Energy Code in NYC

Emily Hoffman, PE, CEM, LEED AP
Director of Energy Code Compliance
Copyrighted Materials

This presentation is protected by US and International Copyright laws. Reproduction, distribution, display and use of the presentation without written permission of the speaker is prohibited.

© 2016 New York City Department of Buildings
Use of this Presentation

LEGAL DISCLAIMER: This presentation and any associated handouts should not be used as substitutes for codes and regulations. For specific requirements, please refer to the relevant laws and code provisions.

© New York City Department of Buildings 2018
Presentation Agenda

- NYC Energy Code Progress & Enforcement
- Major Changes in the 2016 NYCECC
  - Envelope
  - HVAC
  - Lighting
  - Commissioning
  - Modeling
  - Operational Changes
- Findings & Challenges
- Future – Where is the code going?
  - Increased stringency
  - Increased enforcement
Building Energy Policy in New York City

- NYCECC in context - what establishes the Baseline?
- Progress - how has NYC improved?
  - Increased stringency
  - Increased enforcement
- Future - where is the code going?
  - Increased stringency
  - Increased enforcement
- Findings and Challenges
Building Energy Policy in New York City

• **NYCECC in context- what establishes the Baseline?**

• **Progress- how has NYC improved?**
  – Increased stringency
  – Increased enforcement

• **Future- where is the code going?**
  – Increased stringency
  – Increased enforcement

Energy Code in NYC
Energy Code in New York State

1970’s Energy Crisis

Establishment of National model codes

Establishment of state energy codes

Photo by David Falconer, Earth graphic by Additceted04, and NY State map by JimIrwin.
Source: Wikipedia Creative Commons
Building Energy Policy in New York City

- **NYCECC in context**: what establishes the Baseline?

- **Progress**: how has NYC improved?
  - Increased stringency
  - Increased enforcement

- **Future**: where is the code going?
  - Increased stringency
  - Increased enforcement

Energy Code in NYC
Energy Policy in New York City

• Increased stringency

Local Law 85 of 2009

Energy Code in NYC

Photo by Dmitry Avdeev. Source: Wikipedia Creative Commons
Context for the NYCECC - Baseline

Source: ACEEE
In 2009, the American Recovery and Reinvestment Act, stipulated that any state that accepted federal funding would have to demonstrate at least 90% compliance with the energy code on all permitted projects by 2017.
First report on Energy Code Compliance in New York State revealed (based on technical compliance with the envelope provisions):

**Residential** - 61%

**Commercial** - 36%

Energy Code in NYS
• Local Law 85 of 2009
  – NYC establishes its own Energy Code
  – Establishes the Energy Code Unit in 2013, starting with New Building applications
  – One City Built to Last Plan calls for increased enforcement in 2014

Energy Code in NYC
• Local Law 85 of 2009
  – NYC establishes its own Energy Code
  – Establishes the Energy Code Unit in 2013, starting with New Building applications
  – One City Built to Last Plan calls for increased enforcement in 2014

Energy Code in NYC
• 2015 DOB Alterations Pilot
  – 12 month study to establish a review strategy for alterations to existing buildings
  • Test filters for high-risk energy projects (current process and future process considerations)
  • Test inspections strategies for agency audits
  • “test” compliance in the alterations market

Energy Code Enforcement
Findings

- Noncompliance issues in plan examination
  - Boiler and Mechanical systems- controls
  - Lighting systems- controls
  - Façade alterations were falling out of the filters

- 75% of projects had technical objections in the first review

Energy Code Enforcement
Findings

- Noncompliance issues in inspections
  - Many issues were related to post-approval drawing changes
  - Most deficiencies identified in the field could be remedied
- 36% of projects received a “Notice of Deficiency”

![Technical NODs Pie Chart]

Energy Code Enforcement
Overview of 2016 NYCECC

1. Residential Advisory Committee
   • 31 proposals

2. Commercial Advisory Committee
   • 142 proposals

3. Common reasons for rejection:
   • Preemption of Federal standards or rules
   • Reduction in stringency
   • Revisions to other codes (such as the NYC MC)
Changes in the Residential Provisions

• Envelope
• Compliance Paths
• Solar-ready requirements
Building Envelope – Adopt the Climate Zone 6 Prescriptive Requirements for NYC

- **Adopt Climate Zone 6 requirements for NYC** - increases the minimum performance of the envelope with more stringent insulation and window performance requirements that are required in upstate NY
  - Has been analyzed for cost effectiveness by members of the Code Committee and by PNNL
  - Requirements will be in place for upstate and large portions of US, showing that products and construction methods are readily available
  - Will improve total performance by approximately 5%
Building Envelope Criteria

• Air Leakage- Mandatory testing:

R402.4.1.2 Testing.

The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in Climate Zones 1 and 2, and three air changes per hour in Climate Zones 3 through 8. Testing shall be conducted in accordance with ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.

– Code language includes criteria for conducting the test.

Compliance Paths - Overview

- Minor changes to the Simulated Performance Alternative. The IECC now requires documentation for permit and for C of O, similar to the current EN-1 and EN-2 requirements at DOB.

- MAJOR CHANGE: IECC 2015 has introduce the Energy Rating Index compliance path.

## Conventional Application

<table>
<thead>
<tr>
<th>Component</th>
<th>Pass/Fail</th>
<th>U-Value</th>
<th>R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FENESTRATION</td>
<td>FAIL</td>
<td>U-0.35</td>
<td></td>
</tr>
<tr>
<td>SKYLIGHT</td>
<td>FAIL</td>
<td>U-0.60</td>
<td></td>
</tr>
<tr>
<td>CEILING</td>
<td>FAIL</td>
<td>R-38</td>
<td></td>
</tr>
<tr>
<td>ENVELOPE</td>
<td>FAIL</td>
<td>R-13</td>
<td></td>
</tr>
<tr>
<td>FLOOR</td>
<td>FAIL</td>
<td>R-19</td>
<td></td>
</tr>
<tr>
<td>BASEMENT WALL</td>
<td>FAIL</td>
<td>R-10/13C</td>
<td></td>
</tr>
<tr>
<td>SLAB</td>
<td>FAIL</td>
<td>R-10/2’</td>
<td></td>
</tr>
<tr>
<td>HVAC</td>
<td>PASS</td>
<td>23.5 SEER</td>
<td></td>
</tr>
<tr>
<td>BOILER/SWH</td>
<td>PASS</td>
<td>95 AFUE</td>
<td></td>
</tr>
</tbody>
</table>

**ERI Score**: 54
Appendix RB is Mandatory

- Appendix RB- Solar-Ready Provisions- Detached One- And Two-Family Dwellings, Multiple Single-Family Dwellings (Townhouses)
  - This appendix outlines the requirements for solar-ready provisions, which are available for adoption.
  - Applies to one- and two-family homes, or townhomes/brownstones only, no multifamily
  - Applies to roofs with a minimum square footage of 600 Sq. Ft. with orientation between 110 degrees and 270 degrees of true north
    - Exempts buildings that are shaded more than 50% of the time (modified based on committee feedback)
  - Solar ready zone is at least 200 Sq. Ft., for townhomes the area can be 100 Sq. Ft. if the townhome has less than 2,000 GSF of floor area.
  - Interconnection pathway, reserved electrical service space, and roof load documentation must be indicated in the drawings.
  - Permanent certificate must describe the accommodations for future solar.
Changes in the Commercial Provisions

• Through-the-wall HVAC equipment – U-0.5
• Air leakage testing
• HVAC equipment, controls
• ERV, economizers
• Daylighting controls
• Appendix G modeling
• Metering requirements
Building Envelope - Overview

- **Major change**- NYCECC will require air-leakage testing for certain commercial buildings.
- **Major change**- buildings utilizing certain through-the-wall mechanical equipment must account for the thermal performance deficiency of the wall area occupied by the equipment.

Source: US Army Corps of Engineers
### Envelope – Through-the-wall Mechanical Equipment

<table>
<thead>
<tr>
<th>NYCECC – C402.1.4.2</th>
<th>ASHRAE 5.5.3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P:</strong> When the total area of penetrations from mechanical equipment listed in Table C403.2.3(3) exceeds 1 percent of the opaque above-grade wall area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default $U$-factor of 0.5.</td>
<td><strong>P:</strong> when the total area of penetrations from through-the-wall equipment or mechanical equipment listed in Table 6.8.1-4 exceeds 1% of the opaque above-grade wall area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default $U$-factor of 0.5, and compliance shall be shown with method b.</td>
</tr>
</tbody>
</table>
Envelope – Air Barrier

• Major change- **Air barrier testing (ECC C402.5.1.3 and ASHRAE 5.4.3.5)**
  • Buildings 25,000 sq. ft. and greater, but less than 50,000 sq. ft. and less than or equal to 75’ in height must show compliance through testing in accordance with ASTM E779 (whole-building leakage rate of 0.4 cfm/ft$^2$ or less).
  • Buildings 50,000 sq. ft. and greater must test or inspect each type of unique air barrier joint or seam for continuity and defects, as per an **Air Barrier Continuity Plan**, or may show compliance through testing in accordance with ASTM E779.

WE WANT DETAILS!
HVAC- Overview

• **Major change-** ASHRAE has increased the scope of the standard and now applies to more systems and applications.
  - Now regulates Refrigeration
  - Many more fan requirements – efficiency, controls
  - Minimum turndown for boilers/boiler plants >1 MMBTU/h
  - Energy Recovery in more applications

• **Major change-** 2016 NYCECC has aligned many requirements with ASHRAE, although there are still some differences
  - Removed the distinction between simple/complex systems
  - Aligned efficiencies with ASHRAE
## HVACR – Scope

<table>
<thead>
<tr>
<th>NYCECC – C403.1</th>
<th>ASHRAE – 6.1.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M:</strong> Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers</td>
<td><strong>M:</strong> Mechanical equipment serving heating, cooling, ventilating and refrigeration needs</td>
</tr>
</tbody>
</table>

Source: www.energy.gov Photo by Lynn Billman, NREL.
HVAC – Minimum Efficiencies

• Alignment between NYCECC and ASHRAE 90.1

• Updated requirements for:
  • Air conditioners >65kBTU – IEER
  • Room Air Conditioners - CEER
  • Heat pumps – IEER, EER, COP
  • PTAC (cooling) – EER
  • VRF – IEER
  • Chillers – EER, kW/ton, COP
  • Open circuit cooling tower – gpm/hp
  • Computer room units
  • Evaporative condensers
<table>
<thead>
<tr>
<th>NYCECC</th>
<th>ASHRAE – 6.4.3.10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M:</strong> Not required.</td>
<td><strong>M:</strong> Central scheduling of all units</td>
</tr>
<tr>
<td></td>
<td>New buildings:</td>
</tr>
<tr>
<td></td>
<td>• Fan system ≥ 10 bhp</td>
</tr>
<tr>
<td></td>
<td>• Chilled water plant ≥ 25 tons</td>
</tr>
<tr>
<td></td>
<td>• Hot water plant ≥ 300 kBTU/h</td>
</tr>
<tr>
<td></td>
<td>Existing buildings, depends on:</td>
</tr>
<tr>
<td></td>
<td>• Extent of alterations</td>
</tr>
<tr>
<td></td>
<td>• System in alteration</td>
</tr>
</tbody>
</table>

Source: Wikipedia - Mat the w at English Wikipedia [GFDL (http://www.gnu.org/copyleft/fdl.html), CC-BY-SA-3.0 (http://creativecommons.org/licenses/by-sa/3.0/) or CC BY-SA 2.5-2.0-1.0 (http://creativecommons.org/licenses/by-sa/2.5-2.0-1.0)], via Wikimedia Commons
HVAC – Energy Recovery Ventilation Systems

**NYCECC – C403.2.7**

**M:** Same as ASHRAE

Required on ALL ventilation systems operating 8000+hrs OR 80%+ outdoor air

**ASHRAE – 6.5.6.1**

**P:** Same as IECC

Exhausted air source within 30’ radius of supply air source unit shall be considered single exhaust location.

Image: Google Earth 73rd Street & 1st Ave, 8/24/16
# HVAC – Kitchen Exhaust Systems

<table>
<thead>
<tr>
<th>NYCECC – C403.2.8</th>
<th>ASHRAE – 6.5.7.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M:</strong> NEW, Aligns with ASHRAE</td>
<td><strong>P:</strong> Same as NYCECC</td>
</tr>
<tr>
<td>• “short-circuit” airflow does not exceed 10% of exhaust rate</td>
<td>Required, no changes</td>
</tr>
<tr>
<td>• Limits conditioned make-up air</td>
<td></td>
</tr>
<tr>
<td>• Total kitchen exhaust &gt; 5000 CFM must meet one of the following:</td>
<td></td>
</tr>
<tr>
<td>– 50%+ of replacement air is make-up air</td>
<td></td>
</tr>
<tr>
<td>– 75%+ of exhaust air is controlled by DVS</td>
<td></td>
</tr>
<tr>
<td>– 50%+ total exhaust airflow has ERV</td>
<td></td>
</tr>
</tbody>
</table>

## HVAC – Fan System Efficiency

### NYCECC – C403.2.12.3

**M:** SAME as ASHRAE

Fans > 5hp & not in packaged units

Fan Efficiency Grade (FEG) ≥ 67

### ASHRAE – 6.5.3.1.3

**P:** SAME as NYCECC

---

*“HVAC Ventilation Exhaust” by PictorialEvidence - Own work. Licensed under CC BY-SA 3.0 via Commons - https://commons.wikimedia.org/wiki/File:HVAC_Ventilation_Exhaust.jpg#/media/File:HVAC_Ventilation_Exhaust.jpg*
## HVAC – Refrigeration Equipment

### NYCECC – C403.2.14

**M:** Similar to ASHRAE
- Minimum efficiency requirements
- Walk-in coolers/freezers
  - Automatic Doors
  - Insulation (R-25/R-32)
  - ECM Motors
  - Anti-sweat heater controls
  - Lighting + controls
- Refrigerated display cases
  - Lighting controls (occ/timer)
  - Defrost termination
  - Anti-sweat heaters

### ASHRAE – 6.4.5, 6.4.6

**M:** Similar to IECC

Courtesy of REMIS America, LLC.

HVAC – Economizers

Requirements (NYCECC C403.3 & ASHRAE 6.5.1)

P: Economizer requirements, regardless of compliance path
• Air-side or water-side required on each cooling system
• Exceptions where economizers are not required:
  – Processes where >25% of the air must be humidified >35F dp
  – Systems expected to operate < 20hrs/wk
  – Systems serving zones with open refrigerated casework
  – Systems with condenser heat recovery

Source: www.energystar.gov
## HVAC – Common Economizer Exceptions

<table>
<thead>
<tr>
<th>NYCECC – C403.3</th>
<th>ASHRAE – 6.5.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P:</strong></td>
<td><strong>P:</strong></td>
</tr>
<tr>
<td>Maximum allowable units without economizers is 20% of total supply cooling capacity of building or 300,000 BTU/h for the following exceptions:</td>
<td>Fan cooling units &lt; 54,000 BTU/h for comfort cooling</td>
</tr>
<tr>
<td>• DX units ≤ 54,000 BTU/h</td>
<td>• Systems &lt; 270,000 BTU/h serving residential spaces</td>
</tr>
<tr>
<td>• Chilled water units &lt; 54,000 BTU/h where total chilled water system capacity &lt; 60 tons (water-cooled) or &lt; 78 tons (air-cooled)</td>
<td>• High efficiency units 42% more efficient than code minimum</td>
</tr>
</tbody>
</table>
## HVAC – Economizer High-Limit Shut-off

### NYCECC – C403.3.3.3

**M:** Same as ASHRAE

**Allowed:**
- Fixed dry-bulb, $T_{OA} > 65^\circ F$
- Fixed enthalpy w/ fixed dry-bulb
- Differential enthalpy w/ fixed dry-bulb

**Not allowed:**
- Differential dry-bulb
- Electronic enthalpy
- Dew point & dry-bulb temps

### ASHRAE – 6.5.1.1.3

**P:** Same as NYCECC

### Map

Source: Trane, Engineers Newsletter, Vol 44-2 “Airside economizers and ASHRAE Standard 90.1-2013”
HVAC – Economizer Controls

**NYCECC – C403.2.4.7**

**M:** Fault Detection & Diagnostics (FDD)
- Temperature sensors (OA, RA, SA)
- Sensor Accuracy
  - Temperature: +/- 2% from 40-80F
  - Pressure (refrigerant): 3%
- System operating status
- Independent operating controls
  - Compressors, economizer, fans, htg sys
- Fault reporting
  - bldg operator or zone t-stat
- Capability to detect
  - Air temp sensor failure
  - Economizing or not when should or not
  - Damper not modulating
  - Excess OA

**ASHRAE – 6.5.1.1.6**

**P:** No FDD
- Sensor Accuracy – same as ECC

Source: Dept. of Energy, BECU, PNNL-SA-120201

---

**Source:**
- Fig. 17, C7650A Solid State Temperature Sensor output current vs. temperature.
- High Limit Set per table C403.3.1.1.3(2) for climate zone
- https://buildingcontrols.honeywell.com/products/jade-Economizer
**NYCECC – C403.3.1**

**P:** DX units with air-side economizers

> 75,000 BTU/h shall have at least 2-stage cooling capability

DX units with modulating airflow, shall meet t

---

**TABLE C403.3.1**

<table>
<thead>
<tr>
<th>RATING CAPACITY</th>
<th>MINIMUM NUMBER OF MECHANICAL COOLING STAGES</th>
<th>MINIMUM COMPRESSOR DISPLACEMENT (^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 65,000 Btu/h and &lt; 240,000 Btu/h</td>
<td>3 stages</td>
<td>≤ 35% of full load</td>
</tr>
<tr>
<td>≥ 240,000 Btu/h</td>
<td>4 stages</td>
<td>≤ 25% full load</td>
</tr>
</tbody>
</table>

---

For SI: 1 British thermal unit per hour = 0.2931 W.

a. For mechanical cooling stage control that does not use variable compressor displacement, the percent displacement shall be equivalent to the mechanical cooling capacity reduction evaluated at the full load rating conditions for the compressor.
**HVAC – Fan Control**

<table>
<thead>
<tr>
<th><strong>NYCECC – C403.4.1</strong></th>
<th><strong>ASHRAE – 6.5.3.2.1</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P:</strong> Aligns with ASHRAE</td>
<td><strong>P:</strong> Same as NYCECC</td>
</tr>
</tbody>
</table>

Fans in hydronic and multiple zone systems must be variable flow
- DX 65 MBH or more: 2-speed
- CHW > ¼ hp: Variable speed
- Fans 1/12 – 1hp: ECM or 70% eff.

Source: [Department of Energy, Building Energy Codes Program](https://en.wikipedia.org/wiki/Variable-frequency_drive)
HVAC – Boiler Turndown

NYCECC – C403.4.2.5

P: Aligns with ASHRAE

Turndown requirements for boilers required for
≥ 1,000,000 BTU/h

Requirement shall be met through:
• Multiple single-input boilers
• 1 or more modulating boilers
• Or combination or single input & modulating

ASHRAE – 6.5.4.1

P: Same as NYCECC

<table>
<thead>
<tr>
<th>BOILER SYSTEM DESIGN INPUT (Btu/h)</th>
<th>MINIMUM TURNDOWN RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 1,000,000 and less than or equal to 5,000,000</td>
<td>3 to 1</td>
</tr>
<tr>
<td>&gt; 5,000,000 and less than or equal to 10,000,000</td>
<td>4 to 1</td>
</tr>
<tr>
<td>&gt; 10,000,000</td>
<td>5 to 1</td>
</tr>
</tbody>
</table>

For SI: 1 British thermal unit per hour = 0.2931 W.
## HVAC – Door Switches

<table>
<thead>
<tr>
<th>NYCECC</th>
<th>ASHRAE – 6.5.10</th>
</tr>
</thead>
</table>
| **P:** No requirement | **P:** Doors separating conditioned space from the outdoors provided with controls that within 5 minutes of the door opening:  
  - Disable heating or reset set point to <55F  
  - Disable cooling or reset set point to >90F  

**Exceptions:**  
- Alterations to existing buildings  
- Loading docks  
- Entries with auto. closing devices  
- Spaces without t-stats  

*Source: Google Earth, 8/24/16*
HVAC – Guest Room Controls

• Mandatory - Hotels with $\geq 50$ guestrooms
• Captive key card system, OR
• Automatic HVAC setback controls
  – +/- 4F when unoccupied
  – 80F/60F when unrented

Wikipedia Commons, photo by Loftcwyouth
Alt. Compliance Path – Computer Rm Systems

NYCECC

P: No requirement

Source: www.energy.gov

ASHRAE – 6.6

P: Alternate HVAC compliance path for data centers using power usage effectiveness (PUE)

Compliance following
- Mandatory provisions (Section 6.4)
- $\text{PUE}_1$ or $\text{PUE}_0 \leq 1.36$
- Breakdown of energy kW or kWh by IT equip, power distribution losses external to IT equip, HVAC systems, and lighting

Source: www.energy.gov
## Service Water Heating – High efficiency

**NYCECC – C404.2.1**

**P:** Aligns with ASHRAE

Domestic water heating systems installed in new buildings with total input \( \geq 1 \text{ MMBH} \) shall be \( >90\% \text{ Et} \)

**Exception:**
- Water heaters in dwelling units and those \( < 100 \text{ kBTU/h} \) are not counted toward capacity
- Water heating systems \( >25\% \) of annual requirements comes from site recovered or site solar energy

**ASHRAE – 7.5.3**

**P:** Same as IECC

90%+
Service Water Heating – Efficient Piping

**IECC – C404.5**

M: Limits flowrate in piping:

\[
\frac{3}{16}'' \leq 1\text{gpm}, \quad \frac{3}{8}'' \leq 1.5\text{gpm}
\]

Option between maximum allowable piping length or volume in piping from heating source or riser.

**ASHRAE**

No requirement

<table>
<thead>
<tr>
<th>NOMINAL PIPE SIZE (inches)</th>
<th>VOLUME (liquid ounces per foot length)</th>
<th>MAXIMUM PIPING LENGTH (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Public lavatory faucets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other fixtures and appliances</td>
</tr>
<tr>
<td>1/4</td>
<td>0.33</td>
<td>6</td>
</tr>
<tr>
<td>5/16</td>
<td>0.5</td>
<td>4</td>
</tr>
<tr>
<td>3/8</td>
<td>0.75</td>
<td>3</td>
</tr>
<tr>
<td>1/2</td>
<td>1.5</td>
<td>2</td>
</tr>
</tbody>
</table>

**TABLE C404.5.1**

PIPING VOLUME AND MAXIMUM PIPING LENGTHS
Lighting- Overview

- **Major change**- Both 2016 NYCECC and ASHRAE have reduced lighting power densities in both the Building Area Method and the Space by Space method.
- **Major change**- ASHRAE has added requirements for secondary sidelighting areas.
- **Major change**- NYCECC has clarified that controls are within the scope of lighting alterations, and commissioning is required for lighting alterations.
# Lighting – Interior LPDs

<table>
<thead>
<tr>
<th>NYCECC – C405.4.2</th>
<th>ASHRAE – 9.5, 9.6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P:</strong> Reduced in most spaces. Same as ASHRAE</td>
<td><strong>P:</strong> Reduced in most spaces. Same as NYCECC</td>
</tr>
<tr>
<td>New Table format easily provides LPD and controls requirements</td>
<td></td>
</tr>
</tbody>
</table>

NYC has further reduced LPD in enclosed offices, open offices, and sales areas/retail spaces in both the ECC and ASHRAE, by about 10%.

- **Enclosed office** - 1.0
- **Open plan offices** - 0.9
- **Sales area** - 1.30
# Lighting – Scope (Alterations)

<table>
<thead>
<tr>
<th><strong>NYCECC – C503.1</strong></th>
<th><strong>ASHRAE – 9.1</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing building alterations trigger full code compliance when replacing &gt;20%** of luminaires in a space</td>
<td>Existing building alterations trigger LPD and controls requirements when replacing &gt;20% connected lighting load</td>
</tr>
</tbody>
</table>

**previously 50%**

**NYC does NOT have an exception** for lighting within dwelling units!!!

- 75% of fixtures shall be fitted for and contain only high-efficacy lamps.
Lighting – Daylighting Control

**NYCECC – C405.2.3.1**

**M:** Auto dimming controls
(no more manual option!)

New daylight zone definition
• NOT aligned with ASHRAE

Exceptions for spaces with < 150W

**ASHRAE – 9.4.1.1(e)**

**M:** Now mandatory!
Requires control of primary and secondary sidelighting

New daylight zone definition
• NOT aligned with IECC

Exceptions for spaces with <150W in primary or
< 300 W in primary & secondary.
(Previously < 250 SF)

Source:
## Escalators & Moving Walks

<table>
<thead>
<tr>
<th><strong>NYCECC – C405.9.2</strong></th>
<th><strong>ASHRAE 10.4.4</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M:</strong> Automatic controls to reduce speed to a minimum permitted speed (ASME A17.1/CSA B44) when not carrying occupants.</td>
<td><strong>M:</strong> Same as NYCECC</td>
</tr>
<tr>
<td>VFD regenerative drive on one-way down escalators</td>
<td>Source: NYC Dept. of Buildings, “Elevators and Escalators: Staying Safe”</td>
</tr>
</tbody>
</table>
Power – Voltage Drop

<table>
<thead>
<tr>
<th>NYCECC</th>
<th>ASHRAE 8.4.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Requirements</td>
<td>M: MAX voltage drop limited to:</td>
</tr>
<tr>
<td></td>
<td>• 5% total for feeder conductors and branch circuit conductors combined</td>
</tr>
</tbody>
</table>
## Power – Automatic Receptacle Control

<table>
<thead>
<tr>
<th>NYCECC</th>
<th>ASHRAE 8.4.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Requirements</td>
<td>M:</td>
</tr>
<tr>
<td></td>
<td>• 50% of receptacles in private offices, conference rooms, copy rooms, break rooms, classrooms and individual workstations are controlled by automatic control device</td>
</tr>
<tr>
<td></td>
<td>• Permanently marked to visually differentiate</td>
</tr>
<tr>
<td></td>
<td>• Uniformly distributed throughout space</td>
</tr>
</tbody>
</table>
Electrical Energy Monitoring

**NYCECC**
No requirement

**Electric Energy Usage**
- Int. Ltg
- HVAC
- Ext. Ltg
- Other
- Receptacle

**ASHRAE 10.4.5**

**M**: New Buildings > 25,000 SF
Measurement devices shall be installed to monitor electrical use of the following:
- Total electrical
- HVAC systems
- Interior Lighting
- Exterior Lighting
- Receptacle Circuits

Exceptions: tenant spaces < 10,000 SF, R-2 < 10,000 SF common area, dwelling units
Data collection every 15-min
Hourly reporting made available to tenants for min. 36 months of data
## NYCECC – C406

**M:** Added 3 additional options, edited 3 existing options  
- Efficient HVAC – 10% more than min  
- Reduced LPD – 10% less than min.  
- Enhanced digital lighting controls  
- On-site renewable (no change)  
- Dedicated OA system w/ ERV  
- Reduced DHW – 60% from heat recovery or solar

## ASHRAE

No Requirements
## HVAC – Commissioning

### NYCECC – C408

**M:**
- Same as NYCECC 2014, except establishes a 25kW threshold for on-site renewable energy systems required to commission
  - Clarifies that DHW is included in the heating capacity
  - Approved Agency shall provide evidence of lighting functional testing

### ASHRAE 6.7.2.4

**M:**
- Same as NYCECC
Energy Modeling – ASHRAE 90.1 Section 11

• Limited on-site renewable energy set to 5% of the design energy cost
• WWR – East/West facades meet prescriptive compliance or average rotations
• Added Fan power removal calculations
• More stringent fan controls in baseline
• Lighting controls language expanded
  – Added language regarding modeling controls and daylighting controls directly as controls or through schedule adjustments
  – Additional lighting controls may be modeled as reduced LPD, directly as controls, or schedule adjustment
  – Additional lighting power for non-mandatory controls allowed under 9.6.3 shall not be included in budget building design
Energy Modeling – Appendix G

• Performance Rating Method – Appendix G, adopted addendum bm
  – Permanent baseline established at ASHRAE 90.1-2004 version
  – Sets approximately 45% improvement target
  – Performance path no longer lags behind prescriptive changes
  – Multiple baselines no longer required for code/beyond code

• Major Changes
  – No longer % improvement over baseline

Sets Performance Cost Index (PCI) target for baseline

\[ PCI_t = \frac{Unregulated (\$) + [BPF \times Regulated (\$)]}{Total Baseline (\$)} \]

Compliance indicated by PCI ≥ PCI_t

\[ PCI = \frac{Total Proposed (\$)}{Total Baseline (\$)} \]

<table>
<thead>
<tr>
<th>Building Area Type</th>
<th>Building Performance Factor (CZ 4A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multifamily</td>
<td>0.78</td>
</tr>
<tr>
<td>Healthcare/hospital</td>
<td>0.57</td>
</tr>
<tr>
<td>Hotel/motel</td>
<td>0.62</td>
</tr>
<tr>
<td>Office</td>
<td>0.58</td>
</tr>
<tr>
<td>Restaurant</td>
<td>0.58</td>
</tr>
<tr>
<td>Retail</td>
<td>0.55</td>
</tr>
<tr>
<td>School</td>
<td>0.49</td>
</tr>
<tr>
<td>Warehouse</td>
<td>0.58</td>
</tr>
<tr>
<td>All others</td>
<td>0.58</td>
</tr>
</tbody>
</table>
EXISTING BUILDINGS- Overview

- The requirements covering existing buildings have been moved from Chapter 1 to a new Chapter C5. This chapter clarifies many requirements but does not increase the stringency.
  - Altered portions of the building must comply with sections C502 (Additions), C503 (Alterations), and C504 (Repairs).
  - Additions must either comply prescriptively or can comply through the performance path, with both the existing building and addition modeled as a whole building.
  - One exception has been added clarifying that extension of ductwork from an existing system will not require testing if the ducts are less than 40’ in length.

EXISTING BUILDINGS- Overview

• Changes to the requirements for Historic Buildings, C501.6, may not be enforceable in NYC, if it is not modified in the NY State Energy Law.
• A separate section, C504, has been introduced to cover repairs, which clarifies that repairs are not subject to the code under certain conditions.
• A separate section, C505, now covers change of occupancy or use. Similar to the conversion to conditioned space from unconditioned space, if not meeting the code fully, a home is allowed to comply if the modeling shows no more than 10% usage above the allowable.
Resources

• DOB’s Energy code page
  – DOB’s How to Guide on Compliance with NYCECC
    • [http://www1.nyc.gov/assets/buildings/pdf/h2g_all.pdf](http://www1.nyc.gov/assets/buildings/pdf/h2g_all.pdf)

• IECC Code Commentary

• ASHRAE 90.1-2013 User’s Manual

• ASHRAE Interpretations

• Errata – edits to publication issues
# How to Demonstrate Energy Code Compliance

**Quick Reference Guide for 2016 NYCECC**

<table>
<thead>
<tr>
<th>FORMS (to be submitted)</th>
<th>Required</th>
<th>Sections (required to be filled)</th>
<th>Notes/Reference Code Sections</th>
</tr>
</thead>
</table>
| PW1                     | All job applications submitted to DOB | • 7: to indicate whether Energy Analysis is included in the plans  
• 9G: to indicate whether Lighting is included in the work scope  
• 10: to indicate Compliance, and accordingly, to choose Code Compliance Path and Energy Analysis options; or to claim Exemption, and accordingly, to indicate the reason for exemption | Appendix forms as applicable: PW1A, PW1B, and PW1D |
| TR1                     | All job applications submitted to DOB | • 4 - Progress Inspection Categories:  
• to indicate whether Energy Code Compliance Inspections (TR8) are required | Subsequent form as applicable: TR8 |
| TR8                     | Jobs applications with TR1 indicating Energy Code Compliance Inspections are required | • All Sections | 1. RCNY §5000-01(h) |
| PC1                     | For Professionally-Certified job applications for which Commissioning is required | • Forms Required Prior To C/O or Signoff  
• to indicate whether Preliminary Commissioning Report Certification is required | C40R/ ASHRAE 90.1-6.7.2.4 |
| EN1                     | Job applications for Commercial Buildings with Energy Modeling chosen for Energy Analysis option | • All Sections as applicable per the proposed scope of work | - ASHRAE 90.1 – Section 11, Appendix G  
- Print entire Excel workbook to PDF at Excel, and paste each page onto Energy Analysis Drawings (on EN-labeled sheets). |

## DRAWINGS (to include the below, and be submitted)

<table>
<thead>
<tr>
<th>Professional Statement</th>
<th>Required</th>
<th>Recommended Location (within Drawings)</th>
<th>Requirements/Notes</th>
<th>Reference Code Sections</th>
</tr>
</thead>
</table>
| PW1 - Section 10       | On EN-labeled sheet | * Must specify the Version of Code the job is complying with (e.g., '2016 NYCECC') | Commercial Building - Energy Analysis options  
• Tabular Analysis  
• REScheck*  
• Energy Rating Index*  
* must be supplemented with Supporting Documentation Index | 1. RCNY §5000-01(e) |

## Supporting Documentation

| On Non-EN-labeled sheet | Construction drawings covering all Work Types indicated on PW1 - Section 6  
• Must include construction data for the below, as corresponding to the proposed scope of work  
a. Building Envelope  
b. Building Mechanical Systems (HVAC)  
c. Service Water Heating  
d. Electrical Power and Lighting Systems  
e. Additional Efficiency Package option  
f. Existing Buildings  
• Data on Construction Drawings must match or exceed the values and specifications reported on Energy Analysis | | 1. RCNY §5000-01(g) | a. R402/ C402/ ASHRAE 90.1-Section 5  
b. R403/ C403/ ASHRAE 90.1-Section 6  
c. R403/ C404/ ASHRAE 90.1-Section 7  
d. R404/ C405/ ASHRAE 90.1-Section 8, Section 9  
e. C406  
f. R5/ C5/ ASHRAE 90.1-Section 4 through Section 10 |

## List of Required Progress Inspections

| On EN-labeled sheet | Commissioning Statement |  
• Identifying whether System Commissioning is either Required or Not Required  
• Generally Required for Buildings of:  
• Total Installed Heating capacity ≥ 600 Kbtu/h, or  
• Total Installed Cooling capacity ≥ 480 Kbtu/h, or  
• Total Installed Site-Generated Renewable Energy ≥ 25kw | | 1. RCNY §5000-01(h) |

## Air Barrier Testing Statement

| On EN-labeled sheet | Air Barrier Testing Statement  
• For New, Residential Building applications, that Air Barrier Testing (Whole Building) is Required  
• For New, Commercial Building applications, whether Air Barrier Testing is Required  
• New, Commercial Buildings ≥ 25,000 sf and <50,000 sf: Whole Building Testing is Required  
• New, Commercial Buildings ≥ 50,000 sf: Selected Area Testing per Air Barrier Continuity Plan is Required  
• When Air Barrier Testing is required: Schedule of Tests and Air Barrier Continuity test guidelines are to be submitted | | 1. RCNY §5000-01(g)(iv) |
**Minimum Equipment Efficiency/Performance**

- **Complete Equipment Specifications**
  For all proposed HVAC and Service Water Heating (SWH) equipment, the equipment schedule on construction drawings must clearly list the equipment efficiency or performance rating along with the type, size, capacity, and fuel type of all equipment, and any additional specifications pertaining to the energy use of the equipment. For all Energy-Code-regulated equipment, their rated efficiency/performance ratings identified in the equipment schedule must meet or exceed the corresponding Code-prescribed value.

- **Values on Construction Drawings First, and then on Energy Analysis**
  Values and descriptions for HVAC and SWH equipment reported on Energy Analysis (on EN-labeled sheets) must be quoted from those in the equipment schedules and specifications on the relevant construction drawings - e.g., M- or P-labeled drawings.

<table>
<thead>
<tr>
<th>VARIABLE REFRIGERANT FLOW - SPLIT TYPE - HEAT PUMP UNITS</th>
<th>OUTDOOR UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAG</td>
<td>LOCATION</td>
</tr>
<tr>
<td>-----</td>
<td>----------</td>
</tr>
<tr>
<td>HPC-1</td>
<td>ROOF</td>
</tr>
<tr>
<td>HPC-2</td>
<td>ROOF</td>
</tr>
<tr>
<td>HPC-3</td>
<td>ROOF</td>
</tr>
<tr>
<td>HPC-4</td>
<td>ROOF</td>
</tr>
<tr>
<td>HPC-5</td>
<td>ROOF</td>
</tr>
<tr>
<td>HPC-6</td>
<td>ROOF</td>
</tr>
<tr>
<td>HPC-7</td>
<td>ROOF</td>
</tr>
<tr>
<td>HPC-8</td>
<td>ROOF</td>
</tr>
<tr>
<td>HPC-9</td>
<td>ROOF</td>
</tr>
</tbody>
</table>

Provide central control for system. System shall control setpoints and operation of all units. Location on controller to be determined.

<table>
<thead>
<tr>
<th>GAS-FIRED, COMMERCIAL, HOT WATER HEATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANUFACTURER AND MODEL NUMBER</td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>HPH-1</td>
</tr>
<tr>
<td>HPH-2</td>
</tr>
</tbody>
</table>

**Figure MS-2.** Sample Mechanical Equipment Schedules & Matching Mechanical COMcheck Report

- Efficiency value of individual equipment should be listed in the same measurement unit prescribed in the corresponding efficiency requirements table in the Code.
Building Energy Policy in New York City

• NYCECC in context- what establishes the Baseline?
• Progress- how has NYC improved?
  – Increased stringency
  – Increased enforcement
• Future- where is the code going?
  – Increased stringency
  – Increased enforcement
• Findings and Challenges

Energy Code in NYC
Sustainability in City-Owned Buildings

• NYC has a LEED requirement for city-owned projects or city-funded projects
  – Recently revised to LEED Gold version 4
  – Also amended the law to move the city toward a low-energy building performance standard, with an energy use target of 50% less than code (Local Law 31 of 2016)
Future of the Energy Code in NYC

**Local Law 32/2018** (EUI targets for buildings 25,000 sq.ft. and greater)

- A local law to amend the New York city Administrative Code, on adoption of a more stringent energy efficiency requirements for buildings and energy use intensity requirements for new and substantially reconstructed buildings
  
  - Adopt a 2019 and 2022 code that is 20% more stringent than ASHRAE 90.1-2013 (Stretch Code)
  
  - 2025- Develop metric and targets for building types
Future of the Energy Code in NYC

Implement the alterations strategies:

– Applying the filters that were successful
  • Creating logic in the new all-electronic application process to further narrow the universe
  • Auditing by applicant
  • Auditing “non-filtered” jobs
– Inspecting highest-risk jobs
– Auditing the third-party inspectors
Thank-you!
Email DOB’s energy team at
energycodes@buildings.nyc.gov
Ehoffman@buildings.nyc.gov

For more on energy codes of the future: