Commercial Field Study

Start: October 2016

Focus: Office and Retail

Major Milestones:
- Completion of Sampling Plan
- Completion of data collection methodology, protocol and forms.
- Pilot of protocol
- Commence data collection

Current Progress: 50% data collected.

Next Steps: Analyze data, continue data collection and draft education materials
Develop a replicable, cost and time effective methodology for states to evaluate code compliance in commercial buildings.

Construct a data set across target climate zones and states to test and refine the methodology.

Develop training materials based on findings that can be leveraged by future education and outreach activities.
Study Areas: CZ2A

<table>
<thead>
<tr>
<th>Building Type</th>
<th># Required</th>
<th># Complete</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Office</td>
<td>56</td>
<td>18</td>
<td>32%</td>
</tr>
<tr>
<td>Large Office</td>
<td>1</td>
<td>1</td>
<td>100%</td>
</tr>
<tr>
<td>Small Retail</td>
<td>40</td>
<td>22</td>
<td>55%</td>
</tr>
<tr>
<td>Large Retail</td>
<td>14</td>
<td>1</td>
<td>7%</td>
</tr>
</tbody>
</table>
Study Areas: **CZ5A**

### Sampling Plan

<table>
<thead>
<tr>
<th>Building Type</th>
<th># Required</th>
<th># Complete</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Office</td>
<td>44</td>
<td>40</td>
<td>91%</td>
</tr>
<tr>
<td>Large Office</td>
<td>10</td>
<td>5</td>
<td>50%</td>
</tr>
<tr>
<td>Small Retail</td>
<td>46</td>
<td>21</td>
<td>45%</td>
</tr>
<tr>
<td>Large Retail</td>
<td>8</td>
<td>3</td>
<td>37%</td>
</tr>
</tbody>
</table>
Data Collection Start: July 2018

Continuing Work:
• Work to fulfill sample
• Refine data collection protocol document with lessons learned

Major Hurdles Identified:
• Data Entry time after site visit
• Gaps in protocol based on primary build to 2012 IECC
• Gaps in protocol based on primary build to prescriptive compliance
• Lack of specificity in protocol
Time/Task Breakdown

### Time Breakdown

<table>
<thead>
<tr>
<th>Task</th>
<th>2A</th>
<th>5A</th>
<th>Total</th>
<th>/Bldg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recruitment</td>
<td>1.1</td>
<td>3.9</td>
<td>285</td>
<td>2.9</td>
</tr>
<tr>
<td>Review/Data Entry</td>
<td>22.9</td>
<td>44.7</td>
<td>1955</td>
<td>36.2</td>
</tr>
<tr>
<td>Site Visit</td>
<td>3.1</td>
<td>5.1</td>
<td>422</td>
<td>4.4</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>3</td>
<td>289</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>30.1</td>
<td>56.7</td>
<td>2952</td>
<td>46.6</td>
</tr>
</tbody>
</table>

- Recruitment
- Review/Data Entry
- Site Visit
- Other
A Glimpse at PV Savings

SQFT: 278,232
PV Lost: 1,271,144
PV/1,000 sqft: 4,568
End: March 2020

Major Milestones:
• Complete 100% data collection
• Draft and pilot education materials
• Revise protocol based on lessons learned
• Analyze data

Questions We’re Asking:
• Is there a “top ten”?
• Are there regional variations?
• Are there code variations (IECC/90.1)?
• Does energy modeling have a disproportionate impact?
• What else is in the data?
Residential Field Study

Start: Anticipated June 1, 2019

Baseline Assessment:
• Define Sample
• Collect Data
• Analysis with PNNL

Education + Training:
• Review and Adapt available content
• Develop Approach + Curriculum
• Implement Training
• Assess and Adjust (mid-stream where necessary)

First Step: Kick off Meetings in AZ + UT
Goals of the Field Study

Collect field data to generate baseline compliance rate across two states (Arizona and Utah)

Develop targeted education programs to address key measures that will result in the largest savings

Pilot jurisdictional administrative enforcement mechanisms that may increase compliance without education
Study Areas: Arizona and Utah

<table>
<thead>
<tr>
<th>Stage</th>
<th># Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation</td>
<td>63</td>
</tr>
<tr>
<td>Final</td>
<td>63</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
</tr>
<tr>
<td>Full Homes</td>
<td>63</td>
</tr>
</tbody>
</table>
Identified **Key Measures**

1. Envelope tightness (ACH50)
2. Window SHGC
3. Window U-factor
4. Exterior wall insulation
5. Ceiling insulation
6. High-efficiency lighting
7. Foundation insulation
8. Duct leakage

**QUESTION:**
Are there other measures we want to add for Arizona and/or Utah?
Are there construction practices that are different in the west/southwest that we didn’t see in the first set of studies that are important/prevalent enough to drive focus on?

STANDARD:
Wood frame cavity insulation construction.
HVAC Sizing

Do we have enough information on dry and hot climates enforcement and right sizing of equipment? All previous states were moist climates (A)

STANDARD:
Manual J Calculation
Impact of **Home Rule**

What happens when adoption is variable? Does a rising tide lift all boats?

**STANDARD:**
Single State Wide Code Adoption; Variable enforcement