Reimagine Cities! Achieving Efficient, Resilient and Sustainable Communities through Zero Energy Buildings

Wednesday, May 17, 2017
11:15 am – 12:30 pm
Panelists

- Kirk Myers, REI
- Holly Lennihan, Hickok Cole Architects
- Barbara Frommell, National Western Center
- Solome Girma, Department of Energy (moderator)
REI Goodyear, AZ Distribution Center
IT ALL STARTED WITH AN ICE AXE

Amerindian peoples of the Maine Woods were well versed in the use of ice axes. The term "Indian axe" was spread throughout the Maine Woods by early woodcutters. The axe was well suited for the immediate needs of the woodcutters. It was used to cut hinges and split hemlock into cordwood and was also used as a chopping tool for the fires that kept the men alive. It is said that the axe is the most important tool in the forest and that it is the key to survival. The axe is not just a tool, but a symbol of strength and perseverance. It is a tool that is used to cut through the trials and tribulations of life, to break through the barriers that stand in the way of progress. It is a tool that is used to shape and mold the world around us, to create and to destroy. It is a tool that is used to express our feelings and emotions, to show the world who we are and what we stand for. It is a tool that is used to connect us to the natural world, to remind us of our place in the greater scheme of things. It is a tool that is used to bring us together, to bring us closer to each other. It is a tool that is used to help us to overcome the challenges of life, to help us to become better people. It is a tool that is used to help us to understand ourselves and our place in the world. It is a tool that is used to help us to create a better world, for ourselves and for the generations to come.
Our Aspiration

• To thrive as a co-op serving outdoor enthusiasts 100 years from now and beyond
Co-operative Design

- Integrated design approach
- Clear requirements of Net Zero Energy and long-term total cost of ownership
- Partners work in parallel, starting with charrette
Sustainability

- Net Zero Energy
- LEED Platinum
- Water Conservation
Efficiency Measures

- 57 measures were considered post-charrette
  - Optimized orientation, envelope and insulation through extensive energy modelling
  - Used all LED lighting
  - Included Air Turnover Units to de-stratify building; highest-efficiency mechanical cooling used
  - Focused on “vampire loads” for all material handling equipment
  - Hyperchairs are one cool example of innovation

- Reduced consumption over 50% below ASHRAE 90.1-2007

- Significantly downsized size of needed PV array

- Energy modelling for a production facility is difficult
Water Project

• Whole systems thinking
  • Intersection of energy and water: “embedded water” in energy

• Habitat restoration project in Verde Valley in partnership with Bonneville Environmental Foundation and The Nature Conservancy of Arizona
  • Putting water back in river
  • Supporting local farmers
  • Creating recreation economy

• Balanced facility’s annual water footprint over five years and earned two LEED points

• USGBC now recognizes Water Restoration Certificates for LEED points
Holly Lennihan

Hickok Cole Architects
WHY ARE WE HERE TODAY?

Organizations and companies seek to gain cost savings and productivity improvements while supporting their missions.

Cities are committed to creating a sustainable future for their residents.
THE PROJECT: AGU

78,000 SF

DESIGNED IN 1992
NET ZERO ENERGY RENOVATION
OF THE INTERIOR AND EXTERIOR
AGU: DESIGNED FROM THE INSIDE OUT

- State of the art workplace environment
- Flexible and adaptable 21st century work environment - use Wellness principles
- Use the building as a research and educational tool: create building tour to showcase sustainable strategies
- Showcase contributions of earth and space science - exhibit space at the ground floor
- Push the limits of building energy and water performance using innovative technologies
- Raise AGU’s visibility
AGU STRATEGIES USED

Dynamic Glazing **10.45** kBtu/sf*

Solar PV Array **10.23** kBtu/sf*

Radiant Ceiling **11.1** kBtu/sf*

Municipal Heat Extraction **9.0** kBtu/sf*

Material Re-use

Behavior Modification

Greywater Reclamation

Hydroponic Phytoremediation

*per year contribution
AGU ACTIVATED GROUND FLOOR

AN EXPRESSION OF ITS MEMBERS

COMMUNITY ENGAGEMENT & EDUCATION
AGU HEALTHY, HIGH-PERFORMANCE INTERIOR

- **Hydroponic Phytoremediation**
- **Radiant Cooling & DC Powered Ceiling**
- **Spaces for Focused Work**
- **Collaborative Space**
- **Active Design Principles**
FLOOR PLAN  TYPICAL WORK LEVEL

LEVEL 03

LEVEL 04

LEVEL 05
AGU FUNCTIONAL, ENERGY-PRODUCING ROOF
THE PLACE: WASHINGTON, DC

- DC goal is 50-50-50 (new construction)
- New Philosophy for DC: buildings as generators not consumers
- DC DOEE just released the Climate Action Plan and a Comprehensive Energy Plan
- ICC Green Construction Code 2012 adopted
- Stringent stormwater requirements
- GSA goal of all new construction to be Net Zero Energy by 2030
- The proposed DC Green Bank would utilize an initial investment of public funds and significantly leverage private capital
HISTORIC PRESERVATION: HISTORIC DISTRICT

CURRENT BUILDING
2000 FLORIDA AVE NW

NEW DESIGN
2000 FLORIDA AVE NW
HISTORIC PRESERVATION

EXISTING CONDITIONS

PROPOSED FLORIDA AVENUE STOREFRONT
ZONING: PV ARRAY DOES NOT MEET SETBACK
THANK YOU!
NATIONAL WESTERN CENTER

LOCAL IMPACT ✩ GLOBAL REACH
Reimagining Cities!
Achieving Efficient, Resilient and Sustainable Communities through Zero Energy Buildings

National Western Center
Denver, Colorado
Barb Frommell
May 17, 2017
- 2 miles from Downtown Denver
- Easy access from I-25 and I-70
- 1 stop from Denver Union Station
- 20 min to Denver Int’l Airport (DEN)
- South Platte River Greenway Trail
- Visibility from I-70 (150,000 vehicles / day)
111 Years of History
A bold vision:
Create *the* Global Destination for Agricultural Heritage and Innovation.

A bold mission:
Convene the world to create, educate, entertain, inspire, lead and deliver global food solutions.
How will we feed 9 billion people?
National Western Center – Five Founding Partners

DENVER
THE MILE HIGH CITY

NATIONAL WESTERN Stock Show

Colorado State University

HISTORY Colorado

DENVER MUSEUM OF NATURE & SCIENCE

Adopted March 2015
Key Site Elements

Phase 1
1. New bridges at 49th and 51st Streets
2. CSU Water Resources Center & S Platte Riverfront
3. Relocated National Western Drive
4. Stock Yards & Stock Yards Events Center
5. NWC Transit Station
6. Shared Use/TOD Parking Structure

Phase 2
7. Livestock Center
8. Equestrian Center
9. CSU Equine Sports Medicine Clinic
10. Livestock Exchange Building/Flex Space
11. NWSS Maintenance Facility
12. Brighton Boulevard

Phase 3-8
13. Stadium Arena Market
14. Colorado Commons
15. CSU Center
16. Trade Show/Exposition Hall
17. New Arena
18. Coliseum Site Redevelopment
Funding Secured!

CO House Bill 15-1344
Bi-partisan, statewide support

Denver Ballot Measure 2C
Tourism Tax
65.5% voter support

Regional Tourism Act Grant
Master Plan
Guiding Principals

Sustainability and Regeneration Framework

- 9 Categories
- 63 Goals
Master Plan Energy & GHG Goals:

• Create a Net Zero Energy district, prioritizing technical and behavioral strategies to increase efficiency and using on-site renewable energy sources (by 5 years after build-out)

• Maintain or reduce greenhouse gas emissions (GHG) levels, including transportation, at or below 2016 GHG emissions; and strive for continuous reduction over time, aiming for alignment with City and County GHG and climate goals.
Current Energy Use by Premise

Natural Gas

Electricity

- Activities Pavilion
- Etna Building
- Events Center
- Events Center
- Residential Boarding Home
- Security and Employment Building
- Stadium Arena Complex
- Stock Yards Arena
- Stock Yards Auction Arena
- Stockyards
- Coliseum Parking
- Gold Buckle Parking Lot
- Parking Lot A
- Parking Lot B
- Parking Lot C
- Parking Lot D
- Parking Lot H
- Parking Lot I
- Parking Lot N
- Unknown
## Snapshot of NWC Energy Use Today vs. Build-Out Scenarios*

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<thead>
<tr>
<th></th>
<th>Today</th>
<th>Redeveloped (In 2032)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Code-Built</td>
</tr>
<tr>
<td><strong>Square Footage</strong></td>
<td>700,000</td>
<td>2,900,000</td>
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<tr>
<td><strong>Electricity/Natural Gas Split</strong></td>
<td>40%/60%</td>
<td>TBD</td>
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<tr>
<td><strong>Electricity</strong></td>
<td>5,800,000</td>
<td>11,000,000</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>$522,000</td>
<td>$990,000</td>
</tr>
<tr>
<td><strong>Natural Gas</strong></td>
<td>300,000</td>
<td>590,000</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>$150,000</td>
<td>$300,000</td>
</tr>
<tr>
<td><strong>Greenhouse Gas Emissions (MTCO2e)</strong></td>
<td>5,400</td>
<td>8,300</td>
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<tr>
<td><strong>GHG Split (Electricity/Natural Gas)</strong></td>
<td>72%/28%</td>
<td>TBD</td>
</tr>
<tr>
<td><strong>Incremental Cost(^1)</strong></td>
<td>-</td>
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* Do not include renewables or district energy

PRE-DESIGN SNAPSHOT
Energy Ladder
Energy Use Reduction Strategies

Minimize building loads
Maximize system efficiency
Optimize operational & occupant behavior

Net Zero (or better)

Renewable Energy

How?
- Program right-sizing
- Building orientation
- Building design
- Building materials
- District systems
- High efficiency heating & cooling
- Low energy fixtures
- Building automation systems
- Lighting controls
- Governance/operational guidelines
- Solar
- Wind
- Geothermal
- Sewer heat recovery
- Waste to energy

When?
- Design/build
- Design
- Procurement guidelines
- Operations & maintenance
- Design
- Governance
- Operations & maintenance
- Design
- After the three prior steps are resolved!
OPPORTUNITIES

- Campus Scale
- Partners: University, Utilities, DOE/NREL
- Fully Integrated Design
- City 2020 Goals
- Potential Sewer Heat recovery
- Modernizing infrastructure and more stringent building codes
- Public Private Partnerships
- Renewable Sources: Solar and Sewer Heat
OPPORTUNITY: ROOFTOP SOLAR

- Stock yards 20k SF
- Equestrian 500k SF
- TOD 150k SF
- Expo Hall 350k SF
- Arena 75k SF
- Water Resources Center 30k SF
- Livestock 300k SF
- Maintenance 40k SF
- CSU Center 75k SF
OPPORTUNITY: SEWER HEAT RECOVERY
45 MILLION GPD
4°C EFFLUENT TEMPERATURE PROBLEM
CHALLENGES

• Time
• Phasing
• Funding/Financing
• Governance
• Tenant Controls
Zero Energy District Case Studies
Snapshot: Where are we in the development process?

- **2016**: Land Acquisition *
- **2017**: Rail Consolidation *
- **2018**: Environmental Investigation & Remediation - Site
- **2019**: Preliminary Planning/Studies
- **2020**: Infrastructure Planning, Design & Construction
- **2021**: Vertical Planning, Design & Construction
- **2022**

* Design and construction timelines will depend completely on the trajectory and schedule of the Land Acquisition and Rail Consolidation programs.

• Xcel Partners in Energy
• DOE ZED Accelerator
Immediate Next Steps:

• Xcel Partners in Energy:
  • Finalize Goals, KPIs and ZED “boundaries”
  • Finalize Energy Plan
• DOE ZED Accelerator Program
  • Develop Business Case / Life Cycle Analysis
  • Operational Plan / Governance
  • Assess Procurement Strategies
• Incorporate into larger NWC Development Program, Design Standards
• Build Partnerships to get it done
Thank You

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