Evolving Toward Zero in Affordable Multifamily
Karla Butterfield
Sustainability Directory
kbutterfield@swinter.com
Learning Objectives

1. Understand the selection process of high performing assemblies and systems

2. Learn the correlation between state climate initiatives, affordable housing loans and program requirements

3. Identify pay back opportunities through energy & water savings, durability and decreased resident turnover

4. Recognize lessons learned and best practices toward standardization
SUCCESS IS IN THE DETAILS
Air Barrier
Air Barrier
Air Barrier
Air Barrier
Air Barrier
Air Barrier
Air Barrier

NOTE: PER PH+ PASSIVE HOUSE DESIGN REQUIREMENTS, ROOF R-VALUE SHALL MEET A MINIMUM OF R-40, REFER TO COMPLIANCE REPORT FOR ADDITIONAL INFORMATION

1/2' APA STRUCTURAL 1 RATED EXP.
1 PLYWOOD SHEATHING
CONTINUOUS A/V MEMBRANE
BASE OF DESIGN: HENRY BLUESKIN
5A (LAP AND SEAL ALL JOINTS)
Air Barrier

Susan O’Dell, Paul Bailey Architects
Air Barrier
Air Barrier
Air Barrier
Air Barrier
Air Barrier
Air Barrier

Photo Courtesy, Handel Architects
THE COMPOSITION OF A WALL
Thermal Barrier
Thermal Barrier

\[ T_{\text{interface}} = T_{\text{indoor}} - [(T_{\text{indoor}} - T_{\text{outdoor}}) \times (\frac{R_{\text{cavity}}}{R_{\text{total}}})] \]

<table>
<thead>
<tr>
<th>Average Daily Temperature Dec/Jan/Feb (T_{\text{outdoor}})</th>
<th>Minimum Recommended Exterior RFB R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>4.0</td>
</tr>
<tr>
<td>32</td>
<td>5.5</td>
</tr>
<tr>
<td>30</td>
<td>7.0</td>
</tr>
<tr>
<td>28</td>
<td>8.5</td>
</tr>
<tr>
<td>26</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Bridgeport 32.5° F

Hartford 28.4° F

Worcester, MA 26.1° F

20°F Dry
• 10-15% RH at 70°F

70°F 25-33% RH

85°F Dry bulb
• 67% RH
• 95% RH at 75°F

75°F 50-55% RH

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Thermal Barrier
Sheathing Daily Average Moisture Content
WUFI vs. Measured

Moisture Content [%]

- Measured NS (Corrected)
- Measured SS (Corrected)
- WUFI NS + Act Int/Ext Cond
- WUFI SS + Actual Int/Ext Cond
- WUFI SS ASHRAE

INCENTIVIZING HIGH PERFORMANCE
Affordable Housing Financing

Image credit: The PHFA Project by Tim McDonald, Temple University Architect Research Center
Affordable Housing Financing

Green Rewards for existing multifamily:
• ASHRAE Level 2 audit paid for
• Lower pricing than “non-green” loans
• Underwriting 75% of owner’s projected savings
• Underwriting 25% of tenant’s projected costs

Green Preservation Plus:
• Awards for updating equipment & reducing costs

New Construction Certified Projects:
• Lower all-in interest rate with “green bundling” loans
Residents of Crescent Crossings, the majority of whom are members of low-income households, can live both comfortably and sustainably at Crescent Crossings. This is of particular importance in a community of predominantly older, less efficient homes. Residents may have formerly had to choose the necessities of rent or food over their utility bills, residents are able to stress less without sacrificing comfort during cold winters and humid summers.

Their sustainable homes and enjoy learning how to conserve energy by using their sustainable home’s features, such as programmable thermostats.

Especially in our affordable housing communities, utility savings for residents is very valuable and directly impacts their daily lives.

Energy savings in addition to high-performing buildings create and healthy environment that does better prepare residents in tending to their lives at work and school. Orientation training provided by staff educates residents on the functionality of their new apartments and the benefits they receive which helps reduce maintenance requests.

These are lessons they will take with them wherever they go, bringing the message of conservation to the wider community. Finally, Crescent Crossings is an example to the greater affordable housing community of how sustainable building design is achievable, desirable, and marketable.

- Dan Montanaro, JHM Group:
CASE IN POINT
Evolving Toward Zero
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**Willow Creek 3, Hartford (PHI)**

<table>
<thead>
<tr>
<th>Envelope Component</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat Roofs</td>
<td>R-90</td>
</tr>
<tr>
<td>Above Grade Walls</td>
<td>R-46</td>
</tr>
<tr>
<td>Ground Slab</td>
<td>R-40</td>
</tr>
<tr>
<td>Window U/lass U/rame</td>
<td>0.106; SHGC 0.6</td>
</tr>
<tr>
<td>Window Edge Psi</td>
<td>0.14</td>
</tr>
<tr>
<td>Window Frame to Wall Psi</td>
<td>0.015</td>
</tr>
<tr>
<td>Glass Exterior Doors U/lass U/rame</td>
<td>0.15; SHGC 0.6</td>
</tr>
<tr>
<td>Glass Exterior Doors Uframe</td>
<td>0.18</td>
</tr>
<tr>
<td>Exterior Solid Doors</td>
<td>R-8</td>
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</table>

**Marina Village 2, Bridgeport (PHIUS+)**

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<tr>
<th>Envelope Component</th>
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<tbody>
<tr>
<td>Roofs</td>
<td>R-86</td>
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<tr>
<td>Above-Grade Walls</td>
<td>R-39</td>
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<tr>
<td>Cantilevered Floors</td>
<td>R-58</td>
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<tr>
<td>Ground Slab</td>
<td>R-10</td>
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<tr>
<td>Window U/lass U/rame</td>
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<tr>
<td>Window Edge Psi</td>
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<td>Window Edge Psi</td>
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<td>Window SHGC</td>
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<td>Glass Exterior Doors Uframe</td>
<td>0.25</td>
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<tr>
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## Evolving Toward Zero

### Criteria for Certification

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<th>SWA Model</th>
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<tbody>
<tr>
<td>Space Heating Demand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(kBTU/ft²·yr)</td>
<td>5.20</td>
<td>3.58</td>
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<tr>
<td>Space Cooling Demand</td>
<td></td>
<td></td>
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<tr>
<td>(kBTU/ft²·yr) ft²·yr</td>
<td>3.50</td>
<td>2.86</td>
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<tr>
<td>Space Heating Load (BTU/hr·ft²)</td>
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<td>3.99</td>
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<tr>
<td>Space Cooling Load</td>
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<tr>
<td>(BTU/hr·ft²)</td>
<td>4.30</td>
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<tr>
<td>Primary Energy (kWh/person·yr)</td>
<td>6.200</td>
<td>4,724</td>
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<tr>
<td>Pressurized Airtightness (ACH₅₀)</td>
<td>0.6</td>
<td>0.59</td>
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### Willow Creek 3, Hartford (PHI)

### Marina Village 2, Bridgeport (PHIUS+)

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<td>4.90</td>
<td>4.73</td>
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<tr>
<td>Space Cooling Demand</td>
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<td></td>
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<tr>
<td>(kBTU/ft²·yr) ft²·yr</td>
<td>3.20</td>
<td>3.15</td>
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<tr>
<td>Space Heating Load (BTU/hr·ft²)</td>
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<td>3.77</td>
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<tr>
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<tr>
<td>(BTU/hr·ft²)</td>
<td>4.00</td>
<td>1.96</td>
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<td>Primary Energy (kWh/person·yr)</td>
<td>6.200</td>
<td>5,096</td>
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Evolving Toward Zero

Predicted Annual Energy Costs

- The Heights at Darien
- Crescent Crossings
- Windward

% Saved

Cost ($) Per Year

- Heating
  - 43.4% (59.6%)
- Cooling
  - 3.4% (47.4%)
- Water Heating
  - 58.1% (34.3%)
- Lights & Appliances
  - 17.7% (42.2%)
- Total
  - 36.8% (46.0%)
Marina Village 2 bedroom: Predicted Annual Energy Cost

- Heating: $482
- Cooling: $58
- Water Heating: $184
- Lights & Appliances: $8
- Ventilation: $239

Evolving Toward Zero
In Summary

- Identifying the air barrier at design helps ensure a successful installation
- Assemblies vary but the end result is thermal bridge free construction
- Incentives matter
- Evolving toward zero can mean one (effective) step at a time
Thank You!
Any Questions?

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