Why Doesn't 25 Years of an Evolving Energy Code Make More of a Difference?

Charles Withers, Jr.

BECC Conference 2015

Session 4D: Perspectives on Implementing National - State and Utility Policy

October 20, 2015
Where Did the Savings Go?

- Residential 1985 FL Code era “Old” vs 2010 era “New”
- **Simulation 50% savings vs measured 7%-13% savings**

Simulation (Fairey, 2009) compared as-built min. code efficiency “old” to “new”.
Detailed Energy Audits Completed, Energy Use and T &RH Monitored
"Old Home" vs "New Home"
Envelope Efficiency *(as found 2011)*

<table>
<thead>
<tr>
<th></th>
<th>Averages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New</td>
</tr>
<tr>
<td>Stories</td>
<td>1.1</td>
</tr>
<tr>
<td>Floor Area [ft(^2)]</td>
<td>1,829</td>
</tr>
<tr>
<td>Volume [ft(^3)]</td>
<td>16,137</td>
</tr>
<tr>
<td>Attic Insulation [R]</td>
<td>31</td>
</tr>
<tr>
<td>Single Pane Window [ft(^2)]</td>
<td>29</td>
</tr>
<tr>
<td>Double Pane Area [ft(^2)]</td>
<td>182</td>
</tr>
<tr>
<td>Infiltration (ACH50)</td>
<td>5.6</td>
</tr>
</tbody>
</table>
## “Old Home” vs “New Home”

### Equipment Efficiency (as found 2011)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Averages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New</td>
</tr>
<tr>
<td>A/C Efficiency [SEER]</td>
<td>14.1</td>
</tr>
<tr>
<td>Electric Heat Pump [HSPF]</td>
<td>8.3</td>
</tr>
<tr>
<td>Electric Water Heater Efficiency</td>
<td>0.92</td>
</tr>
<tr>
<td>Gas Water Heater Efficiency</td>
<td>0.66</td>
</tr>
<tr>
<td>Number of Ceiling Fans</td>
<td>3.3</td>
</tr>
<tr>
<td>% Fluorescent Bulbs</td>
<td>26</td>
</tr>
</tbody>
</table>
“Old” vs “New” Indoor Temperature

Is there any behavioral aspect to indoor temperature set-point differences?
What Happens if Adjustments Are Made to the Simulation?

- Simulation inputs were modified to account for average “as-found” qualities in old code and new code homes in study.
- Equipment efficiency
- Interior summer temperatures
- Baseline loads*
  - Old code study homes 13% lower than New.

*energy use other than space heat/cool or DHW energy
What Happens if Adjustments Are Made to the Simulation?

• Simulation adjustments result in only 9.4% savings (instead of 50%).

• Adjustment results are much closer to the annual measured savings of 7%-13%.
Where Did the Savings Go?

Old home behavior related impacts?

- Replaced old appliances with more efficient options
- More conservative heat & cool setpoints
- Added ceiling insulation
- Used less baseline energy
- Some window replacement.
Impact of Non-Compliance in New code Homes

New code compliance 90%.
(minimal impact ~ 1% energy impact in Florida study)
Example: DHW EF 0.90 instead of EF=0.92
Florida 2009 Code Compliance

Ten Highest Categories of Residential Non-Compliance

- Windows: 46.5%
- DHW Systems: 34.9%
- Wall Type: 27.9%
- Glass/floor area: 27.9%
- Ducts: 18.6%
- Cooling: 16.3%
- Heating: 16.3%
- e-ratio: 9.7%
- Correct Form: 9.3%
- Ceiling Type: 9.3%
Some Influences on Implementation of Energy Efficiency/Conservation

- Increased awareness of benefits
- Increased energy cost
- Utility conservation programs and tax incentives
- Federal mandated minimum appliance efficiency standards
- Technological advances in efficiency
Parting Comments

- Energy codes have had significant impacts.
- They have long-term impacts for years, but limited impact in total energy use.
Parting Comments

• Energy codes only address legal minimal levels of efficiency in new construction.
• Homeowners are improving efficiency of older homes, however it occurs over long periods of time.
Thank You

Chuck Withers
chuck@fsec.ucf.edu

Search publications at:
escholarship.org
“Why Doesn't 25 Years of an Evolving Energy Code Make More of a Difference?”
By C. Withers Jr. and R. Vieira 2015.

www.fsec.ucf.edu
“A Comparison of Homes Built to the 2009 and 1984 Florida Energy Codes”.
By C. Withers, et. al 2012. FSEC-CR-1934-12