DESIGNING DENVER'S FIRST WASTEWATER DISTRICT ENERGY SYSTEM

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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**: Enhance air quality by reducing emissions from vehicles.
- **Climate**: Reduce the impact of climate change through sustainable practices.
- **Energy**: Increase energy efficiency and reduce fossil fuel use.
- **Food**: Promote sustainable food systems and reduce waste.
- **Health**: Improve public health through clean water and air.
- **Housing**: Provide affordable and sustainable housing options.
- **Land Use**: Efficient use of land for economic and environmental benefits.
- **Materials**: Reduce waste and promote sustainable materials.
- **Mobility**: Enhance transportation options for a sustainable future.
- **Water Quality**: Protect water sources and improve water quality.
- **Water Quantity**: Manage water resources efficiently.
- **Workforce**: Invest in a skilled workforce for sustainability.
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
ENERGY FROM WASTEWATER

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

RFP Concept

- Validation of Loads
- Establish Baseline
- Define Alternatives
- Alternatives Charette

Energy Modeling
Code-compliant Systems
Performance & Cost Modeling

- Distribution
- Central Plant
- Building Systems
- Alternative Comparison

Preferred Design
DESIGN DEMAND PROFILE

>15% load is simultaneous heating and cooling

- Heating Load
- Cooling Load
- Simultaneous
Alternatives Analysis

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
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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THANK YOU

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