Planning for Districts and Urban Environments

February 23, 2017

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We are an engine of innovation for the energy efficiency industry. We drive research, uncover solutions, and advance industry practices and policies that deliver positive change in the built environment.

Ralph DiNola
CEO
New Buildings Institute

Ken Sandler
US General Services Administration (GSA)

Eric Shafran
City and County of Denver

Charles Eley
Eley and Associates
The 2016 List of ZNE Buildings!

Number of ZNE Projects

- 2012: 21 Total
- 2014: 279 Total
- 2016: 53 Total

Jan 2017: 430 Total

Significant Savings Potential

Average Site EUI

- CBECS 2003
- CBECS 2012
- Ultralow - Verified
- ZNE - Verified

Roughly a 75% reduction compared to CBECS
ZNE Buildings in Every Climate Zone

Who is Aiming for ZNE?

ZNE Building Ownership Type
- 30% Private for Profit
- 12% Private - Multi-family
- 12% Public - County
- 10% Public - State
- 9% Private - Non-profit
- 5% Public - Federal

ZNE Status:
- Emerging
- Verified

ZNE and Ultra-Low Energy Building Types
- 38% Education
- 23% Office
- 11% Multi-family
- 7% Public Assembly
- 2% Other
Existing Scaling Frameworks

Prototypes  Portfolios  Districts

GETTING TO ZNE
Tools for the Policy:
1. Goals and Definitions
2. Market Readiness
3. Public Buildings
4. Case Studies
5. Outreach to Stakeholders
6. Emerging issues – DG, EV, etc...
7. Engagement w/ Energy Utilities

ASHRAE 90.1 – Energy Use Targets

OREGON SB 79

California: Big Bold Goals

WASHINGTON: SB 5854

CARBON NEUTRAL PATH
Vancouver, British Columbia

NYStretch and Code Minimum

Codes and Policy
Access ZNE Resources

- CPUC & NBI ZNE Case Studies
- PG&E Case Studies
- Getting to Zero Database
- NBI Registry

www.newbuildings.org

ZNE Action Bulletin
Progress Towards Zero Net Energy Buildings

Email connie@newbuildings.org to sign up
Empower Your Team

Trainings

Planning Tools

Tours

Peer Learning

www.newbuildings.org

Planning for Districts and Urban Environments: Introduction

Ken Sandler
GSA Office of Federal High-Performance Green Buildings
February 23, 2017
Getting Federal Buildings to Zero: Mandates and Goals

• Federal goals and mandates
  o Energy Independence and Security Act (EISA 2007)
  o Executive Order 13693

• Key GSA initiatives
  o 25 x 25
  o Deep Energy Retrofits
  o ReOpt
  o Energy Storage RFI

Getting Federal Buildings to Zero: Lessons Learned to Date

• A matter of policy even more than of technology
• Requiring planning at a higher level than usual
• Essential to engage people: leaders, facility managers & occupants
Net Zero: Building vs. Campus Approaches

- Implementation & measurement questions
- DOE FEMP Large Campus Innovative Change Team

The Army’s Net Zero Initiative
Net Zero at the Campus Level: Advantages

- Larger resource flows to tap: waste, water, heat
- Take advantage of site ecology: wind, sun, hydrology
- More space for renewables and energy storage
- Employ broad energy savings approaches like district energy, combined heat and power, automation
- Economies of scale, e.g., bundling financing, ESPCs
- Leverage bargaining power: with suppliers, utilities, governments
- Institute alternative campus transportation solutions

Net Zero at the Campus Level: Challenges

- Bigger target!
- Larger planning responsibilities
- Financial and legal hurdles
- New roles: e.g., integrated energy service provider
- More players, training needed
- From limited experiments to scale & centralization
Expanding the Boundary for Zero Net-Energy Buildings

Charles Eley, FAIA, PE

Presentation Outline
- ZNE Common Definition
- Campuses, Communities and Portfolios
- Challenging Building Types and Climates
- Off-Site Renewable Energy
- Community Solar
- Renewable Energy Certificates (RECs)
- Wrap-up and Conclusions

Planning for Districts and Urban Environments
DOE Common ZNE Definition

DOE Common Definition

DOE Common ZNE Definition

ZNE Definition

- The sum of all energy that is delivered to the property line must be less than the energy that is exported from the property.
- All energy use is included.
- EV charging is considered exported energy.

Campuses, Communities and Portfolios

ZNE Campus

Delivered Energy
- Electricity
- Gas
- Chilled Water
- Other

On-site Renewable-Energy System

Exported Energy
- Electricity
- Other

Campus Boundary


Campuses, Communities and Portfolios

ZNE Communities

Total Delivered Energy
- Electricity
- Gas
- Other

Community Renewable-Energy System

Total Exported Energy
- Electricity
- Other

Commons

Virtual Boundary

Campuses, Communities and Portfolios

ZNE Portfolio

Combining Buildings within a School District

Dry Creek Elementary School District

Portfolio Example
Challenging Buildings and Climates

Challenging Building Types and Climates

Ratio of 0.33  1.00

- One Story Building
- Two Story Building
- Three Story Building
### Challenging Buildings and Climates

#### Collector Area to Floor Area Ratio

**Maximum Technical Potential**

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<th></th>
<th>Pacific Coast</th>
<th>Warm and Day</th>
<th>Hot and Humid</th>
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<td>4.99</td>
<td>5.91</td>
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### Off-Site Renewable Energy

- ZNE feasible for four stories or more
- ZNE feasible for two-story buildings
- ZNE feasible for one-story buildings
- PV on roof not enough
Off-Site Renewable Energy

Stanford University
Palo Alto Campus

73 MW Solar System in California Desert

All Electric Central Plant

Example only not the Stanford facility
One of the first examples . . .

“SolarShares gives everyone the opportunity to benefit from the sun’s power whether you rent or own your home”

Solar energy should be available and affordable for everyone, but putting a solar system on your roof is not always an option. SMUD’s SolarShares gives everyone the opportunity to benefit from the sun’s power whether you rent or own your home. Plus, SolarShares is 100% local with the solar farm located in our service area, providing local environmental benefits in Sacramento County.
Community Solar

Electric Utilities are Embracing the Concept


Community Solar

Significant Growth is Expected

### Participation Models

**Capacity Model**
- A participant pays money up front (or arranges financing) to lease a certain number of panels
- **High** additionality probability
- Likely included in **capital improvement budget**

**Subscription Model**
- A participant contracts to purchase output from the system on a monthly basis
- **Low** additionality probability
- Likely included in **operating budget**

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### Renewable Energy Certificates (RECs)
# Renewable Energy Certificates (RECs)

## Per Year

<table>
<thead>
<tr>
<th>Annual Revenue/Cost</th>
<th>Electricity Sales/Cost</th>
<th>Renewable Energy Certificate Sales/Cost</th>
</tr>
</thead>
</table>

## For the Life of the System

<table>
<thead>
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<th>Value of Renewable Generation Asset</th>
<th>Net Present Value of Electricity Production</th>
<th>Net Present Value of Future RECs</th>
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</thead>
</table>

### National average price for RECs

$/MWh$

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### Summary and Wrap up
### Summary and Wrapup

#### Off-Site Priorities

<table>
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<th></th>
<th>On-Site Test</th>
<th>The Zero Net-Energy Criteria</th>
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<tbody>
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<td>1</td>
<td>ØDelivered – ØExported</td>
<td>≤ 0</td>
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</table>

**Description**
- Basic definition of on-site zero net-energy building

**Additionality**
- New renewable energy is added as part of the construction project

**Funding**
- Capital Improvement Budget

**Equation**
- \[ Q_{\text{Delivered}} - Q_{\text{Exported}} \leq 0 \]

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#### Design Professionals Guide

*Much of the material in this presentation is adapted from this book to be published by Island Press, November 2016.*

Promotion Code 4ELEY

charles@eley.com
Planning for Districts & Urban Environments
National Western Center’s path to ZNE in real time

February 23, 2017

Eric Shafran
Portfolio Integration Manager, City & County of Denver
Presentation Goals

National Western Center's path to Zero Net Energy in real-time

- Introduction to the National Western Center
- What are our sustainability/regenerative development goals?
- How will we define ZNE for our development?
- How will we assess the feasibility of a ZNE strategy?
- How are we getting from a ZNE goal to a ZNE campus?
- How do we integrate zero net energy, waste and water?

110 Years of History
A bold vision:
The Global Destination for Agricultural Heritage and Innovation
An equally bold (emerging) mission:
Convene the world at NWC to create, educate, entertain, inspire, lead and deliver global food solutions
Located at nexus of I-25 and I-70 with new RTD commuter rail stop at 49th & Brighton Blvd

Establishes new northern gateway into downtown Denver

Estimated 240 acres at buildout

Site will honor our past for future generations (“Cowtown”)

Approximately 2.8 million SF in new and/or renovated facilities

A unique year-round destination, bringing commerce, experiential learning, research, entertainment and the arts

Campus serves as a critical “bridge” between rural and urban food interests (our future)
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

The NWC Guiding Principles

NWC Vision

- Community & Neighborhood Integration
- Engage River and Nature
- Celebrate Western Heritage
- Inspire Health and Wellness
- Be Pioneering: Break Trail and Foster Innovation
- Create Fun & Entertaining Experiences
- Grow Local, Regional, & Global Intelligence
- Build Cultural Crossroads
- Embrace an Ethic of Regeneration
National Western Center Master Plan Appendix D

• Sustainability and Regeneration Framework
• 9 Categories – aligned with the NWC Guiding Principles
• 63 Goals, Including:
  • Net Zero energy, waste, water and stormwater
TOD 150k SF

Water Resources Center 30k SF

Livestock 300k SF

Maintenance 40k SF

CSU Center 75k SF

Stock yards 20k SF

Equestrian 500k SF

Expo Hall 350k SF

Arena 75k SF

Opportunity: Rooftop Solar

Opportunity: Sewer Heat Recovery

45 Million GPD

4°C Temperature Problem
### OPPORTUNITIES
- Campus Scale
- University Partner
- Operational Efficiency
- Fully Integrated Design
- City 2020 Goals

### CHALLENGES
- Funding
- Tenant Controls
- Regulatory Hurdles
- Process for Fully Integrated Design??

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### THE TEAM

![Logo Images]
How do we get to net zero?

Master Plan
- Regeneration Framework
- Preliminary Infrastructure Study
  - *Regeneration Roadmap*

Screening Analyses
- Energy
- Waste
- Water
- Stormwater

Regeneration Feasibility Studies
- Technical
- Economic
- Cultural
- District Border Study
- Procurement Analysis

District Strategy/Conceptual Infrastructure Plan
- Operational Guidelines
- Tech/Performance Specifications
- Design Standards

Bridging Documents?

Procurement Strategy

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Screening Analysis - Energy

Clarify goals, metrics, and options for design criteria (EUI, % renewables, etc.)

Clarify demand and load distribution

Technology screening
- Heat (BAU, geothermal, sewage heat, CoGen, etc.)
- Electricity (BAU, solar, wind, CoGen, etc.)

ROM cost estimating (life cycle costing)

Policy issues
- Peak-demand management
- On-site generation and sale

Financing options
- Renewable energy sale
- Demonstration pilots
- Collaboration with partners
- Public/Private Partnership

Preliminary Energy Strategy
Energy Ladder

**Energy Use Reduction Strategies**

- **Minimize building loads**
- **Maximize system efficiency**
- **Optimize operational & occupant behavior**
- **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!

---

**Where are we in the development process?**

<table>
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<tr>
<th>Year</th>
<th>Land Acquisition</th>
<th>Rail Consolidation</th>
<th>Environmental Investigation &amp; Remediation - Site</th>
<th>Preliminary Planning/Studies</th>
<th>Infrastructure Planning, Design &amp; Construction</th>
<th>Vertical Planning, Design &amp; Construction</th>
<th>Regeneration Feasibility Studies</th>
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* Design and construction timelines will depend completely on the trajectory and schedule of the Land Acquisition and Rail Consolidation programs.
Integrated Planning Process

Parking & Mobility Study
- Share GHG and Carbon Footprint data
- Feed parking requirements/specs and mobility recommendations

Regeneration Feasibility Studies
- Mode-split recommendations
- Feed programmatic inputs into Program Refinement
- Feed district infrastructure recommendations in public realm study
- Feed design standards recommendations

Campus Placemaking Study
- Feed refined program info into NZ Study to inform demand modeling

To learn more:
Visit: www.denvergov.org/nationalwestern
Q & A

Join us for our next zero net energy webinar in March

Risks and Rewards in the ZNE Marketplace
March 30, 10-11 am PT

Register at: newbuildings.org/event/
Thank you for joining us for today’s session

Don’t forget to download the certificate if you need proof of attendance. If you would like AIA credits please enter your AIA number in the survey.