“Decoding the Code”
understanding the workings of Building Code for energy conservation and PlaNYC2030 Goals

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Overview

• What’s the challenge and the objective?

• Estimating the likely impact of NYC’s new 2007 Building Code on the city’s energy use

• How Building Code is structured and how it works regarding energy conservation
PlaNYC2030 carbon/energy challenge

- “30 x 30”
  - really much more aggressive than that
  - 30% from 2005
  - With BAU growth factored in, close to 60% carbon reduction

- Energy efficiency the largest wedge
NYC 2007 Building Code and Energy Conservation

- specific requirements referenced to NYS Energy Conservation Construction Code (NYSECCC)

- NYSECCC based on ICC Energy Conservation Code (residential) and ASHRAE 90.1 (commercial)
  - Prescriptive and Performance paths
  - ASHRAE 90.1: Energy-cost Budget Method, based on computer modeling

- Triennial revision cycle
How much impact from Building Code?

- Depends on how stringent BC (or the inter-related set of codes) becomes
How much impact from Building Code?

- ASHRAE’s actual improvements in 90.1 have lagged behind goals

<table>
<thead>
<tr>
<th>YEAR of 90.1 Release</th>
<th>MBTU/SF</th>
<th>% Reduction from Previous Release</th>
<th>% Reduction from 1999 Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>53.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>51.6</td>
<td>3.8%</td>
<td>3.8%</td>
</tr>
<tr>
<td>2004</td>
<td>47.0</td>
<td>11.1%</td>
<td>11.8%</td>
</tr>
<tr>
<td>2007</td>
<td>44.0</td>
<td>6.6%</td>
<td>17.5%</td>
</tr>
<tr>
<td>2010</td>
<td>36.0</td>
<td>13.2%</td>
<td>32.5%</td>
</tr>
<tr>
<td>2013</td>
<td>30.0</td>
<td>16.7%</td>
<td>43.7%</td>
</tr>
<tr>
<td>2020</td>
<td>18.0</td>
<td>40.0%</td>
<td>66.2%</td>
</tr>
<tr>
<td>2025</td>
<td>10.0</td>
<td>44.5%</td>
<td>81.2%</td>
</tr>
<tr>
<td>2030</td>
<td>Net Zero</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Holness ASHRAE Journal 2008
How much impact from Building Code?

- Building Code comes into play at new construction and alterations.

- How much impact BC has is a function of how much construction activity
  - and how BC is applied to that construction.

- Most construction is alteration work
  - NYSECCC 50% rule.
Important elements of energy use are *not* covered by design and building code

- Plug loads
- Appliances
- Computers and data center equipment
## A spreadsheet exercise

<table>
<thead>
<tr>
<th>Sample SF</th>
<th>Total Square Footage</th>
<th>Annual % Construction</th>
<th>Annual Construction, SF</th>
<th>CBECS Energy Use MBTU/ per SF</th>
<th>Energy Use Reduction (%)</th>
<th>Energy Reduction (MBTU/SF)</th>
<th>Annual Savings, MBTU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commercial</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office</td>
<td>616,000,000</td>
<td>2%</td>
<td>20,632,000</td>
<td>90</td>
<td>25%</td>
<td>22.5</td>
<td>464,220,000</td>
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<tr>
<td>Retail</td>
<td>215,600,000</td>
<td>-</td>
<td>-</td>
<td>92.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>200,000,000</td>
<td>-</td>
<td>-</td>
<td>89.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Institutional</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>K-12 Schools</td>
<td>868,400,000</td>
<td>2%</td>
<td>17,368,000</td>
<td>96</td>
<td>20%</td>
<td>19.2</td>
<td>333,465,600</td>
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<tr>
<td>Hospital s</td>
<td>-</td>
<td>-</td>
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<td>98</td>
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<td>Universities</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>99</td>
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<tr>
<td>Public Assembly</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>96</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Municipal Buildings</td>
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<td>-</td>
<td>-</td>
<td>99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Residential</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Single Family&quot; Homes</td>
<td>3,300,000,000</td>
<td>2%</td>
<td>66,000,000</td>
<td>110</td>
<td>15%</td>
<td>16.5</td>
<td>1,089,000,000</td>
</tr>
<tr>
<td>1,650,000,000</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>1,650,000,000</td>
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<td>Multifamily</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>110</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5,200,000,000</td>
<td>104,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,886,685,600</td>
</tr>
</tbody>
</table>

- Annual savings: $1,886,685,600
- MBTU to BTU: 1,000
- Time period: 2030 - 2008 = 22 years
- Reduction over period: 4.0 × 10^13 BTU

% of 2030 target: 23.3%
Study Findings

• Building Code impacts limited
  – 15-25% of the PlaNYC2030 goal

• Why?
  – Limitations in the BC process
  – Uncertainties in construction activity and code compliance

• Can “yield” from this policy tool be improved?
Using Building Code to do better

• “Learning Curves”
  – LEED - how cities are using it
  – ASHRAE 90.1 and 189 – towards “zero net energy”

• “30% Solution”
  – Energy Efficient Codes Coalition, the Building Codes Assistance Project & the ICC
  – Architecture2030

• An interesting kicker: relationship of requirements to incentives
BC based on design, not actual performance

- A design may not perform as expected

- Even if initial performance meets expectations, no check on persistence over time
BC based on design, not actual performance

• Existing Buildings not covered (except when undergoing alteration)
  – exceptions via specific local laws -- DOB does have power to regulate existing building conditions

• Another kicker: Could a very demanding Building Code actually become a disincentive to undertaking alterations?
Conclusions

• Importance of the triennial revision process

• Improve the design profession’s modeling capacity and accuracy

• Close the 50% loophole

• Report real energy performance on an on-going basis
Thank You

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