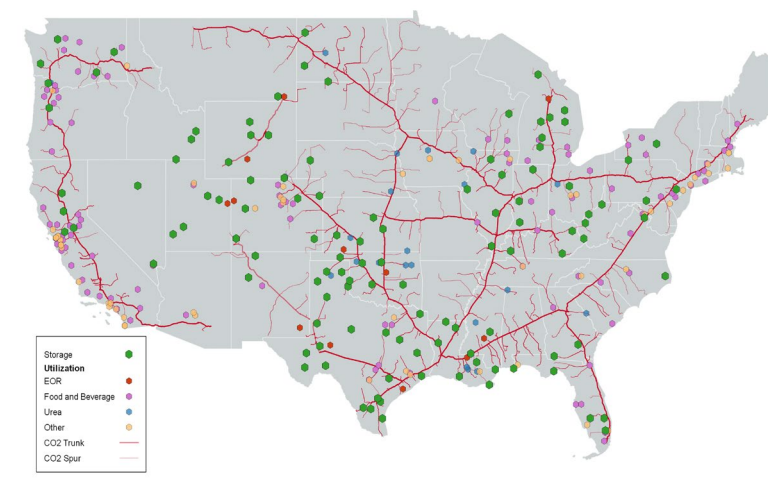
Coupling DAC and Transportation Networks (Contacts: David Sholl, shollds@ornl.gov; Majbah Uddin, uddinm@ornl.gov)



Rail



Water



Pipeline

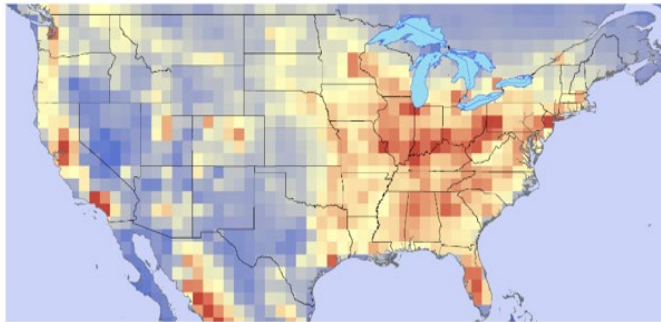
- Candidate geologic storage sites are selected, inside geologic formations, based on a multi-criteria decision making approach that considers proximity to transportation networks and sources as well as low-risk areas.
- Agent-based approach designed to allow users to weigh multiple performance factors



Summary: Tools for the DAC Community from ORNL

Meteorological impacts on siting

- Contact – David Sholl (shollds@ornl.gov)



Testing facilities for all US climate zones

- Contacts – David Sholl (shollds@ornl.gov), Kashif Nawaz (nawazk@ornl.gov)



Coupling DAC with CO2 transportation

- Contacts – David Sholl (shollds@ornl.gov), Majbah Uddin (uddinm@ornl.gov)

