R1616/R1708 Residential Lighting Impact Saturation Study

Study Kickoff for Connecticut Energy Efficiency Board, Eversource, United Illuminating, and Stakeholders

NMR Research Team: David Barclay, Nicole Rosenberg, Kiersten von Trapp, Jared Powell

March 21 2018

Res Lighting Kickoff Agenda

- Background
- PSD and planning implications
- Methodology
- Task approaches
- Timing

Background – Project Tasks

1. Kickoff Meeting
2. Sampling design and recruitment plan
3. Data collection plan
4. Data collection implementation
5. Analysis
6. Reporting

Background – Cross-Study Collaboration
### Single Family (R1708)

- **Lead:** NMR
- **Sites:** 90
- **Lighting**
  - R1708 protocols
  - R1708 QA/QC
- **RASS**
  - R1706 (RASS) verification
- **Weatherization**
  - None
- **Timing**
  - Coordinated with R1705

### Multifamily (R1705)

- **Lead:** ERS
- **Sites:** 145
- **Lighting**
  - R1708 protocols
  - R1708 QA/QC
- **RASS**
  - R1706 (RASS) verification
- **Weatherization**
  - R1705 protocols
- **Timing**
  - Coordinated with R1708

### Background – Key Questions - Lighting

- Why study the residential lighting market?
  - Understand program impacts
  - Assessing progression in the marketplace
  - Help inform future of residential lighting programs (planning)
- What is a Residential On-site Lighting Study?
  - Trained technicians visit homes and quantify bulbs installed and stored
- Why perform a Residential On-site Lighting Study?
  - Informs planning and PSD
  - Higher data quality than customer self-report
- Why visit panel sites?
  - Understand sales patterns in panel homes over time
  - Assess replacement rates from storage and isolate newly obtained bulbs

### Background – Key Questions - RASS

- What is a RASS verification visit?
  - Verifies self-reported data for nuanced, complex, and key measures
  - Results in or allows for “true-up” factors for RASS analysis and database
- Why perform RASS on-site verification?
  - Validates and expands on RASS
  - Respondent recall/knowledge is limited for important end-use measures
- Why integrate with lighting on-site visits?
  - Lighting inventory cannot be reliably self-reported – requiring on-sites
  - Leverages existing/planned efforts
  - Lighting on-sites require survey for recruitment

### Background Project Goals

- Develop estimates of delta watts and ISR for PSD
- Assess changes in saturation
- Understand sales patterns in panel homes (replacement from storage and newly obtained)
  - Only 81 possible panelists (63 SF and 18 MF) from 2015
  - May reach 30-50 homes
- Inform strategy for the future of the residential lighting market
- Update HOU estimate based on changes in saturation
PSD and Planning Implications - Lighting

<table>
<thead>
<tr>
<th>Current PSD/CL&amp;M Plan</th>
<th>How could the on-site study test this?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours-of-use (Retail)</td>
<td>How has the location of newly installed LEDs impacted the household-level HOU for Connecticut? Northeast Residential HOU Study designed to allow for updates based on changes in saturation over time. Update based on observed changes between 2015 and 2018.</td>
</tr>
<tr>
<td>Delta Watt</td>
<td>What is the rated wattage of alternative lamps available in the marketplace? The MAM will allow for the calculation of baseline wattage. Program records provide rated wattage of supported lamps.</td>
</tr>
</tbody>
</table>

Qualitative NTG Check

<table>
<thead>
<tr>
<th>Current PSD/CL&amp;M Plan</th>
<th>How could the on-site study test this?</th>
</tr>
</thead>
<tbody>
<tr>
<td>NTG</td>
<td>How do the prospective NTG values align with on-site saturation derived values? Qualitative check but won’t necessarily be used to update the PSD. May be used to help inform direction moving forward. Using changes in saturation in both Connecticut and a comparison area (Upstate New York), the study will examine possible NTG values to help provide context and support for the values already derived as part of R1615.</td>
</tr>
</tbody>
</table>

PSD and Planning Implications - Lighting

<table>
<thead>
<tr>
<th>Current PSD/CL&amp;M Plan</th>
<th>How could the on-site study test this?</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-service Rate (Retail)</td>
<td>What proportion of LEDs are installed within first year? Within lifetime? On-site results will allow for calculation of first-year ISR. We will extrapolate to lifetime savings based on available data.</td>
</tr>
</tbody>
</table>

On-site Methodology

- Sample recruited through RASS random customer pull
- Visit 145 Multifamily and 90 Single-Family households
  - Multifamily = 5+ (conducted by ERS)
  - Single family =1-4 units (conducted by NMR)
- On-site data collection will use a tailored data-collection form (DCF)
  - Collaboration between NMR and ERS
  - Single family will include two trained technicians at each site for lighting and RASS verification
- Instrument aligned with studies in Massachusetts and Rhode Island
- In field for 5-8 weeks
Preliminary Sample Design – Single Family

<table>
<thead>
<tr>
<th>Dwelling type</th>
<th>Tenure</th>
<th>Total visits</th>
<th>Low-income visits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detached</td>
<td>All</td>
<td>66</td>
<td>22% (n=10)</td>
</tr>
<tr>
<td></td>
<td>Own</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rent</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Attached</td>
<td>All</td>
<td>7</td>
<td>36% (n=3)</td>
</tr>
<tr>
<td></td>
<td>Own</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rent</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2-4 Units</td>
<td>All</td>
<td>17</td>
<td>58% (n=10)</td>
</tr>
<tr>
<td></td>
<td>Own</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rent</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

- Final sample design subject to RASS results
- Income targets based on census if sample allows
- Sample proportionally between Companies

Recruitment Status – As of Mar. 16, 2018

<table>
<thead>
<tr>
<th>R1616/1708 (SF)</th>
<th>R1705 (MF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detached</td>
<td>Attached</td>
</tr>
<tr>
<td>RASS Complete</td>
<td>1,132</td>
</tr>
<tr>
<td>On-site Recruits</td>
<td>602 (53%)</td>
</tr>
<tr>
<td>On-site Target</td>
<td>66</td>
</tr>
</tbody>
</table>

- Note: We increased the multifamily incentive after 153 completes and saw the on-site recruit rate increase from 31% to 44%.
- We have an additional wave of letters planned for late March. This wave will target multifamily (2-4 and 5+).

Lighting Data

- Room type (installed only)
- Fixture type (installed only)
- Bulb type
- Socket type
- Wattage
- Specialty characteristics
- LED Manufacturer and model number
- When purchased LEDs
- Where purchased recently obtained LEDs
- Stored bulb questions
- Count

RASS Verification

- Verify or collect data for select end uses:
  - EV/Solar
  - Shell measures
  - HVAC equipment
  - Building characteristics

Data Collection – RASS Verification Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Fuel</th>
<th>Presence</th>
<th>Count</th>
<th>Age</th>
<th>Use</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Priority</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heating (Primary, secondary, tertiary)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling (Primary, secondary, tertiary)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiation (portable/non)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ducts</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric radiant heat (bath)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water heater</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Temp. settings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Photovoltaic</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>kW size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy storage batteries</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exclude: Hot water recirculator, pipe insulation, water heater blanket, low-flow showerhead, fan coil, air filter, radon mitigation
Data Collection – Building Characteristics

<table>
<thead>
<tr>
<th>Building Characteristics</th>
<th>RASS Verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Priority</td>
<td></td>
</tr>
<tr>
<td>Home type</td>
<td>✓</td>
</tr>
<tr>
<td>Stories</td>
<td>✓</td>
</tr>
<tr>
<td>Low Priority</td>
<td></td>
</tr>
<tr>
<td>Conditioned floor area (MF only)</td>
<td></td>
</tr>
<tr>
<td>Building shell (attic and wall insulation)</td>
<td></td>
</tr>
<tr>
<td>Weatherization (MF only)</td>
<td></td>
</tr>
<tr>
<td>Window panes and frames</td>
<td>✓</td>
</tr>
</tbody>
</table>

Detailed Research Plan

- Executive summary
  - Recommendations, considerations, and guidance
- Introduction and Background
- Methodology
- Lighting Analysis
  - Changes in saturation over time
  - Comparison to other studies
  - ISR update
  - HOU update
  - Penetration
  - Purchase behavior
  - Storage behavior
  - Qualitative NTG assessment
  - Demographics
- Appendices
  - Additional methodology details
  - Additional analysis
- Database Incorporation
  - RASS adjustment factors
  - RASS lighting data
    - Saturation by technology added to RASS database
    - Additional detailed lighting database
- Study Timing (Coordinated with R1705)
Recap and Next Steps

• Study will result in…
  – Recommendations for PSD and planning
  – Baseline characterization
  – RASS true-up values

• Coordination with R1706 and R1705
  – On-site protocols and DCF preparation underway
  – Coordination meetings with R1705 team occurring weekly
  – Awaiting final R1706 MF sample
  – Visit scheduling to commence in late March

Questions?