Accelerating Zero Energy Communities of the Future

Sarah Zaleski, U.S. DOE
Ben Polly, NREL
IDEA2019
The Mission

Innovative
Reliable
Affordable
Equitable
Resilient
Engaged
HEALTHY
Connected
Ecological
Secure
Zero Energy Buildings are Here.... and Many More are Coming

Media

19 Global Cities Commit to Make New Buildings “Net-Zero Carbon” by 2030

Regulations and planning policy will also target existing buildings to make them net-zero carbon by 2050 to ensure cities deliver on the highest goals of Paris Agreement.


London, UK (23 August 2018) – Today, 19 pioneering mayors, representing 130 million urban citizens, committed to significantly cut greenhouse gas emissions from their cities by ensuring that new buildings operate at net zero carbon by 2030. By signing the Net Zero Carbon Buildings Declaration, the leaders of Copenhagen, Johannesburg, London, Los Angeles, Montreal, New York City, Newburyport, Paris, Portland, San Francisco, San Jose, Santa Monica, Stockholm, Sydney, Tokyo, Toronto, Tshwane, Vancouver & Washington D.C. also pledged to ensure all buildings in the cities, old or new, will meet net-zero carbon standards by 2050.
Districts are Key to our Zero Energy Future

- Economies of scale
- Shared infrastructure
- Balance across buildings
- Opportunity for enhanced “code”
- Social structures and accountability
- Large collective impact
DOE’s Zero Energy Districts Accelerator

6 District Partners
- Sun Valley EcoDistrict (CO)
- Erie County Industrial Redevelopment (NY)
- St. Paul Ford Site Redevelopment (MN)
- National Western Center (CO)
- Huntington Beach Advanced Energy Community (CA)
- Catalyst Spokane (WA)

4 National Partners
Commit to provide resources and support to districts
City and County of Denver
Mayor’s Office of the National Western Center
Jenna Espinoza, Director of Communications & Public Information
jenna.espinoza@denvergov.org
O: 720-865-2906

Mayor’s Office of the National Western Center Announces Energy Partner

DENVER – The Mayor’s Office of the National Western Center (NWCO) today announced that EAS Energy Partners (EAS) has been selected to enter into an exclusive negotiation to become the official campus energy partner of the National Western Center (NWC).

The National Western Center has set a long-term goal of becoming a net-zero energy campus, where energy consumption would be completely offset by renewable on-site energy production annually. As the campus energy partner, EAS will deliver district and renewable energy solutions while also being responsible for the long-term operation and maintenance of NWC energy systems.

The current energy concept features a sewer heat recovery system to transfer heat between the Delgany sewer main and an ambient campus wide piping distribution loop as well as a solar photovoltaic (PV) system located on the rooftops of campus buildings.
Zero Energy District Design Principles

1. Optimize Building Efficiency
2. Optimize Thermal and Heat Recovery
3. Optimize Solar Potential
4. Optimize Demand Flexibility
Optimize Building Efficiency

- Orientation and Natural Lighting
- Enclosure Efficiency
- Misc. Electric Loads
- High Efficiency Lighting and Controls
- District-Connected HVAC
Optimize Building Efficiency

Optimize Solar Potential

Optimize Thermal and Heat Recovery

Industrial Waste Heat

Data Centers

Ground Source Heat Pumps

Sewer Heat Recovery

Examples only, not an exhaustive list.
Optimize Building Efficiency

Minimize Building-to-Building Shading

Minimize Other Systems that Require Roof Space

Shade Parking with Solar Panels

Improve Potential for Off-Grid Resiliency

Optimize Solar Potential
Optimize Building Efficiency

Optimize Solar Potential

Optimize Demand Flexibility

Accommodation of increased penetration of PV by flattening the duck (increasing mid-day demand). Source: Denholm et al. 2015
Peña Station, Denver, CO

- Built on top of OpenStudio® and EnergyPlus™ through new U.S. DOE investments in tools
- Modular, open source platform; “underlying analytics” that can be integrated into private sector tools
Design of low energy campuses and districts using advanced analytical capabilities integrated into typical planning workflows for architects and urban planners.

Design and optimization of grid-interactive efficient buildings (GEBs) at a district-scale in conjunction with distributed energy resources (DERs) and electric distribution systems.

Tools for design and operation of next-generation district energy and control systems.
Analysis Workflows

Geometry/Building Data Input and Detailed Building Energy Model Creation

District-Scale Annual Energy Scenario Analysis

Seek Answers to these and Other Questions

What efficiency and energy generation levels are required to achieve a Zero Energy District?

Should one central system or multiple smaller systems be used and which potential thermal network layout is best?

What impact does the efficiency, demand flexibility, and distributed generation/storage have on the electric distribution grid requirements?

District Thermal System Analysis w/ Modelica

Grid-Interactive Analysis w/ REopt/OpenDSS
• **Provide accurate, transparent, and robust analytics** to support industry tools and applications for district-scale analysis.

• **Identify opportunities for additional efficiencies and cost savings** through the concurrent design, upgrade, and/or optimization of buildings, DERs, district thermal systems, and electricity distribution infrastructure.

• **Accelerate R&D** in district and campus level energy-efficiency and grid-interaction technologies and strategies.
- Focus on Zero Energy principles that support high performance district projects
- Document best practices from Zero Energy District Accelerator and other advanced energy community projects
- Suggest what analysis is most valuable at what stage
- Leverage, reference, and build on existing resources (IDEA resources, RMI, etc.)
- In development – due Fall 2019
Thank you!

Questions?