

2E: Symposium 5 District Energy from Sewage Heat Recovery

DESIGNING DENVER'S FIRST WASTEWATER DISTRICT ENERGY SYSTEM



CampusEnergy2020

THE POWER TO CHANGE

FEBRUARY 10-14 • SHERATON DENVER DOWNTOWN • DENVER, CO

Wednesday, 12 February 2020

THE NATIONAL WESTERN CENTER

The National Western Center represents a visionary transformation of the National Western Complex into a sustainable, year-round destination for agriculture, education and entertainment.



A LOW CARBON, RESILIENT CAMPUS

NWCO Program Goals

1. Energy Efficient Buildings

Prioritizing energy efficiency to achieve LEED Gold or above.

2. District Thermal using Wastewater Heat Recovery

Utilizing wastewater thermal energy to heat and cool campus buildings efficiently.

3. Renewable Energy













100% renewable electric using a combination of on- and off-site sources

4. Community Resiliency

Ensuring critical facilities have power, heating and cooling, even during extreme events.



Goals

Air Quality	Climate	Energy	Food
 Attain all National Ambient Air Quality Standards	 Reduce Denver CO2 emissions to below 1990 levels.	 Hold total energy use below 2012 levels, while cutting fossil fuels by 50%	 Grow and/or process at least 20% of food production in Denver in Colorado.
Health	Housing	Land Use	Materials
 Increase the % of youth in Denver at a healthy weight from 69% to 74%	 Ensure 80% of neighborhoods are rated at affordable	 Move Denver's Walk Friendly rating from Gold to Platinum	 Increase the citywide recycling rate to 34% or greater
Mobility	Water Quality	Water Quantity	Workforce
 Reduce trips in single-occupant vehicles to no more than 60% of commutes	 Make all Denver creeks and rivers swimmable and fishable	 Reduce per capita potable water usage by 22%	 Reduce single-occupant work commutes in transit deserts to less than 60%

THE PROJECT

4 Partners with Facilities on Campus



250 Acres at Full Build-Out

7 Facilities for District Energy

Stockyard Event Center

Livestock Center

Equestrian Center

Spur Health

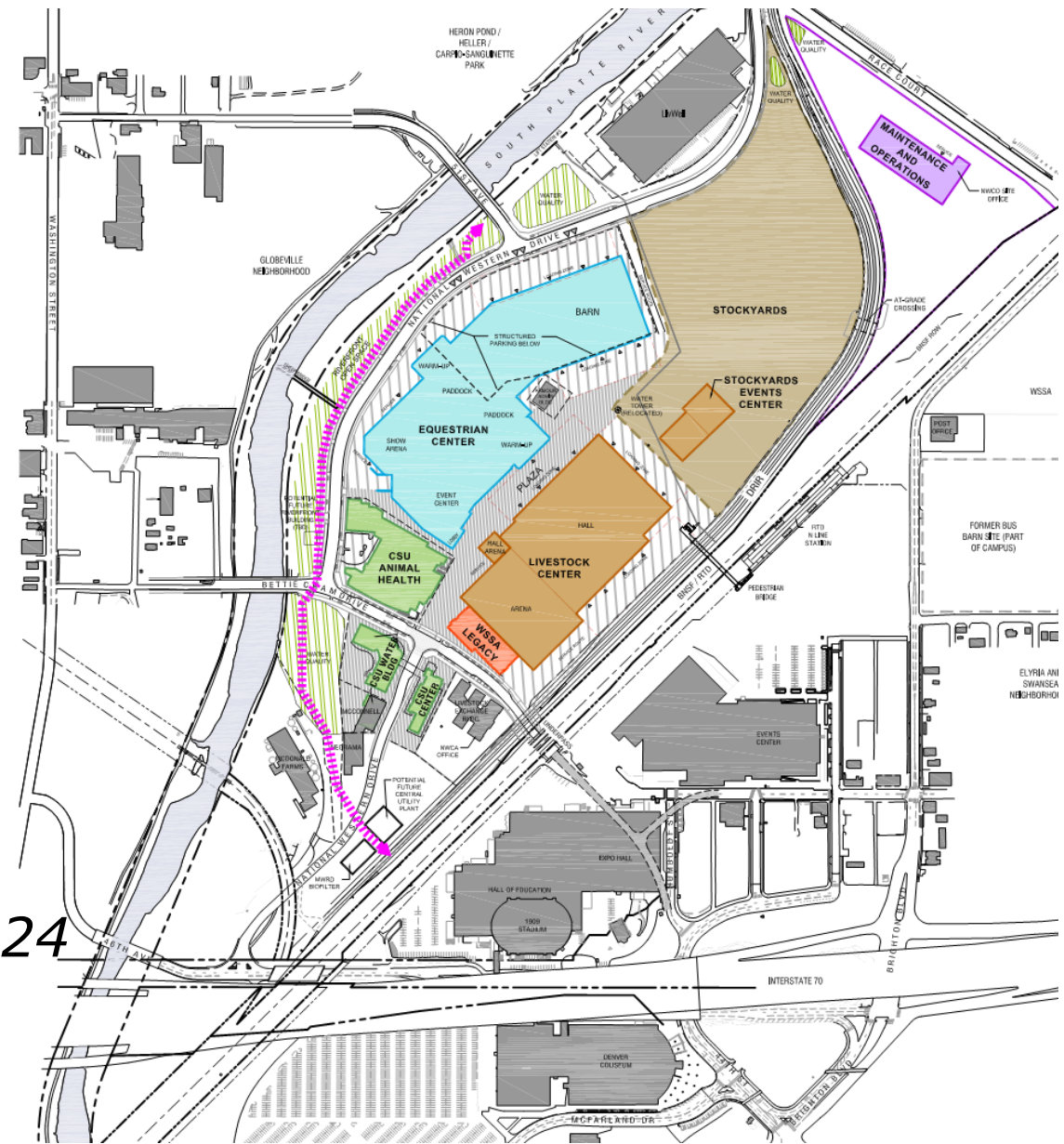
Spur Water

Spur Food

WSSA Legacy Building

7 Yrs. of Campus Construction 2018 - 2024

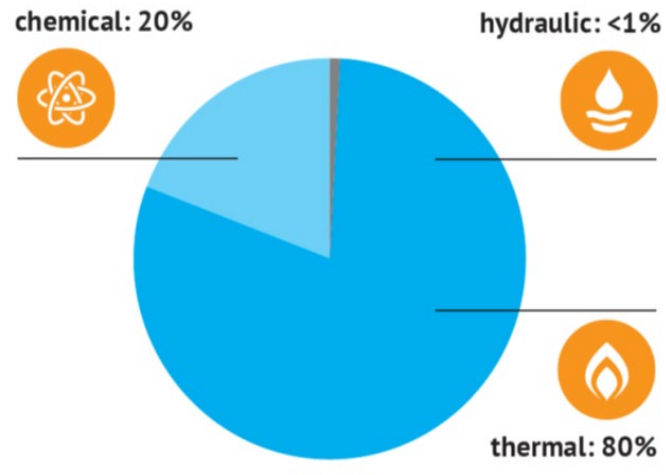
1 Enormous Wastewater Pipe



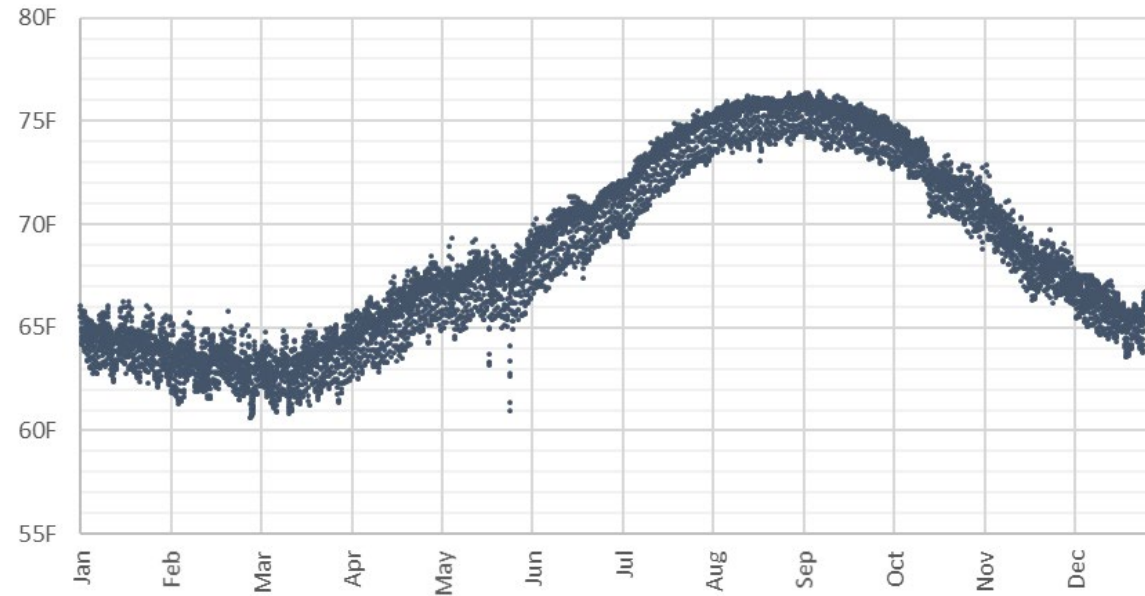
CONSTRUCTION PROGRAM

ENERGY FROM WASTEWATER

Energy Embedded in Wastewater



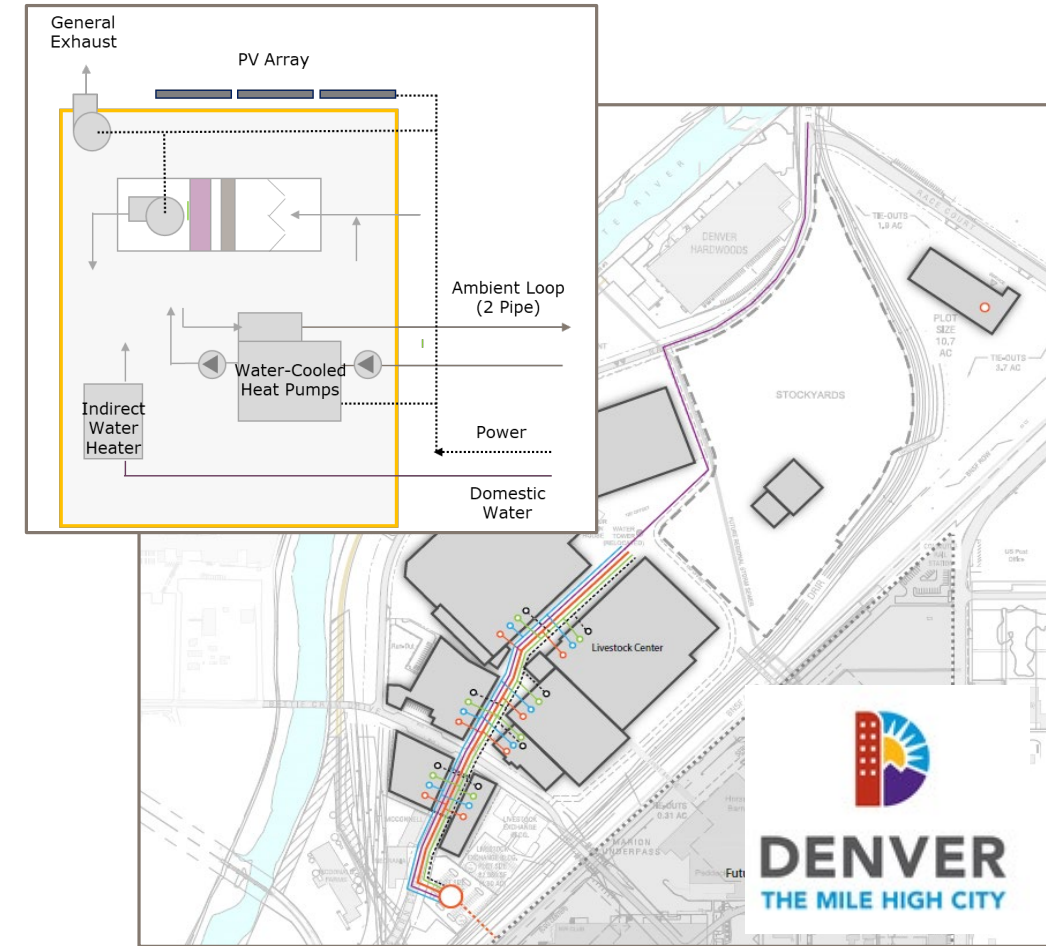
Delgany Interceptor Temperatures



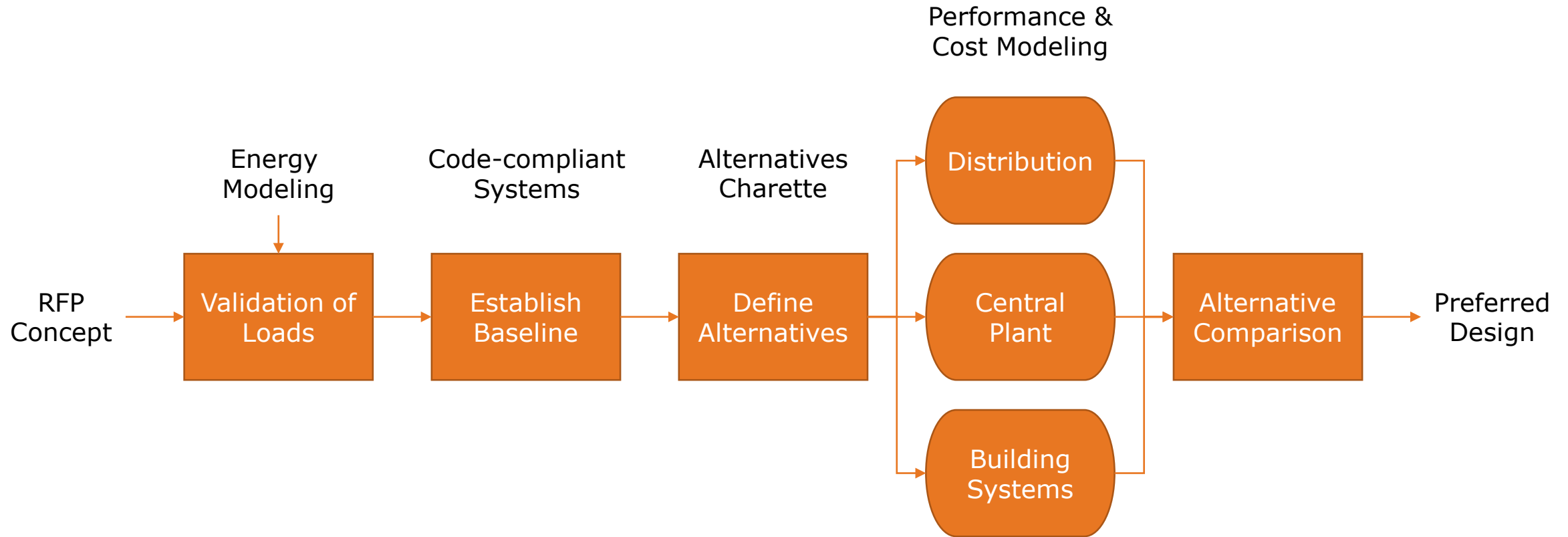
**More than twice the energy
to supply the campus**

TECHNOLOGY VALIDATION

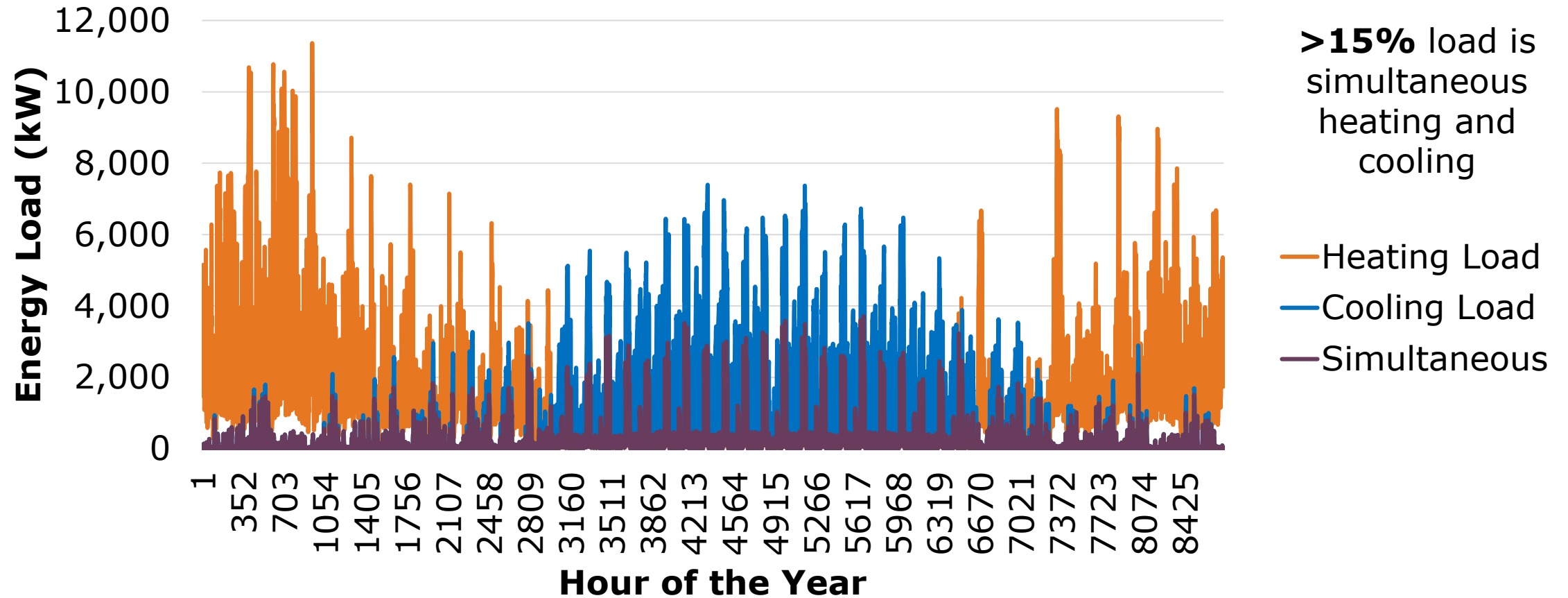
- Issued RFI to assess market interest
- Responses validated feasible technologies
- Developed concept design for procurement
- Selected EAS Energy Partners (Enwave, AECOM, Saunders)
- Intense use of partnerships throughout



CONFIRM / OPTIMIZE APPROACH



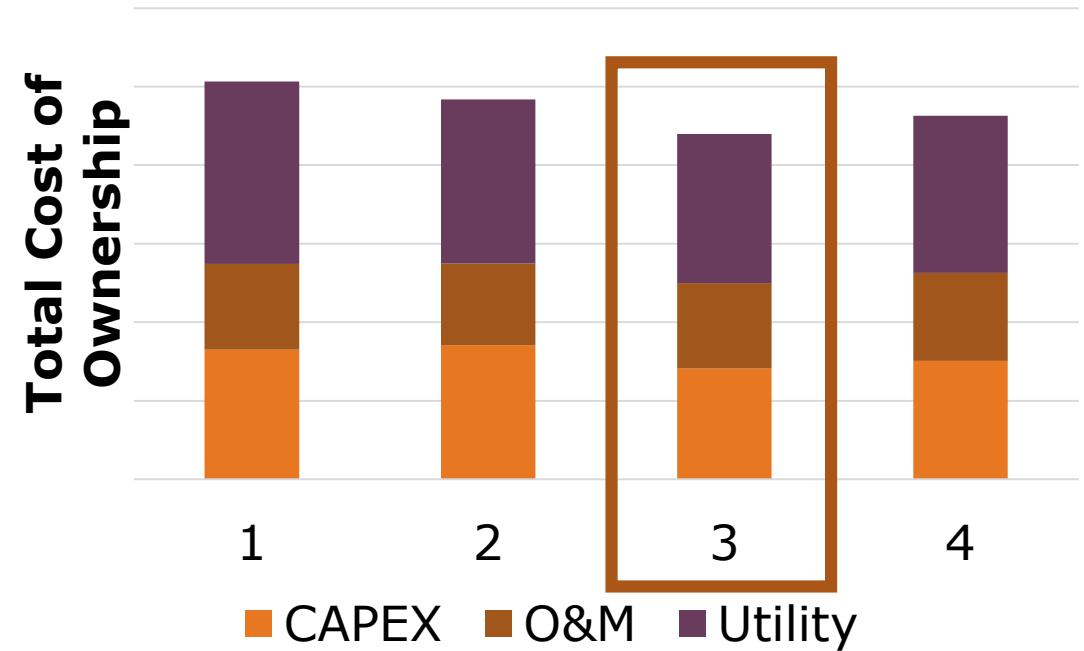
DESIGN DEMAND PROFILE



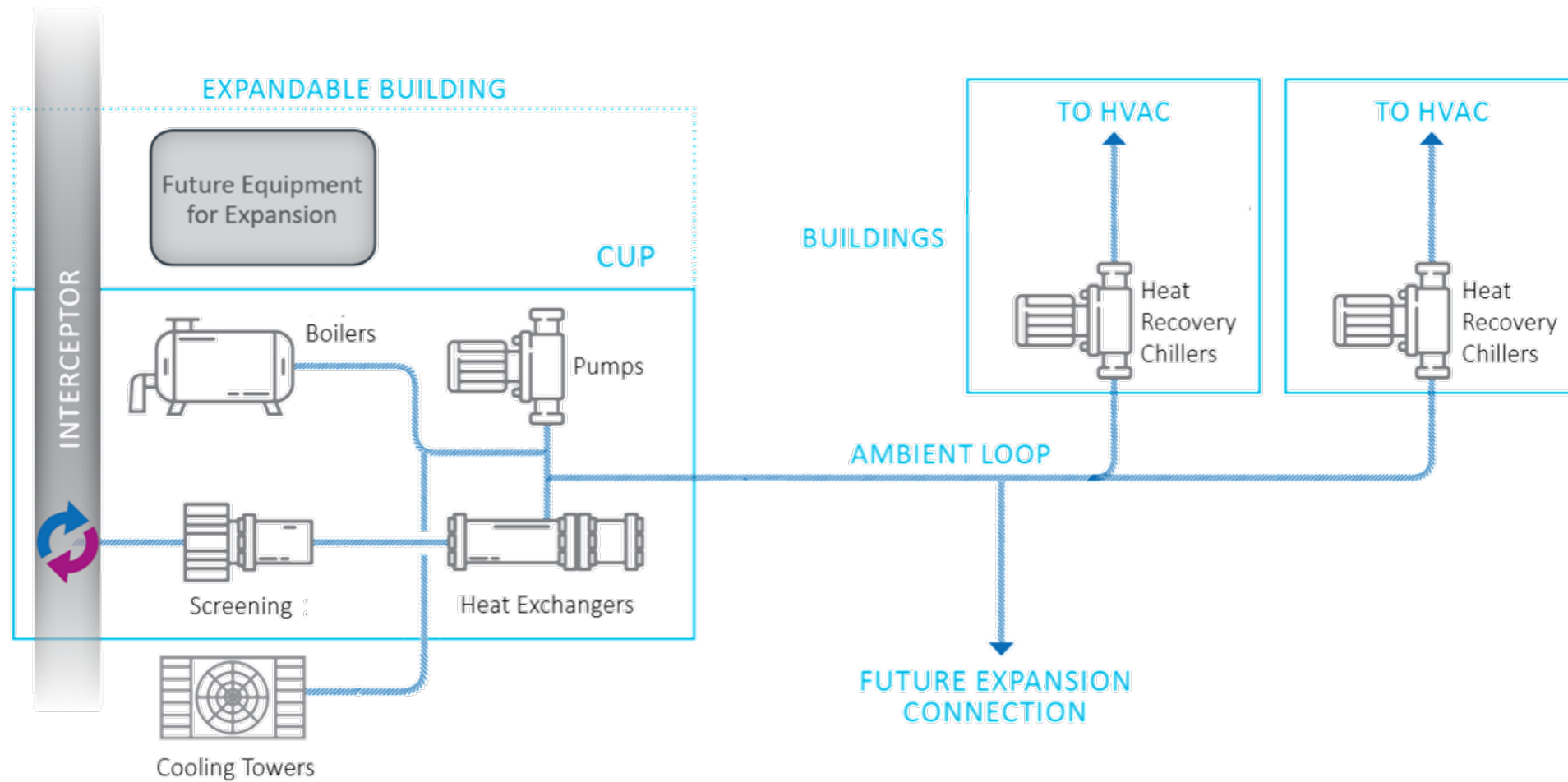
ALTERNATIVES ANALYSIS

Alternatives

- 1) 2-pipe: Boilers + Cooling Towers
- 2) 4-pipe: Boilers + Chillers
- 3) 2-pipe: SHR (HEX) + Boilers + Cooling Towers
- 4) 4-pipe: SHR (Heat Pumps) + Boilers + Chillers



DESIGN SOLUTION



OPTIMIZING OPERATIONS: THE ENWAVE OPERATING SYSTEM

A systematic approach across North America

- Performance management
- Knowledge sharing
- Procurement
- Technology development
- National Operating Center
 - Remote monitoring and control
 - Real-time optimization software

LESSONS LEARNED

1. You need the right team at the table:
 - Project champions
 - Top decision-makers
 - Cross-disciplinary representation
2. Transparency in evaluation is key. Ensure everyone understands the key levers.



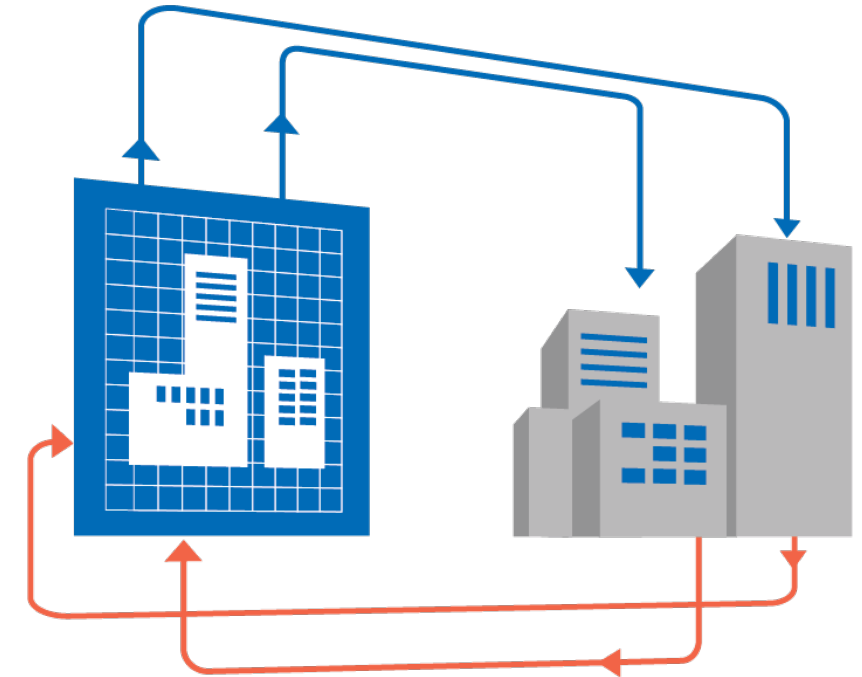
LESSONS LEARNED

3. Plan enough time to develop the baseline in detail, including input from all key stakeholders
4. Plan how to accommodate changes for buildings that are still early in the design process.



LESSONS LEARNED

- 5. Design coordination for ambient systems is more complex than for hot and chilled water systems
- 6. Be flexible in construction approach to gain efficiencies in systems for new developments





QUESTIONS?

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DENVER
THE MILE HIGH CITY

THANK YOU

Laura Rip

Calum Thompson

Catherine Thorn

Jacobs

AECOM

enwave



CONSTRUCTION PROGRAM