New Buildings Institute (NBI)

20 years of Innovation

NBI is redefining energy efficiency in the built environment.

Program Areas:
• Best practices in new and existing buildings
• Continuous code and policy innovation
• Zero energy leadership and market development
Thanks to our valued sponsors & partners

Building Innovation – Multifamily
Multifamily: A Market Divided

High-Rise Multifamily:
- 4 or more stories
- Regulated as Commercial

Low-Rise Multifamily:
- 3 or fewer stories (up to 5 in some cases in MA)
- Regulated as Residential
Low-Rise Multifamily Regulation

**Requirements Crafted for:**
- Single Family usage patterns
- Single Family loads
- Single Family occupancy densities
- Single Family hot water use

High-Rise Multifamily Regulation

**Requirements Crafted for:**
- Commercial usage patterns
- Commercial loads
- Commercial occupancy densities
- Commercial hot water use
### Different Code – Different Requirements

- Windows
- Insulation
- Infiltration
- Hot Water
- Common Area Lighting Controls
- Common Area Lighting Efficiency
- Exterior Lighting Efficiency
- C406: Additional Efficiency Options
Different Code – Different Outcomes

↓ 11%
**Divided Market = Implementation Barriers**

1. How to get Savings over Different Codes
2. Where Does Multifamily Belong Programmatically?
3. Multiplication of Programmatic Expenses
4. Messaging and Branding Barriers
5. Confusion in Marketplace

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**The Future Multifamily in Energy Codes**

- **2015 International Energy Conservation Code**
  - C101.2 Scope. This code applies to commercial buildings and multifamily buildings, and associated systems and equipment.
  - C101.4.1 Mixed occupancy. Where a building includes both commercial occupancies, each occupancy shall be separately considered.
  - C101.8 Compliance. Residential buildings shall meet the provisions of the International Energy Conservation Code, and multifamily buildings shall meet the provisions of IECC—C.

**SECTION 202 DEFINITION**

- **COMMERCIAL BUILDING.** For this code, all buildings that are not included in “Multifamily Building.”
- **COMMON AREA.** For this code, all portions of a multifamily building that are not residential dwelling units.
- **MULTIFAMILY BUILDING.** For this code, all Group R-2 buildings.
- **RESIDENTIAL BUILDING.** For this code, includes detached one- and two-family dwellings (townhouses) as well as Group R-2, R-3, and R-4 buildings therein.
Building Innovation – Multifamily

Advanced Measures for Your Multifamily Program

Advanced Guidance for Your Multifamily Market
Building Innovation – Multifamily

Advanced Measures for Your Multifamily Program
• Standalone Energy Efficiency Measures
• An integrated Bundle of Measures
• Additional Measures for Additional Savings

Advanced Guidance for Your Multifamily Market
• Written Guidance
• Training Webinars
Building Innovation – Multifamily

Advanced Measures for Your Multifamily Program

- Standalone Energy Efficiency Measures
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- Written Guidance
- Training Webinars
## Advanced Measures for Your Multifamily Program

<table>
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<tr>
<th>Measure</th>
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<tbody>
<tr>
<td>1. Windows</td>
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<tr>
<td>2. Thermal Bridging Limitations</td>
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<tr>
<td>3. Infiltration Reduction</td>
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<tr>
<td>4. Equipment Efficiency</td>
</tr>
<tr>
<td>5. Fan Efficiency</td>
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<td>6. HVAC Controls</td>
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<td>7. Efficient Ventilation</td>
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<tr>
<td>8. Lighting Efficacy</td>
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<tr>
<td>9. Common Area Lighting Controls</td>
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<tr>
<td>10. Efficient Exterior Lighting</td>
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<tr>
<td>11. Efficient Hot Water Equipment</td>
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<td>12. Hot Water Conservation</td>
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<td>13. Appliances</td>
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### Advanced Measures for Your Multifamily Program

- Advanced HVAC System Selection
  - Ground Source Heat Pump
  - High Efficiency Heat Pump
  - Radiant Heating/Cooling
- Heat Pump Water Heater
- Energy Recovery Ventilation
- Enhanced Envelope UA
Advanced Measures for Your Multifamily Program

1. Windows
2. Thermal Bridging Limitations
3. Infiltration Reduction
4. Equipment Efficiency
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Advanced Measures for Your Multifamily Program

- Common Area Lighting
- Thermal Bridging Limitations
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- Common Area Lighting Controls
- Efficient Exterior Lighting
- Efficient Hot Water Equipment
- Hot Water Conservation
- Appliances
### Advanced Measures for Your Multifamily Program

#### Envelope Component

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<th>Percent of total</th>
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<td>Outside Corner</td>
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<td>Fenestration-wall intersection</td>
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Area Weighted average: 0.075, 3,751, 100%
### Advanced Measures for Your Multifamily Program

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<th>In-Line Fan</th>
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<td><strong>Efficient Exterior Lighting</strong></td>
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<td><strong>Efficient Hot Water Equipment</strong></td>
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<td><strong>Hot Water Conservation</strong></td>
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<tr>
<td><strong>Appliances</strong></td>
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</table>

- **Range Hood**:
  - Small Bath/Utility: 2.8 cfm/W
  - Large Bath/Utility: 2.8 cfm/W

- **In-Line Fan**:
  - Small Bath/Utility: 2.8 cfm/W
  - Large Bath/Utility: 1.4 cfm/W

- **Energy Star**
  - Small Bath/Utility: 2.8 cfm/W
  - Large Bath/Utility: 2.8 cfm/W
## Advanced Measures for Your Multifamily Program

<table>
<thead>
<tr>
<th>Measure</th>
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<td><strong>Max</strong></td>
<td>3.7 cfm/W</td>
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<td>8.0 cfm/W</td>
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**Note:**
- Common Area Lighting
- Controls
- Efficient Exterior Lighting
- Efficient Hot Water Equipment
- Hot Water Conservation
- Appliances
Advanced Measures for Your Multifamily Program

- Windows
- Thermal Bridging Limitations
- Infiltration Reduction
- Equipment Efficiency
- Fan Efficiency
- HVAC Controls
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  - Appliances

Measure Support for Your Multifamily Program

Technical Document: Energy Savings Study for NBI Advanced Multifamily Solutions

Technical Document: Incremental Cost for NBI Advanced Multifamily Solutions
Measure Support for Your Multifamily Program

Technical Document: Energy Savings Study for NBI Advanced Multifamily Solutions
June, 2017

Technical Document: Incremental Cost for NBI Advanced Multifamily Solutions
June, 2017
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<th>Description</th>
<th>Natural gas savings (therm/ft²)</th>
<th>Electricity savings (kWh/ft²)</th>
<th>EUI savings (kBTU/ft²)</th>
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<th>Electricity savings (%)</th>
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### Measure

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8/28/2017
Advanced Measures for Your Multifamily Program

1. Windows
2. Thermal Bridging Limitations
3. Infiltration Reduction
4. Equipment Efficiency
5. Fan Efficiency
6. HVAC Controls
7. Efficient Ventilation
8. Lighting Efficacy
9. Common Area Lighting Controls
10. Efficient Exterior Lighting
11. Efficient Hot Water Equipment
12. Hot Water Conservation
13. Appliances
Building Innovation – Multifamily

Advanced Measures for Your Multifamily Program
- Standalone Energy Efficiency Measures
- An integrated Bundle of Measures
- Additional Measures for Additional Savings

Advanced Guidance for Your Multifamily Market
- Written Guidance
- Training Webinars

Advanced Guidance for Your Multifamily Program

DHW Efficiency: Condensing Gas Storage
Considerations
- Height
- Venting
- Condensate
Advanced Guidance for Your Multifamily Market

1. Introduction
2. Measure Requirements
3. Guidance
   • Thermal Bridging
   • Ventilation
   • Water Heating
   • Exterior Lighting

Water Heating Equipment Requirements

• All Water Heaters shall have a minimum Energy Factor of 0.95.
• All boilers used for domestic water heating shall meet the equipment standards of the efficiency tables of the HVAC Equipment Efficiency measure.
• Where a natural gas boiler reheats returning water in a recirculation loop, the loop shall be designed to return water to the boiler at a temperature below the threshold for condensing mode as stated by the boiler manufacturer.
• Air-Source Heat Pump Water Heaters shall not be located within conditioned space in locations with more Heating Degree Days than Cooling Degree Days.

Exception: Heat Pump Water Heaters with ducted intake and exhaust air.
DOMESTIC HOT WATER

Guidance
In typical multifamily buildings, water heating can account for up to 1/3 of the building's total energy cost. The water heating system is therefore an essential component of the total efficiency of multifamily buildings. There are three primary components to the performance of the domestic water heating system: the efficiency of the water heating equipment, water conservation at the point of use, and the distribution system. High performance water heating requires careful consideration of all three of these components in the system design.

Water Heating Equipment Requirements
- All water heaters shall have a minimum Energy Factor of 0.80.
- All boilers used for domestic water heating shall meet the efficiency tables of the HVAC Equipment Efficiency measure.

SITE LIGHTING

Guidance
Light Emitting Diode (LED) lighting had some of the earliest and broadest successes in exterior lighting applications. The substantially better energy performance of LED light sources allowed for significant energy savings in exterior applications, especially considering the long operating hours and large areas that often characterized many exterior lighting installations. The long service life and resulting lowered maintenance costs only contributed more cost savings. And the better color rendering LED offers over the High Pressure Sodium (HPS) lamps that dominated exterior lighting applications was a non-energy benefit that just made another strong selling point for many projects.

Requirements
- All luminaires with a total fixture wattage over 50W used for exterior lighting shall have a total luminaire efficacy of no less than 100 lumens/Watt including light sources, drivers and ballasts.
- All other luminaires used for exterior lighting shall have a total luminaire efficacy of no less than 60 lumens/Watt.
**THERMAL BRIDGING**

**Guidance**

Thermal bridges are created when a relatively high thermally conductive material “bridges” through the insulating materials in the thermal envelope. Whether they penetrate all the way from the exterior to the interior of the building or only partially through the thermal envelope, thermal bridges make it easier for heat to travel in or out of the building. This has an impact on the heating and cooling loads of the building, as well as on the perceived comfort of space occupants. Humans perceive heat primarily through conduction, then radiation, then convection. So the presence of hot or cold surfaces due to thermal bridges can have a significant impact on thermal comfort. When the thermal envelope has hot or cold spots from thermal bridges, occupants are more likely to feel uncomfortable and respond by over-conditioning the air in the space, creating another source of energy loss.

**Requirements:**

- The opaque envelope shall meet the U-factor requirements in the base code based on the Area-Weighted Average of the entire envelope component (e.g., Roofs, Above-Grade Walls, Floors, etc.).
- In calculating the U-factor of a building component, the U-factor shall be calculated as an area-weighted average of all points in the whole envelope component, not just a representative assembly. No points in the envelope shall be ignored, overlooked, but not limited to:

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**VENTILATION**

**Guidance**

Indoor air quality is one of the more pressing issues facing multifamily buildings, especially within modern new construction. Historically, ventilation in residential buildings was provided through the building envelope, through both windows and high infiltration rates. As envelopes have been tightened by code and further tightened by above-code standards, balanced mechanical ventilation with dedicated paths for make-up and exhaust air has become necessary to ensure sufficient fresh air in multifamily buildings. The ventilation requirements in the Multifamily Guide ensure that proper ventilation is being provided to the building in a manner that is energy efficient.

**Requirements:**

- All ventilation shall be provided by a system meeting the following requirements:
  - Based in accordance with the 2016 or later editions of ASHRAE Standard 62.2 for dwelling units and ASHRAE Standard 62.1 for common areas.
  - Balanced ventilation that is designed to provide make-up
Advanced Guidance for Your Multifamily Market

- Educate program staff
- Improve measure implementation in market
- Improve savings confidence
- Meet programmatic education goals

Advanced Guidance for Your Multifamily Program

- Improve measure implementation in market
- Meet programmatic education goals
- Promote Programs
Advanced Guidance for Your Multifamily Program

- Improve measure implementation in market
- Meet programmatic education goals
- Promote Programs
Energy Efficiency Opportunities

Water Heating Efficiency

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## Water Heating Efficiency

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<td>0.95 EF / 1.0 EF</td>
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## DHW Efficiency: Condensing Gas Storage

[DHW Efficiency: Condensing Gas Storage](http://www.bockwaterheaters.com)
DHW Efficiency: Condensing Gas Storage

Considerations
• Height
• Venting
• Condensate

DHW Efficiency: Condensing Gas Storage

Opportunities
• Relocation
DHW Efficiency: Condensing Gas Instantaneous

Considerations

• Capacity
• Venting
• Condensate

http://www.rinnai.com
DHW Efficiency: Condensing Gas Instantaneous

Opportunities
• Retrofit for tight spaces
• Eliminate recirculation loop
• Downsize cooling

DHW Efficiency: Heat Pump Water Heaters
DHW Efficiency: Heat Pump Water Heaters

Considerations
• Taller & Wider
• Noise
• Higher Capacity
• Heat Load Impact
• Central System Complexity

http://www.geappliances.com

DHW Efficiency: Heat Pump Water Heaters

http://www.sanden-hot-water.com.au
DHW Efficiency: Heat Pump Water Heaters

Opportunities

- Load shifting
- Reduce cooling loads
- Integrate with HVAC

http://www.geappliances.com

DHW Efficiency: Heat Pump Water Heaters

Indoor Unit (Heating or Cooling)

DHW Supply
Entering Water

Special Electric Water Heater w/tank wrap
Controls integrated with outdoor unit

Outdoor Unit
Hot Gas
Liquid
Building Innovation – Multifamily

Advanced Measures for Your Multifamily Program

Advanced Guidance for Your Multifamily Market

NEEA Member Benefits

1. Measure Requirements
2. Savings Study
3. Incremental Cost Study
4. Multifamily Guide
5. DHW Technical Webinar Template
NEEA Member (and Other NBI Sponsors) Benefits

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- Air-Source Heat Pump
  Degree Days from C:
  **Exception:** Heat Pur

![Diagram of building innovation multifamily](image)
Customization Options

1. Custom Measures/Bundles
2. Custom Code Baselines
3. Custom Cost Studies
4. Co-branded MF Guide
5. Co-branded / NBI Hosted Webinars (including additional topics)

Questions?

For More Info:

www.newbuildings.org
info@newbuildings.org