Decarbonization: A Way Forward
Panelists

• Ralph DiNola – New Buildings Institute (moderator)
• Lisa Westerhoff – Integral Group
• Jeff Frost – Brightworks
• Bronwyn Barry – North America Passive House Network
Agenda

- Buildings and Carbon - presentations
  - Context and policy update – Ralph
  - Canada on the path to Zero Carbon – Lisa
  - Building Materials and embodied carbon – Jeff
  - The Passive House Opportunity - Bronwyn
- Moderated Discussion
- Audience Q&A
Efficiency delivered.

NBI is responding to increasing urgency to reduce carbon emissions increased demand for improved energy performance of new and existing buildings.

NBI’s Theory of Market Change:

- Vision
- Thought Leadership
- Codes & Policy
- Research
- Solutions

Our Program Areas

1. Building & Program Innovation
2. Zero Energy Leadership & Market Development
3. Advancing Codes & Policy

VanDusen Botanical Gardens Visitor Centre | Vancouver, BC
Source: Nic Lehoux
Carbon Emissions in the Building Life Cycle

Construction stage 12.6%
Demolition stage 2%
Operational stage 85.4%

Table 12. Number of Years Required for New Buildings to Overcome Climate Change Impacts from Construction Process

According to this study, it takes 10 to 80 years for a new building that is 30 percent more efficient than an average-performing existing building to overcome, through efficient operations, the negative climate change impacts related to construction. This table illustrates the number of years required for different energy efficient, new buildings to overcome impacts.

<table>
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<tr>
<th>Building Type</th>
<th>Chicago</th>
<th>Portland</th>
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<tr>
<td>Urban Village Mixed Use</td>
<td>42 years</td>
<td>80 years</td>
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<tr>
<td>Single-Family Residential</td>
<td>38 years</td>
<td>50 years</td>
</tr>
<tr>
<td>Commercial Office</td>
<td>25 years</td>
<td>42 years</td>
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<td>Warehouse-to-Office Conversion</td>
<td>12 years</td>
<td>19 years</td>
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<td>Multifamily Residential</td>
<td>16 years</td>
<td>20 years</td>
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<tr>
<td>Elementary School</td>
<td>10 years</td>
<td>16 years</td>
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Figure 28: Climate Change Impacts for Commercial Office
Carbon Emissions in the Building Life Cycle

Figure 4: Life Cycle OC and EC Proportions of Buildings
(Source: RICS, 2012)
Getting to Zero Lists of Buildings

2012

700% growth since 2012 with more than 550 projects
Proving Feasibility by Tracking Trends and Growth
Advancing Net Zero

WorldGBC definition:
A net zero carbon building is highly energy efficient with all remaining energy from on-site and/or off-site renewable sources.

Key Principles

1. Measure and disclose carbon
Carbon is the ultimate metric to track; buildings must achieve an annual operational net zero carbon emissions balance based on metered data.

2. Reduce energy demand
Prioritise energy efficiency to ensure that buildings are performing as efficiently as possible, and not wasting energy.

3. Generate balance from renewables
Supply remaining demand from renewable energy sources, preferably on-site followed by off-site, or from offsets.

4. Improve verification and rigour
Over time, progress to include embodied carbon and other impact areas such as zero water and zero waste.

100% of buildings must operate at net zero carbon by 2050.
All new buildings must operate at net zero carbon by 2030.
Terminology and Certifications

- Zero Net Energy
- Zero Energy
- Net Zero Energy
- ZE Site
- ZE Source
- ZE Ready
- Zero Carbon
- Zero Emission
- Living Building
- Passive House
Certifications: LEED Zero

- Zero Carbon - 12 months of data that accounts for the balance of carbon from:
  - Building energy consumption
  - Occupant transportation
  - Carbon emissions avoided (from renewable energy generation and procurement)

- Zero Energy - 12 months of data demonstrating a net zero energy balance:
  - Total source energy consumed (Energy Star Source-Site ratios)
  - Total energy generated on-site or procured off-site
Certifications: ILFI

• Zero Carbon
  • Achieve a targeted energy efficiency level over a 12 month performance period
  • 100% percent of energy use must be offset by on- or off-site power
  • Account for total embodied carbon impact from construction and materials and offset through a one-time carbon offset
    - 10% embodied carbon reduction of foundation, structure and enclosure

• Zero Energy
  • 100% of the buildings energy (site) needs on a net annual basis must be supplied by on-site renewable energy
  • No combustion allowed
Code Progression to Zero

-20 -10 0 10 20 30 40 50 60

2018 2021 2024 2027 2030

Renewables offset load to achieve goal

PV contribution  Unregulated Loads  Regulated Loads  Performance Goal
2021 IECC Updates are Underway

Better energy codes are key to achieving climate goals.

Local governments have the power to move national energy codes forward.

Energy codes are life safety codes
Evolution of State Codes and Policies

State Goal: Carbon Neutral by 2045

Low-Carbon Buildings Bill (2018)

AB 3232  State to reduce greenhouse gas emissions from California’s residential and commercial buildings by 40% by 2030 below 1990 levels.

California Renewables Portfolio Standard Program (2018)

SB 100  60% of California’s electricity to be generated from renewable resources by 2030 and for it to be 100 percent carbon-free by 2045.

Title 24 (2019)

In residential, requires deep efficiency in regulated loads (envelope, HVAC, lighting and domestic hot water) and will require buildings to be efficient enough that their annual electricity use can be offset by a modestly sized solar array. (Does not include gas usage).
2019 Title 24 Standard

- Parallel residential prescriptive paths
  1. Mixed fuel homes
  2. All-electric homes
- 2019 Standards results in significant CO2 reductions in buildings

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<th>CO2 Impact of Housing Choices</th>
<th>Metric Tons of CO2 Emitted/yr</th>
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<td>Mixed Fuel 2000 Compliant Building, No PV</td>
<td>6.5</td>
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<td>3.26</td>
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<td>Mixed Fuel 2019 Standard Design, with 3.1 kW PV</td>
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<td>All-Elect 2019, 3.1 kW PV</td>
<td>1.12</td>
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<tr>
<td>All-Elect 2019, 6 kW PV</td>
<td>0.46</td>
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Source: California Energy Commission
Implications of Future Standards

Although the 2019 Standards project is a major success on many fronts, it reveals the need for attention on the following going forward:

• Move to a more GHG-based metric that promotes electrification
• Move away from “netting” – must have a metric that advances building measures that support grid flexibility
• Maintain an energy efficiency first priority but advance 2019 Standards’ second priority on PV self utilization and demand responsive measures
• Continue to advance compliance software information enabling users to take GHG reduction into account in design and construction
target: carbon neutral building stock

NYSERDA KEY ACTIONS FOR 2019–2022

- Develop and publish the New York State Net Zero Buildings Roadmap—charting a path to a carbon neutral building stock
- Sponsor successive rounds of demonstration projects to improve the performance and lower the cost of net zero retrofits
- Work with strategic partners to foster prefabricated high-performance building component manufacturing in New York State
- Support the development of integrated solution provider companies capable of delivering net zero retrofits
- Identify additional value streams for high-performance buildings (e.g., grid responsiveness, thermal and acoustic comfort, indoor air quality)
- Identify and address regulatory barriers
- Develop private sector financing products to monetize long-term operational savings
- Coordinate net zero components of relevant programs

PRIORITY ACTIONS FOR NEW YORK

- Demonstrate the economic viability of net zero buildings by encouraging, supporting, and publicizing early adopters
- Shape and encourage adoption of building code revisions requiring net zero for many building types by 2030
- Lead by example with State-owned buildings
- Engage strategic partners to nurture linkages between stakeholders in real estate, finance, and manufacturing sectors
- Leverage standard affordable housing subsidized financing processes to drive adoption
- Provide technical support and education on Lifecycle Cost Analysis and long-term capital planning
AMERICAN CITIES
CLIMATE CHALLENGE
HELPING AMERICA’S LEADING
A New Metric For Building-Grid Interactions
Alternate Grid Metrics (Carbon) can be Incorporated

Relative Carbon Intensity of Grid Power by Hour of Year (CAISO)
Opportunities for Building Integration with Grid

Permanent Efficiency
• Reduce building energy loads…

Peak Shifting
• Design to modify time of peak building energy use to adapt to grid…

Dynamic Response
• Actively reduce building energy use in response to short-term grid constraints…

Dispatchable Energy Storage
• Actively manage energy use patterns based on grid signals…
Comparing Building Load to Grid Characteristics

- Building efficiency
- Start-up/Shut down optimization
- Night load management
- Smart appliances
- Smart-charging vehicles
- On-site generation and storage

Peak time of use and grid carbon characteristics add dimensions to building design strategy evaluation.
SB 1477: CLEAN HEAT FOR CALIFORNIA HOMES

Senate Bill 1477 will deliver the next generation of clean, energy efficient homes and empower Californians to reduce energy costs, improve air quality, and cut climate pollution.


"Technology and Equipment for Clean Heating (TECH) Initiative"  
"Building Initiative for Low-Emissions Development (BUILD) Program"
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GOAL 1
Customers, builders, contractors and policy-makers are aware of and demand building decarbonization measures.

GOAL 2
Customers receive a good value from adopting building decarbonization measures.

GOAL 3
Building decarbonization provides a better value to builders and contractors than fossil-fuel heating.

GOAL 4
Supply-chains and delivery agents are able to meet rising demand for carbon-free building technologies with a quality product.

GOAL 5
Policies are aligned to maximize customer awareness of and interest in building decarbonization, the customer, builder and contractor value proposition, and the industry’s ability to meet rising demand.

http://www.buildingdecarb.org/resources/a-roadmap-to-decarbonize-californias-buildings
Getting to Zero Resources HUB

Zero Energy Schools Resources

Learn how zero energy schools are leading the zero energy buildings trend through policy and design.

https://gettingtozeroforum.org/zero-energy-schools-resources/
Save the Date!

GETTING TO ZERO NATIONAL FORUM October 9-11, 2019 OAKLAND MARRIOTT Oakland, CA gettingtozeroforum.org

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Call for Speakers Now Open Deadline March 22
Visit: gettingtozeroforum.org for submission details
Thank you!
ralph@newbuildings.org