Better Buildings, Better Plants

SUMMIT

Learn more: betterbuildingssolutioncenter.energy.gov/summit
Cutting Edge Retrofit Solutions in Multifamily Housing

Wednesday, May 18
11am ET
Today’s Presenters

- Martha Campbell, Principal
  - RMI

- Christina McPike, Director of Energy and Sustainability
  - WinnCompanies
Martha Campbell
Rocky Mountain Institute
Leveraging Advanced Building Construction to Decarbonize our Existing Building Stock

Martha Campbell
Better Buildings Summit 2022
WE NEED AFFORDABLE HOUSING
We must evolve.
We see ABC as the path forward.
Advanced Building Construction

Innovative low carbon, highly efficient new construction and renovation solutions that are faster to deploy, high quality, affordable, and appealing to users and owners.
Mechanical Pods

Photo courtesy of Factory Zero
3D Printed Homes

Photo courtesy of Mighty Buildings
High-Performance Roofs with Solar

Photo courtesy of VolkerWessels
Digitized Workflows
Our mission is to catalyze constructive relationships among incumbent and emergent buildings sector actors to accelerate mainstream adoption of ABC while modernizing the US construction industry.
2030 Vision

**Demand**
- 3M zero carbon retrofits per year
- All new construction is zero carbon

**Technology**
ABC is 25% of the market or greater

**Delivery**
Streamlined business models unlock the market
Theory of Change

WE FACILITATE THE MARKET TO DO SO THROUGH:

STANDARDIZE DECARBONIZATION PACKAGES

ENABLE FUNDING & STANDARDIZE FINANCING

AGGREGATE DEMAND

SCALE SOLUTIONS
Standardize Decarbonization Packages

- High-performance roof system including integrated solar
- Integrated mechanicals including domestic hot water, heating, cooling, and ventilation, with controls and option for smart inverter and energy storage
- Prefabricated wall panel including high-performance windows and doors
- All-electric appliances
Enable & Standardize Funding & Financing

First solve the incremental cost gap
Aggregate Demand

PLEDGES SIGNAL FUTURE DEMAND

CHALLENGES AND DEMONSTRATIONS SERVE TO TEST HYPOTHETICAL PACKAGES AND BUILD SECTOR KNOWLEDGE

ORGANIZE DISCREET TYPOLOGY AND CLIMATE ZONE COMBINATIONS IN VOLUME

PATHWAY TO SCALING BUILDING DECARBONIZATION PROJECTS

RetrofitNY & REALIZE CA
Pledges 450,000 units

RetrofitNY, REALIZE-MA & REALIZE-CA Demonstrations

REALIZE MA 1,000 Apartment Challenge
starting construction 2023

SCALING REALIZE IN THE NORTHEAST

TARGETED MULTIFAMILY BUILDING TYPOLOGIES

LOW-RISE: 518,000 Units
- 2-4 units per building
- 46% of multifamily units
- Median construction year: 1924

High-rise: 181,000 units
- 50+ units per building
- 16% of multifamily units
- Median construction year: 1980

Mid-rise: 168,000 units
- 20-49 units per building
- 15% of multifamily units
- Median construction year: 1969

Top 3 HVAC System Typologies (across all multifamily buildings)

<table>
<thead>
<tr>
<th>Heating System Type</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
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<tbody>
<tr>
<td>Heating Fuel</td>
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<td>Piped NG</td>
<td>Electricity</td>
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<tr>
<td>AC Type</td>
<td>No AC</td>
<td>Central AC</td>
<td>Room AC</td>
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<tr>
<td>Water Heater Fuel</td>
<td>Piped NG</td>
<td>Piped NG</td>
<td>Electricity</td>
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Sources: American Housing Survey, Residential Energy Consumption Survey
SCALING REALIZE IN CALIFORNIA
TARGETED MULTIFAMILY BUILDING TYPOLOGIES

Townhouse
762,018 Units
- 5-9 Units, 2 Stories
- Natural gas gravity furnace or forced air furnace
- In-unit cooling or no cooling
- In-unit natural gas water heater

Garden Style
647,511 Units
- 10-19 Units, 2 Stories
- Natural gas gravity furnace or forced air furnace
- In-unit cooling or no cooling
- In-unit or central natural gas water heater

Loaded Corridor
629,470 Units
- 20-49 Units, 2-3 Stories
- Natural gas gravity furnace, electric baseboard, or district heating
- In-unit cooling or no cooling
- In-unit or central natural gas water heater
DEMONSTRATIONS
• Year built: 1995
• Location: Richgrove, CA
• Building size: 2 story townhomes; 2-4 units per building; 49 units in 14 buildings

Before & After

CORONA DEL REY

- Year built: 1966
- Location: Corona, CA
- Building size: 2 story townhomes; 4 units per building

Christina McPike
WinnCompanies
Cutting Edge Retrofit Solutions in Multifamily Housing

Christina McPike, Director of Energy & Sustainability
cmcpike@winnco.com | 617-640-9879
WinnCompanies Overview

- WinnCompanies is a 50-year-old mixed income multifamily property developer, owner, and manager.
- Employs more than 3,500 team members.
- Manages 121 Million square feet, including housing, condos, commercial, retail, and parking.
- Provides homes to 330,000 residents.
- Has created or preserved more than 15,000 units of mixed-income housing across the Mid-Atlantic and Northeast.
- A Commitment to Sustainability has been one of 8 Guiding Principles for over a decade.
Eva White Apartments, Boston

- REALIZE-MA Case Study
- DOE Advanced Building Construction
- Key Partners:
  - Castle Square Tenant Organization
  - Boston Housing Authority
  - Reisen Design Associates
  - Petersen Engineering Inc.
Existing Conditions
Existing Conditions
“Business as Usual” Rehab

- **Moderate, Occupied Rehab**
  - Capital Needs Assessment
  - Critical Repairs
  - No Energy Performance Requirements

- **Scope of Work:**
  - Kitchen reno: flooring, cabinets, appliances, lighting, paint
  - Bathroom reno: flooring, vanity, plumbing fixtures, lighting, paint
  - Common area finishes
  - In-kind HVAC upgrades: condensing boilers, MAU, exhaust fans
  - Roof replacement
  - Window replacement
  - Misc. structural repairs to parapet, brick & concrete
Eva White Apartments: REALIZE

Performance Specs:
• R-25 Continuous Insulation
• R-40 Roof
• 0.20 ACH50
• Limited thermal bridging
• U-0.26 Windows
• Full Electrification

Modeled savings:
• 68% site energy savings
• EUI 104 → EUI 29
• $70k/year utility cost savings
Eva White Retrofit Package

Envelope: Prefabricated Wall Panel System

- R&D by Tremco → “Revitalite” System
  - Prefabricated, Lightweight, Structural, Insulated Façade
  - 6” thick, EPS or GPS core with internal framing and EIFS finish
  - uPVC Amberline Window
  - Patented connection assembly
- Installer Training TBD...
- Warranty & Insurance Discussions Ongoing...
Eva White Retrofit Package

**HVAC: All Electric**

- Standard systems
  - VRF, Mitsubishi Y-series
  - ERV, Annexair
  - HPWH, Mitsubishi QAHV
- Master metering required
- Central systems preferred for maintenance
- Utilizing new cavity space
Eva White DER

Reisen Design Associates
Eva White Key Takeaways (pre-construction!)

- Leveraging existing rehab and capital needs can reduce incremental cost
  - BAU: $150k/unit
  - DER: $250k/unit

- New sources needed to support added costs
  - MassSave LEAN (ABCD Inc.)
  - Proportionally higher LIHTC equity
  - RAD/Section 18

- Customized vs. “Standardized”
  - Creativity, Demonstrations, and further R&D still needed
  - Learn as you go → Integrated Design & Project Delivery
Scaling a New BAU

- How can we re-define the “BAU” rehab and capital planning process?
  - It costs more...
  - It’s harder to do...
- **REALIZE** and **ZOT Frameworks** offer solutions for building owners and policy makers
- Carrots & Sticks will continue being primary drivers
  - **Sticks:**
    - BERDO 2.0
    - NYC Local Law 97
  - **Carrots:**
    - Energy Cost Savings (not enough)
    - Non-economic: aesthetics, comfort, etc. (not enough)
**Boston Case Study**

- Considering Boston’s BERDO 2.0 Policy
  - ~ 86 properties, ~ 7,000 apartments
  - 65% of Portfolio > 5 kgCO2e/sf
  - 35% of Portfolio < 4 kgCO2e/sf
  - Whole building energy data still difficult to obtain

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<tr>
<th>Property Use Type</th>
<th>2025</th>
<th>2030</th>
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Taking Inventory

Boston Portfolio GHG Intensity

kg CO2/sf

Multifamily Properties

2025
2030
2035
2040
2045
Looking Ahead

- Strategic Planning
- Leverage capital needs and major recapitalization events
ABC Phase 2: Scaling the Recipe

Walden Square Apartments

PROPOSED SOLUTION

- Scanning to BIM/CAD/CAM workflow
- Prefabricated unitized retrofit panel
- IMSP-C & Whalen Whispertherm
- (Partial) Central plant upgrade
- Prefabricated ductwork
ABC Phase 2: Scaling the Recipe

- Streamlined project design & implementation
- Proven technology
  - “IMSP-C” – Integrated Mechanical System Pod
  - Unitized Panels – proven & tested

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<th>ISMP-C Cost Compression Study (RMI)</th>
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<tbody>
<tr>
<td>Prototype</td>
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<tr>
<td>Stage 1 (100 Units)</td>
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<td>Stage 2 (100-1,000 Units)</td>
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<tr>
<td>Stage 3 (1,000-10,000 Units)</td>
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AGGREGATING DEMAND
REALIZE-CA

March 2022
The purpose of the REALIZE-CA Building Owner Pledge is to demonstrate a commitment to, and demand for, zero-carbon retrofits that meet the needs of California’s affordable multifamily housing sector.
Building Owner Pledge

45,828 Affordable Housing Units pledged across California
Multifamily Rapid Retrofit Direct Install Program

Deep subsidy is needed to jump start the market, policy interventions are required

Supported by: Building decarbonization, affordable housing and environmental justice advocates representing 45,000+ units of affordable housing across California.

State Budget Carve Out: Requesting $50M for a pilot program from Governor Newsom’s proposed $922M building decarbonization budget.

Range of Projects: Initially targeting two to three specific building typologies that constitute a major portion of AMFH in California to catalyze the expeditious deployment of retrofits via a standardized package of measures.

Supply Chain Engagement: Pilot would competitively select a cohort of manufacturers and contractors to train to provide integrated retrofit packages.
Massachusetts Zero Carbon Renovation Fund

Deep subsidy is needed to jump start the market, policy interventions are required

Supported by: 75 organizations representing 30,000+ units of affordable housing across the Commonwealth are asking that 5% of ARPA be allocated for the Zero Carbon Renovation Fund.

Utilize ARPA Funds: In 2021, MA was allocated $5.3 billion of American Rescue Plan Act (ARPA) funds for CoVid relief and economic development.

Range of Projects: If passed, the Zero Carbon Renovation Fund would support projects ranging from electrification + solar for low-income housing to comprehensive deep energy retrofits for communities most in need.

Leverage MassSave and Other Sources: This fund would leverage MassSave and other sources, providing funding for projects that may not otherwise be served.
1,000 Apartment Challenge
1,000 deep energy retrofits under construction in Massachusetts by 2023
The ideal candidate building(s)

1) Scheduled for a **major rehab**
2) **Funds** allocated for major rehab
3) **Planned scope of work** (at least 3 of the following): new windows, roofs, mechanicals, new siding
4) **Simple architecture**
5) **Not historic or architecturally significant building**
Q & A
Thank You!

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