Thank you to our sponsors and supporters
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.

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President
Architectural Nexus
Getting to Zero:  
The 2016 List of Zero Net Energy Buildings  
January 31, 2017 Webinar  
Cathy Higgins  
NBI Research Director  

ATTENDEE BREAKDOWN | Industry  
- Engineering and Architecture (25%, 101)  
- Energy (21%, 86)  
- Consulting (14%, 56)  
- Educational Services (8%, 33)  
- Construction (7%, 27)  
- Professional, Scientific and Technical Services (5%, 21)  
- Manufacturing (3%, 14)  
- Real Estate, Rental & Leasing and Property Management (3%, 14)  
- Non Profit (3%, 14)  
- Student (2%, 10)  
- Utilities (2%, 9)  
- Government (2%, 8)  
- Public Administration (1%, 5)  

Top 3 Topic Areas at the GtZ Forum:  
1. Designing and Delivering on ZNE Projects  
2. Driving ZNE to Scale through Policy and Programs  
3. The Owner and Developer Perspective
The Name Game

Zero Energy Buildings
Zero Carbon Buildings
Zero Electric Buildings
Nearly Zero Energy Buildings
Zero Net Energy
Net Zero Energy
Living Buildings
Zero Net Ready Buildings
Ultra-low Energy Buildings

NBI Terms in the Report

- Zero Net Energy
- EUI in Site & Source
- zEPI
- Verified
- Emerging
Ultra-low Energy Buildings
The 2016 List of ZNE Buildings!

Number of ZNE Projects

<table>
<thead>
<tr>
<th>Year</th>
<th>2012</th>
<th>2014</th>
<th>2016</th>
<th>Jan 2017:</th>
<th>Total</th>
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<td>39</td>
<td>127</td>
<td>53</td>
<td>279</td>
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<tr>
<td></td>
<td>99</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ZNE Verified Buildings and Districts
ZNE Emerging Buildings and Districts
Ultra-low Energy Buildings

Energy Performance

Average Site EUI

ZNE are usually 20 EUI or less!!
Where are ZNE Projects?

ZNE Buildings in Every Climate Zone

ZNE Status:
- Emerging
- Verified
ZNE Buildings on the Eastern Seaboard

ZNE – Now Available in Your Size

Large ZNE and Ultralow Energy Building Growth

- 25k - 50k sf
- 50k - 100k sf
- Over 100k sf

100k + sf
Who is Aiming for ZNE?

ZNE Building Ownership Type

- Private - Non-profit: 6%
- Public - Federal: 8%
- Public - State: 10%
- Public - County: 22%
- Private - Multifamily: 12%
- Total: 30%

+12%

ZNE and Ultra-Low Energy Building Types

- Public Assembly: 7%
- Multifamily: 11%
- Other: 21%
- Office: 23%
- Total: 38%

ZNE Schools: Top Five States

<table>
<thead>
<tr>
<th>State</th>
<th>ZNE Verified</th>
<th>ZNE Emerging</th>
<th>Ultra-Low Energy Verified</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>1</td>
<td>18</td>
<td>6</td>
<td>25</td>
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<tr>
<td>KY</td>
<td>2</td>
<td>3</td>
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<td>NC</td>
<td>1</td>
<td>4</td>
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<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>SC</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9</strong></td>
<td><strong>50</strong></td>
<td><strong>19</strong></td>
<td><strong>78</strong></td>
</tr>
</tbody>
</table>
Codes and Policy

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 with Energy Utilities

ASHRAE 90.1 – Energy Use Targets

OREGON SB 79

California: Big Bold Goals

WASHINGTON: SB 5854

CARBON/INDUSTRIAL PATH
Vancouver, British Columbia

NYStretch and Code Minimum
Resources

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

www.newbuildings.org
Getting to Zero Workshops

- ZNE Project Profiles
- News & Events
- Policy & Planning Updates
- Upcoming Training & Education
- New Research
- Low Energy Building Innovations

Email connie@newbuildings.org to sign up
what part will you play in solving the greatest challenge of our time?

Thank you!

Cathy Higgins
Research Director, NBI
higgins@newbuildings.org

Zero Net Energy Buildings Trends and ZEDx Session
January 31, 2017
A Model for Net Zero Energy Buildings of the Future

Efficient Building Envelope & HVAC

With these strategies, HVAC consumes 70% less energy, which is a reduction of 585,000kWh or 403 metric tons of CO2 annually.
Plug Loads & Service Hot Water

Plug load efficiency measures account for a reduction of 85,000 kWh or 59 metric tons of CO2 annually.

Energy usage for hot water was reduced by 93% - a decrease of 65,000 kWh annually.

LED Lighting & Advanced Controls

An annual reduction of 17,000kWh was achieved by installing the latest generation of dimmable LED lighting monitored by advanced controls.
Interactive Dashboard Displays

Real-time and historic analytics on the NZP ETI’s energy generation, consumption, and storage are displayed on interactive dashboard displays in building’s lobby.

Energy Production & Storage

An approximately 600kW photovoltaic (PV) solar array now produces 1.25 times the amount of energy the building uses annually. Excess energy is stored on a lithium-ion battery storage system.
The Microgrid

- **Battery Storage**: Stores solar electricity from PV for use when PV isn't generating and in emergencies.
- **On-Site PV**: Generates enough electricity over the year to power the building, EV charging stations, and an on-site battery.
- **ETI Facility**: Generates enough electricity over the year to power the building, EV charging stations, and an on-site battery.
- **Electric Vehicle Chargers**: Powered by the PV array, provide electricity to power 10 vehicles at once.
- **Public Utility Grid**: Provides electricity when PV and battery storage can't meet demand.
- **Energy Management System**: Optimizes energy flows based on peak demand, deciding when electricity generated on-site should be stored and when it should be used.
- **Weather Station**: Collects data, which helps explain discrepancies between predicted and actual performance.
- **Dashboards**: In main lobby display current and historical energy use, weather conditions, and interactive graphics to engage students, staff, and visitors.

PBS So Cal Building Below Zero: The Net Zero Plus Transformation

Watch the Net Zero Plus Transformation
Qualified Design Team & Highly-Trained Workforce

Powering America Team

Powering America Team

A conduit to assist various customers with project needs including permitting, regulatory assistance, pre-qualification of signatory electrical contractors and workforce development plans.
Powering America Team Contact Information

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Thank You!

Brett Moss
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A resilient building is able to maintain life-support conditions even during extreme heat waves, storms, or power outages.
What is Comfortable?

“What 70 to 75 deg F”
Personal Thermostats
Plenty of Air Conditioning (more is better)
We Love Radiant Comfort

Radiant Convective Exhalation

47.5% 27.5% 27%
Warm/cool sensitivity maps of hands and feet

Warm sensation

Cold sensation

Radiant for All
Load calculations of radiant cooling systems for sizing the plant

Eleftherios Bourdakis*, Ongun B. Kazanci¹, Bjarne W. Olesen²

*Technical University of Denmark, Nils Koppels Alle – Building 402, Kgs. Lyngby, 2800, Denmark

Abstract

The aim of this study was, by using a building simulation software, to prove that a radiant cooling system should not be sized based on the maximum cooling load but at a lower value. For that reason six radiant cooling models were simulated with two control principles using 100%, 70% and 50% of the maximum cooling load. It was concluded that all tested systems were able to provide an acceptable thermal environment even when the 50% of the maximum cooling load was used. From all the simulated systems the one that performed the best under both control principles was the ESCS ceiling system. Finally it was proved that ventilation systems should be sized based on the maximum cooling load.

Keywords: Radiant cooling systems; Thermal environment

All tested (radiant) systems where able to provide acceptable thermal environment even when (sized) to 50% of the maximum cooling load.

We Love Ceiling Fans
The Solution I Buy at Target

Building Design Tools for Fans

- Anemometer
- Katrina performing tests
- L-shape partition
- Line partition
- Side table
Fans Make Us Resilient

From the Center for Built Environment & TRC

Gwelen Paliaga, TRC
CBE Industry Chair

Sharp Development - Hill House Construction
Integral Group MEP
Radiant chilled ceiling: Cooling capacity results

Change in cooling capacity [%] vs. Acoustical coverage [%]

- Small fans medium
- Ceiling fan up
- No fan
- Small fans low
- Ceiling fan down

Radiant Tubing in Concrete Slab on Fluted Metal Deck

VAV Box reduces airflow when people aren't around

Air Cooled by Radiant Slab
Exposed Below

100% Fresh Air for Ventilation Only
(Neutral 68°F temp)

Ceiling Fan (Blows air up)

Thin Carpet Tile in Walkways & Core
(or where needed)
Future Ready Buildings

Less Cooling = Same Comfort
750 sf/ton radiant = 500 sf/ton air

Ceiling Fans for All ($1/sf?)
Future Ready Buildings

Less Cooling = Same Comfort
750 sf/ton radiant ~= 500 sf/ton air

Ceiling Fans for All ($1/sf?)

W/ Batteries
W/ Solar Systems
W/ Demand Side Management
W/ RESILIENCY

A few questions?
Designing for Resilient & Net Zero Buildings

Neil Bulger, PE | Principal
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Andy Bush, Principal
Morgan Creek Ventures
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Daylight, views, efficient floor plans, flexible configurations

“Off the shelf” Components

- Narrow Floor Plates
- Variable Volume Refrigerant System
- Composite Steel Structure
- Triple Glazed Windows-gas filled
- Good Thermal envelope-mineral wool on exterior
  - All LED Lighting
All open workspaces near windows

Bright, Open, Collaborative Workspaces
Southeast solar wall....panel selection....attachment system....

Creating a Market Rate Return on Solar

• Total Solar Cost-including attachment $1.9 2.3M
• Market Rate for Energy (low end) $1.90/foot/year
  $190,000 per year, before depreciation/credits
• 10 8.3% Cash on Cash Return before financing

100,000 Square Foot Building
Currently Negotiating an “all electric” restaurant
Morgan Creek Ventures

ehdd.

andy@morgancreekventures.com

Turning Passive Occupants into
Active INHABITANTS
TRANSFORM

Occupants into Inhabitants

- Education
- Action
- Reward
- (repeat)
PROCESS

How it Works

- Episodic Competitions
- Weekly “Learn & Earns”
- Short Quiz
- Unlock Actions
- Earn Individual & Team Points
- Dashboard Metrics
  - Points
  - kWh Saved
  - CO2 Avoided
  - Pounds of Waste Diverted
  - Etc.
KENNER KINGSTON
AIA, LFA, LEED AP BD+C, O+M
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More questions?
Join us for zero net energy webinars in February and March

Planning for Districts and Urban Environments
February 23, 10-11 am PT

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