



**BUILDING
DECARBONIZATION
COALITION**



BDC Presents: Building Decarbonization Meets Water Conservation

August 29, 2024

Image credit: Colorado Mesa University

About the BDC

The Building Decarbonization Coalition (BDC) aligns critical stakeholders on a path to transform the nation's buildings through clean energy, using policy, research, market development and public engagement.

The BDC and its members are charting the course to eliminate fossil fuels in buildings to improve people's health, cut climate and air pollution, prioritize high-road jobs, and ensure that our communities are more resilient to the impacts of climate change.

- **Sign up for our newsletter!**
<https://buildingdecarb.org/newsletter>
- **Membership is free!** Join us! buildingdecarb.org/join



Thank you to our Trailblazer Members!



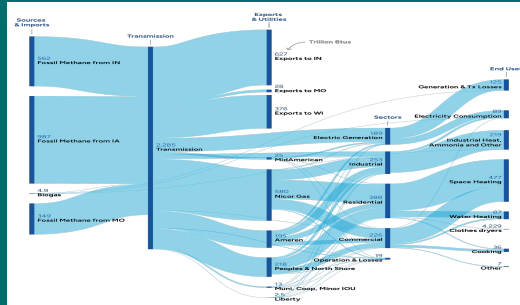
Upcoming Events

CLIMATE WEEK NYC

CLIMATE GROUP

NY Climate Week

[Invest in the Future of Heat](#)
[September 24, 2024](#)



BDC Presents

[The Future of Gas](#)
[September 26, 2024](#)



Policy Calls

[New York](#)
[October 8, 2024](#)

Webinar Logistics

- Everyone is muted.
- Ask **questions** for our panelists in the **chat**.
- Drop **comments** for the whole group in the **chat**.
- This webinar is being recorded and will be placed in our website's Resource Library.
- All registrants will be emailed with a link and additional resources early next week.



Today's Hosts



Ashley Basic
BDC

Thermal Energy Networks
Senior Associate



Kent Marsh
Colorado Mesa University

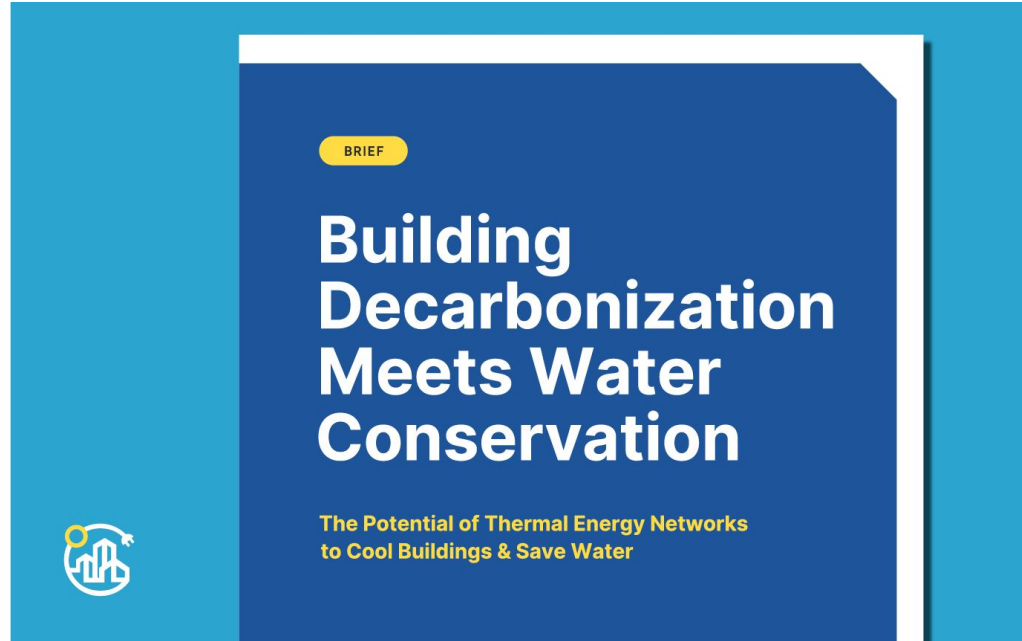
Vice President, Capital Planning,
Sustainability & Campus Operations



Jess Silber-Byrne
BDC

Thermal Energy Networks
Communications Manager

Our New Brief



The challenge, in headlines

Earth's 13-month record heat streak ends, but global temperatures remain high

by Lee Stoll, KOMO News | Sun, August 11th 2024 at 11:11 AM
Updated Mon, August 12th 2024 at 11:30 AM



Hotter heat

Image: KOMO News

Data centers draining resources in water-stressed communities

July 19, 2024



Thirstier buildings

Image: University of Tulsa

Water authority moves to conserve on cooling systems in Southern Nevada

High-consumption evaporative systems banned in new commercial buildings amid drought



Ongoing drought

Image: Las Vegas Sun

What makes a building “thirsty?”

- Climate control can require significant amounts of water.
- An estimated **5-15 billion gallons** of water are consumed **daily** for cooling U.S. commercial spaces.

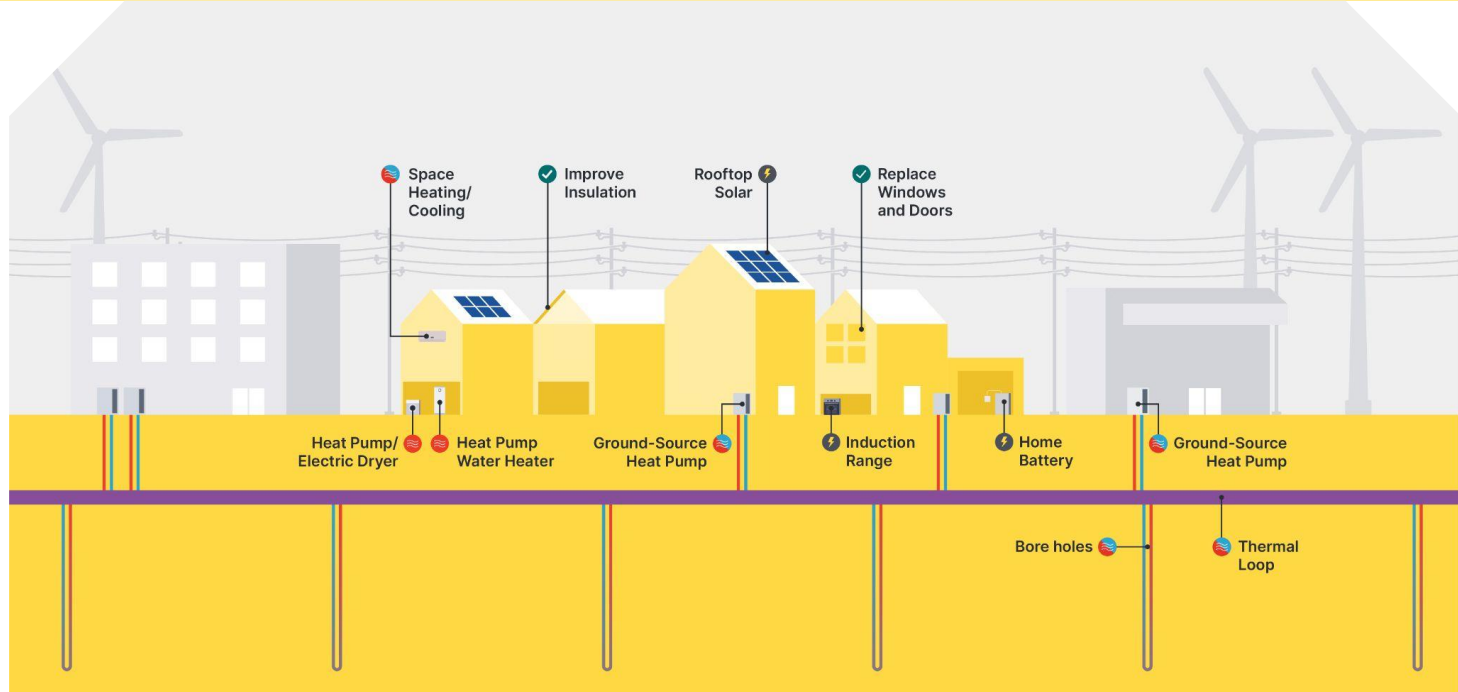


Cooling towers under scrutiny

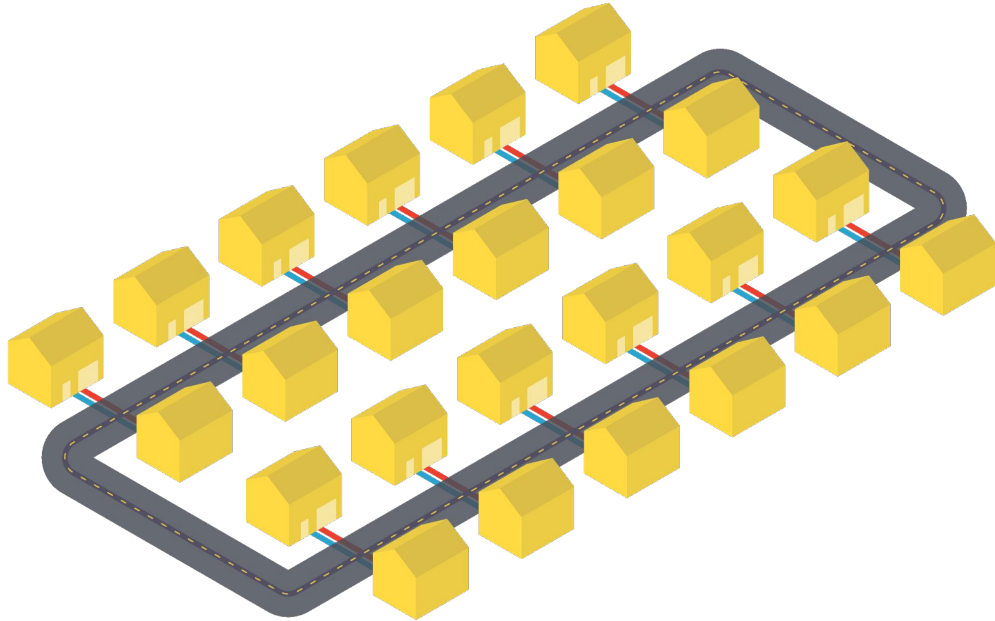


 Every yellow box = cooling tower arrays in this image of downtown L.A.

A solution: Thermal energy networks



Known Benefits of TENs



- Neighborhood-scale decarbonization
- No combustion = better air
- High efficiency = lower energy bills
- Eases strain on electric grid

Surveying Water Use at 10 Sites



Key Result: Significant Water Savings

337 million gallons of water saved annually across 8 sites

- That's 511 Olympic-sized pools
- Or the average annual water use of 3,000 U.S. households



Key Result: Variable Water Savings

- Annual water savings range from 18% to 46%
- Between 3,000 and 18,000 gallons per cooling or heating ton



Key Result: Saving Across Geography

- Water savings achieved across climate zones
- Sites surveyed in Pacific Northwest, Mountain West, California, Midwest, Northeast (and Canada), and Southeast





COLORADO MESA
UNIVERSITY






Thermal Energy Network




Colorado Mesa's TEN

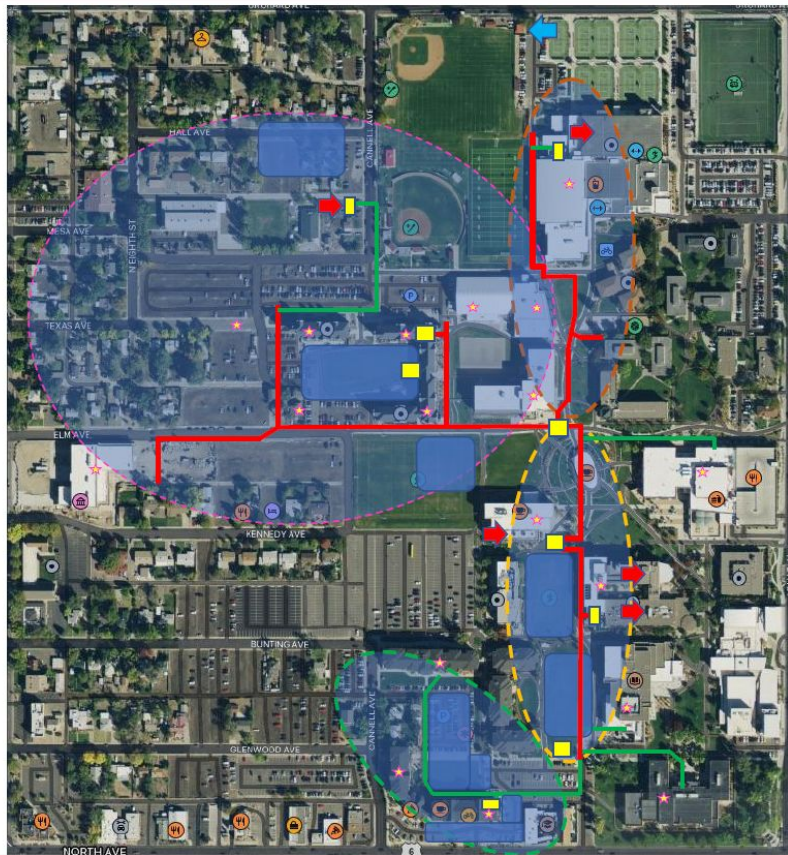
- HDPE piping (1.25" – 18" dia.)
- \approx 2.5 miles of Central loop pipe (18")
- 8 separate drill fields
- 427 boreholes \approx 500 ft deep
- \approx 1000 Heat pumps
- 5 Cooling towers (supplemental cooling)
- 2 Boiler plants (supplemental heating)
- 3 North & 3 South central loop pumps (50 hp)

Layout

Colorado Mesa University System Size ~ 3,500 Tons

-  • Borefields – 213,000 feet
-  • Buildings
- Thermal Highway**
 -  • 18" Pipes -
 -  • 12" & 10" Pipes
 -  • Vaults and Mechanical Rooms

-  • **GeoMicroDistricts**
-  • Cooling Towers - 1250 tons
-  • Future Irrigation (Heat and Cool)



What is a Drill Field



Dominguez Hall Field



Drill Field



8" dia. pipes between
central loop & H.H



Drill
Field



Drill
Rig

Central Loop

18" diameter HDPE Central Loop



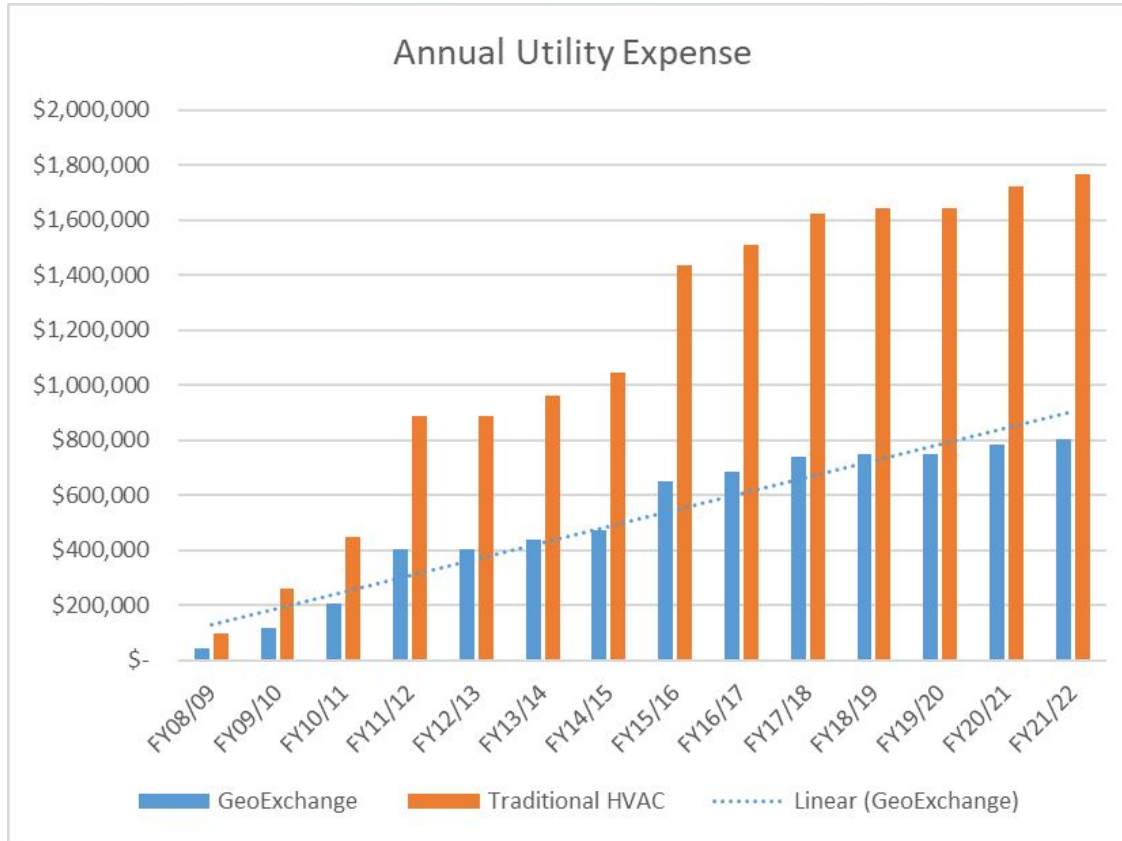
How does it Work?

- CMU's Geo-Exchange system works on the "least energy paths" principle.
- The hierarchy of least energy paths includes:
 - Moving energy from room to room or floor to floor within a building
 - Moving energy from one building to another through the Central Loop
 - Extracting energy from or dumping waste heat to the ground, pool, domestic hot water, and irrigation systems
 - Loop field thermal storage

Do TEN's Save \$'s?

- A traditional HVAC system
 - Consumes as much as 22 kWh/sf/yr
- A GeoExchange system
 - Consumes as little as 10 kWh/SF/yr
 - Lowers demand
- Typical annual CO2 emissions
 - 1.24 pounds CO2 per 1 kWh (2204.62 lbs = mt)
- Provides up to 89% of the energy needed
- Energy savings of \$1.6M/yr.
- Cumulative savings since 2008 = \$11.9M

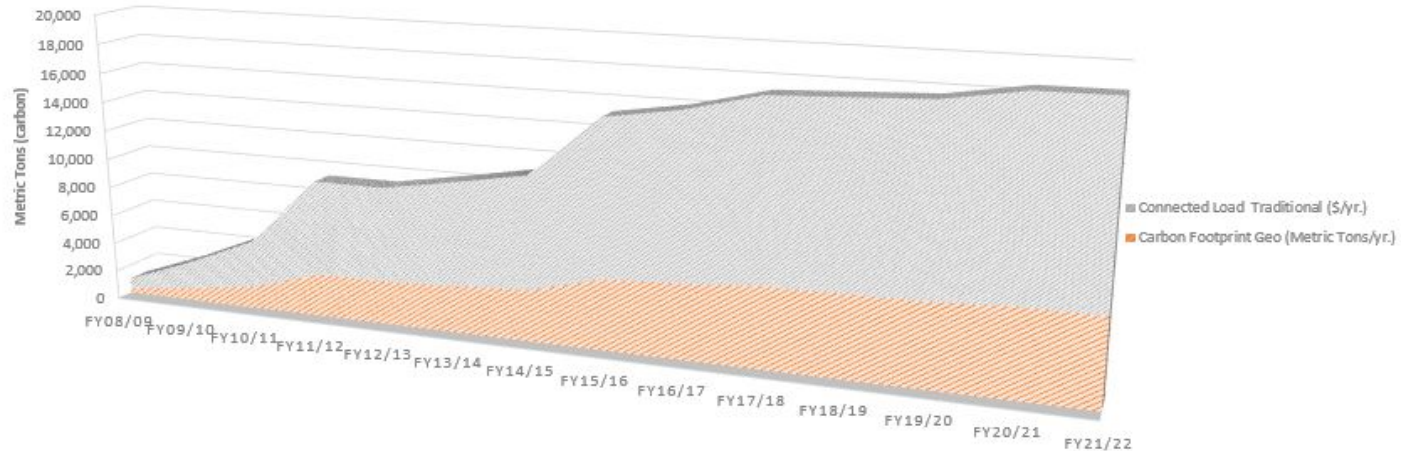
Utility Spend



Carbon Footprint

Carbon footprint has been reduced by 10,114 metric tons/yr.

SUSTAINABLE & ECO-FRIENDLY TECHNOLOGIES VS TRADITIONAL TECHNOLOGIES



Payback

- Financial investment
 - New building cost = \$3,284/ton
 - New loop field = \$30/ft
 - Total Cost of loop fields = \$6.4m
 - Total system cost = \$20.2m
 - Simple payback period = 12 years

Challenges/Lessons Learned

Challenges

- Reliable equipment and system components

Lessons Learned

- Mechanical Engineers & Installation contractors
 - Familiar with TEN's and heat pumps
- Pre-construction considerations
 - Lack of Construction and installation standards and testing procedures

What's Next

- CMU was approved for \$9M in spending authority to connect the rest of campus:
 - Moss Performing Arts renovation - 60k SF
 - Connect Grand Mesa, Lowell Heiny, Fine Arts – 160k SF
 - Mav Pav expansion – 45k sf
 - New Theater bldg - 55k SF
 - Computer & Electrical Engineering - 150k SF
 - Aspen Apartments expansion – 55k sf
- Opportunities
 - Additional domestic hot water generation
 - Domestic irrigation cooling
 - Sanitary system (black water) heat rejection/absorption
 - Help guide Codes & Standards (IGSHPA)

The opportunity



Policy momentum



Utility pilots



Federal tax credits

Key Recommendations

- Standardize data on buildings' water usage
- Make data public
- Consistently track and measure buildings' water savings

Potential questions:

- Are water savings achieved from replacing heating infrastructure, cooling towers, or both?*
- Did any cooling towers remain after the geothermal system was installed, or was the cooling infrastructure completely replaced?*
- How often are the cooling towers used when they remain in place, and what conditions merit their use?*

Questions?





Thank You!

***Questions about TENs?:
jsilberbyrne@buildingdecarb.org***

Additional Resources

- [Brief: Building Decarbonization Meets Water Conservation](#)
- [Website: Colorado Mesa University: Geo-Grid System](#)
- [Website: Thermal Energy Networks](#)
- [Website: HEET](#)
- [Wiki: HEET: Gas-to-Geo](#)
- [Whitepaper: Neighborhood Scale: The Future of Building Decarbonization](#)

