Content

1. Setting the stage: Increasing attention to and importance of multiple benefits of EE in U.S.

2. Study of multiple benefits of EE in small residential buildings in New York
   - Secondary & Primary Research Conducted
   - Non-Energy Impact (NEI) Categories Studied
   - Monetisation of NEIs
~1/3 of U.S. states include non-energy benefits (NEBs) in EE B/C testing
  – Process for NEBs inclusion under review in many more states

Most states use benefit adder of 10% to 15% to account for NEBs instead of individual NEB quantification

Most common NEBs quantified are water, other fuel savings, reduced O&M costs, job creation

Massachusetts most comprehensive. Many NEBs types monetised, including health, comfort, and safety.

Long-term EE Supply Curves for Illustrative Electric Service Area, 2012 v. 2015

2012-2031 Forecast

2015-2034 Forecast
Many EE programs administrators (PAs) in jurisdictions with mature EE markets are feeling squeezed between high performance targets, more efficient baselines, and restrictive cost-effectiveness tests.

This is forcing PAs and regulators to rethink EE program regulation, design, B/C testing, and evaluation.

- Less Planning & Implementation Flexibility $\rightarrow$ More Planning & Implementation Flexibility
- Deemed Savings $\rightarrow$ Metered Savings
- Average Pricing $\rightarrow$ Marginal Pricing
- Minimal NEBs Accounting $\rightarrow$ Maximum (Reasonable) NEBs Accounting
Study of the non-energy impacts (NEIs) of small residential EE

The major goal of this project is to assist NYSERDA in collecting NEI data to monetise the value of NEIs for use in future decision making and cost-effectiveness testing.

Secondary Research Task. Monetise NEIs for important measures
- 84 published papers on NEIs reviewed
- Tool developed to adjust 303 measure-level NEI values to New York

Primary Research Task. Prioritize measures for primary research; specify research methods for most important measures.
NEI Types Studied

A. Durability and Maintenance
   1. Properly Installed Equipment
   2. HVAC Equipment and Distribution
   3. Water and Humidity Management
   4. Appliances
   5. Lighting
   6. General

B. Health and Comfort
   7. Building Thermal/Pressure Envelope
   8. Air Quality
   9. Lighting
   10. Increased Habitable Space
   11. Reduced Risk of Shutting off Services
   12. Lower Monthly Bills
   13. General

C. Improved Safety (Imminent Dangers)
   14. Ambient Air Carbon Monoxide Levels
   15. Gas Leaks/Fires
   16. Radon
   17. Detectors, Ventilation, Air Sealing
   18. Lighting
   19. General

D. Environmental, Societal, and Government Impacts
   20. Recycling and Proper Disposal
   21. Infill over Greenfield Building
   22. Appliance Recycling
   23. Reduced Mobility
   24. General
Descriptions of Individual NEIs Studied – Durability & Maintenance Category

- **Appliance NEIs**
  - Low Income Window AC Retrofit
  - Non-Energy O&M savings for Estar clothes washer
  - Non-Energy O&M savings for Dishwasher Electric DHW and Gas DHW
  - Increased Value of Property
  - Reduced Drying time
  - Reduced wear and tear of clothes
  - Room AC early retirement; NPV of deferred replacement costs
Descriptions of Individual NEIs Studied – Durability & Maintenance Category, cont.

• HVAC Equipment and Distribution
  – Equipment Maintenance - Residential Cooling and Heating
  – Equipment Maintenance - Residential Heating and Hot Water
  – Existing Home: Provide Quality Installation of new AC in existing home - 3 Ton unit
  – Distribution improvements
  – Home Durability - Residential Cooling and Heating Equipment
  – Home Durability and Equipment Maintenance
  – Increased Value of Property and Ease of Selling Home
  – Increased Value of Property - Residential Cooling and Heating Equipment

• Properly Installed Equipment
  – Non-Energy O&M savings of Quality Installation of new AC in existing home - 3 Ton unit
  – Home built following best practices in installation such that the heating and cooling and structural materials are less prone to failure and may exceed their expected lifetimes.
• **Lighting**
  – Exterior Hardwired Compact Fluorescent Lamp (CFL) Fixture; Lumens ≥ 310 and ≤ 2600 (EISA compliant)
  – Lighting lifetime and maintenance reduction
  – Lighting Quality and Lifetime - Per bulb
  – Lighting Quality and Lifetime - Per Fixture
  – NPV of replacing an incandescent downlight lamp with a Solid State Lighting (LED) Recessed Downlight lamp (i.e. time of sale).
  – NPV of replacing CFL bulb
  – NPV of replacing CFL fixture
  – NPV of replacing LED
  – One time O&M Benefit Indoor and Outdoor hardwired fixture
  – One time O&M benefit per bulb: General Service CFL bulb
  – One time O&M benefit per bulb: LED Directional/Downlight
  – One time O&M benefit per bulb: LED Non-General & General Service bulb
  – One time O&M benefit per bulb: Non-General Service CFL bulb
Descriptions of Individual NEIs Studied – Durability & Maintenance Category, cont.

- **General**
  - Overall Improvements in Durability and Maintenance
  - Property value benefits
  - Increased ease of selling

- **Water and Humidity Management**
  - Reduced healthcare costs associated with asthma
## Secondary Research, Illustrative Results for Highest Prominence Measures in Home EE Retrofit Program

<table>
<thead>
<tr>
<th>Measure Name</th>
<th>NEI (1-Year)</th>
<th>Measure Useful Life</th>
<th>Projected 2014 Measure Count</th>
<th>NYSERDA Program NEI (1-Year)</th>
<th>NYSERDA Program NEI (Lifetime)</th>
<th>Lifetime Prominence Ratio</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation</td>
<td>$14.39</td>
<td>30</td>
<td>11,333</td>
<td>$163,058</td>
<td>$4,891,747</td>
<td>50.2%</td>
<td>5</td>
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<tr>
<td>Boiler</td>
<td>$109.01</td>
<td>25</td>
<td>799</td>
<td>$87,128</td>
<td>$2,178,207</td>
<td>22.4%</td>
<td>5</td>
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<tr>
<td>Furnace</td>
<td>$130.62</td>
<td>20</td>
<td>461</td>
<td>$60,279</td>
<td>$1,205,586</td>
<td>12.4%</td>
<td>5</td>
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<tr>
<td>Air Sealing</td>
<td>$16.99</td>
<td>15</td>
<td>3,302</td>
<td>$56,102</td>
<td>$841,529</td>
<td>8.6%</td>
<td>4</td>
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<tr>
<td>CFLs</td>
<td>$2.62</td>
<td>6</td>
<td>10,561</td>
<td>$27,658</td>
<td>$165,946</td>
<td>1.7%</td>
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<tr>
<td>Hot Water System</td>
<td>$42.56</td>
<td>10</td>
<td>422</td>
<td>$17,961</td>
<td>$179,607</td>
<td>1.8%</td>
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<tr>
<td>Central AC</td>
<td>$21.87</td>
<td>15</td>
<td>323</td>
<td>$7,070</td>
<td>$106,057</td>
<td>1.1%</td>
<td>4</td>
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</tbody>
</table>
NEI Measure Database (Primary Research)

Primary Research Score
(Measure Level)

- Weight
- Prominence
- NYSERDA Data
- Existing Data Quality
- Method Reliability
- Documentation & Literature Review
- Method Cost

Weight
Weight
Weight
Weight
Primary Research Methods Evaluated

1. **Direct Calculation and Analysis.** Examples methods include building simulation and pre/post testing (performance data)

2. **Collected Data Analysis.** Examples include existing government, industry, and historical data

3. **Created Records.** Examples include case studies and reporting

4. **Observations.** Examples include direct observation and participant observation

5. **Interviews.** Examples include structured interviews, open-ended interviews, in-depth interviews, key information interviews, and focus group/panel of experts interviews

6. **Surveys.** Examples include contingent valuation (Willingness To Pay) and conjoint analyses
Primary Research Method Papers for Most Prominent Measures

- Measure description and identified NEIs

- Specification of most cost-effective and reliable primary research methods, including:
  - Approach
  - Benefits
  - Analyses
  - Concerns
  - Cost range (measure total)