RESIDENTIAL CUSTOMER PROFILE 2013 - 2016

Stakeholder summary
THE PROJECT
The annual Residential Customer Profile Study offers diverse views of participation, savings, and geographic dynamics within the Massachusetts Program Administrators’ (PA’s) residential energy efficiency programs.

The overall goals of the Residential Customer Profile Study are:
- To integrate the PAs’ billing and tracking data into the MA Evaluation Database
- To analyze this data to explore evolving trends and their implications in the residential energy efficiency landscape

THE DATA

PA tracking
2013~258k accounts
2014~259k accounts
2015~246k accounts
2016~232k accounts

PA billing
Clean & Standardize
2013~3.8M accounts
2014~4.2M accounts
2015~4.3M accounts
2016~4.2M accounts

Logic model matching

THE ANALYSIS
The cube to the left shows some possible permutations of the analysis. Based on the data collected and the ways that different datasets can talk to one another, these statistics can be calculated using each of these input values at these various analysis grains:

For instance, it’s possible to use consumption (kWh) and gross savings (kWh) to calculate electric population savings achieved by ACS block group.

PA tracking
PA billing
3rd party data sources
Emergency 911 data
Level 3 tax data
American Community Survey data

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PA billing
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Level 3 tax data
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PA tracking
PA billing
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Level 3 tax data
American Community Survey data

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Participation and population savings achieved
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Location-level low-income block group savings rates
Location-level renter-occupied block group savings rates

Coming soon!
2017 Residential Customer Profile Study comprehensive report - summer 2019

*Tracking does not include behavioral or upstream lighting accounts.
The PAs’ upstream lighting initiative continues to successfully secure savings. A constraint of upstream initiatives is that they are not associated with participant-level details. This limits the insights that tracking data can yield about the types of customers who participate through the upstream channel, and how deep their energy savings are.

ACS block group analyses presented on pages 11, 12, 15, and 16 have two important caveats:

- The data only allows us to look at block groups as a whole, not at individual buildings or customers. We cannot extend block group attributes to individual customers.
- Block group analyses provide quantitative metrics. They do not yield insight into the effectiveness of program design, outreach strategies, PA efforts, or other qualitative factors.

From 2013-2016, over 1/3 of the unique PA-served addresses in MA received at least one measure from an opt-in PA energy efficiency program. Because upstream store sales cannot be associated with individual addresses, this 1/3 estimate is likely conservative.

Each year, electric customers saved 2% to 4% of their consumption. Gas customers saved 0.5% to 1.5%.

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2016 gas and electric end uses*

** Note that percentages do not add up to 100%, because “unknown/missing” and “other” measures are excluded from this graphic.

Electric and gas location-level participation, excluding behavioral and upstream, 2012-2016 (Boston in inset map)

Electric and gas location-level participation contribution ratios in 2016

The participation contribution ratio shows how much a block group contributed to the state’s total location-level participation rate relative to how much the same block group contributed to the state’s total population of locations (e.g., 1 means that the participation share is exactly proportional to the location population share). Contribution ratios vary from year to year, and while they provide an excellent binary view of participation, they do not capture more subtle data trends, such as the level of a single-family location’s participation (whether lighting only or a whole house retrofit) or the dynamics of multifamily sub-units.

The map to the left shows the block group participation contribution ratio for any gas and/or electric PA-served location in 2016. The larger break point from 0.76 to 1.25 is intentional to help draw the eye to break points lower and higher than 1.0. Towns to the west of Boston between I-495 and I-95 have block groups with larger contribution ratios, as do isolated areas throughout the state. Contribution ratios to the northeast of Boston around Peabody are generally less than 1; many of these towns have municipal electric providers. Municipal and delivered fuel energy efficiency activities are not captured in this report. Along with the urban cores of Worcester, Springfield, and several other major cities, several towns north of Boston have block group contribution ratios less than 1.

The map to the right shows the kWh savings contribution ratios for 2016 only. Areas in the Boston metro region, as well as in Worcester and northwest of Boston, tend to have higher location-level kWh savings contribution ratios in 2016. Individual block group outliers can be seen state-wide. Savings contribution ratios tend to vary more in core urban areas, likely due in part to the impact of large savings from multifamily housing projects when they participate.

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## Number of billing records per year, 2013-2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Total unique accounts 2013-2016</th>
<th>Total unique accounts 2013</th>
<th>Total unique accounts 2014</th>
<th>Total unique accounts 2015</th>
<th>Total unique accounts 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>180,421</td>
<td>188,981</td>
<td>189,318</td>
<td>191,135</td>
<td>240,312</td>
</tr>
<tr>
<td>2014</td>
<td>1,005,355</td>
<td>1,001,653</td>
<td>1,035,645</td>
<td>1,241,164</td>
<td>1,554,277</td>
</tr>
<tr>
<td>2015</td>
<td>1,089,932</td>
<td>1,352,720</td>
<td>1,155,814</td>
<td>1,163,589</td>
<td>1,753,833</td>
</tr>
<tr>
<td>2016</td>
<td>30,400</td>
<td>30,153</td>
<td>30,583</td>
<td>30,596</td>
<td>46,850</td>
</tr>
<tr>
<td><strong>Berks Gas Co.</strong></td>
<td>33,728</td>
<td>34,394</td>
<td>31,148</td>
<td>34,659</td>
<td>50,594</td>
</tr>
<tr>
<td><strong>Eversource</strong></td>
<td>310,950</td>
<td>322,768</td>
<td>325,615</td>
<td>328,888</td>
<td>466,603</td>
</tr>
<tr>
<td><strong>National Grid</strong></td>
<td>303,986</td>
<td>251,560</td>
<td>287,190</td>
<td>313,359</td>
<td>450,759</td>
</tr>
<tr>
<td><strong>Liberty Utilities</strong></td>
<td>44,646</td>
<td>49,661</td>
<td>50,176</td>
<td>47,637</td>
<td>101,489</td>
</tr>
<tr>
<td><strong>National Grid</strong></td>
<td>762,387</td>
<td>932,320</td>
<td>820,959</td>
<td>833,073</td>
<td>2,181,073</td>
</tr>
<tr>
<td><strong>Unitil Gas</strong></td>
<td>15,721</td>
<td>13,237</td>
<td>17,816</td>
<td>17,868</td>
<td>26,707</td>
</tr>
<tr>
<td><strong>Gas total</strong></td>
<td>1,473,218</td>
<td>1,603,940</td>
<td>1,532,904</td>
<td>1,575,484</td>
<td>2,308,328</td>
</tr>
</tbody>
</table>

## Number of unique locations per year, 2013-2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Total unique locations 2013-2016</th>
<th>Total unique locations 2013</th>
<th>Total unique locations 2014</th>
<th>Total unique locations 2015</th>
<th>Total unique locations 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>12,679</td>
<td>10,168</td>
<td>14,275</td>
<td>754,138</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>138</td>
<td>164,652</td>
<td>164,526</td>
<td>205,445</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>30,634</td>
<td>167,553</td>
<td>149,296</td>
<td>204,552</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>526,914</td>
<td>551,165</td>
<td>559,561</td>
<td>558,938</td>
<td></td>
</tr>
<tr>
<td><strong>Gas total</strong></td>
<td>981,513</td>
<td>995,328</td>
<td>1,006,800</td>
<td>1,013,553</td>
<td>1,127,443</td>
</tr>
</tbody>
</table>

## Number of participating locations per year, and savings per year, 2013-2016

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cape Light Compact</strong></td>
<td>10,166</td>
<td>11,661</td>
<td>13,341</td>
<td>14,851</td>
<td>19,702</td>
<td>22,620</td>
</tr>
<tr>
<td><strong>Eversource</strong></td>
<td>63,681</td>
<td>78,957</td>
<td>75,928</td>
<td>122,569</td>
<td>225,599</td>
<td>215,657</td>
</tr>
<tr>
<td><strong>National Grid</strong></td>
<td>97,652</td>
<td>82,108</td>
<td>70,672</td>
<td>69,610</td>
<td>262,445</td>
<td>241,966</td>
</tr>
<tr>
<td><strong>Unitil Gas</strong></td>
<td>616</td>
<td>807</td>
<td>1,274</td>
<td>1,418</td>
<td>2,771</td>
<td>3,643</td>
</tr>
<tr>
<td><strong>Electric total</strong></td>
<td>172,117</td>
<td>187,807</td>
<td>164,574</td>
<td>158,367</td>
<td>510,557</td>
<td>473,726</td>
</tr>
<tr>
<td><strong>Berkshire Gas Co.</strong></td>
<td>2,073</td>
<td>2,121</td>
<td>1,773</td>
<td>1,529</td>
<td>29,184</td>
<td>26,793</td>
</tr>
<tr>
<td><strong>Columbia</strong></td>
<td>12,679</td>
<td>12,911</td>
<td>13,471</td>
<td>16,995</td>
<td>183,315</td>
<td>205,445</td>
</tr>
<tr>
<td><strong>Liberty Utilities</strong></td>
<td>1,823</td>
<td>1,623</td>
<td>1,536</td>
<td>1,586</td>
<td>31,762</td>
<td>31,252</td>
</tr>
<tr>
<td><strong>National Grid</strong></td>
<td>54,728</td>
<td>49,510</td>
<td>38,438</td>
<td>24,448</td>
<td>625,016</td>
<td>764,338</td>
</tr>
<tr>
<td><strong>Unitil Gas</strong></td>
<td>154</td>
<td>306</td>
<td>341</td>
<td>457</td>
<td>4,557</td>
<td>8,792</td>
</tr>
<tr>
<td><strong>Gas total</strong></td>
<td>89,520</td>
<td>81,397</td>
<td>81,177</td>
<td>73,841</td>
<td>1,109,220</td>
<td>1,268,291</td>
</tr>
</tbody>
</table>

*If an account participated in multiple programs in a year, it is only counted once in this table.
*Participant numbers include behavioral data. Savings numbers include behavioral data.
*Some PAs' multifamily data only captured at the account level. This means that while savings are accurate in this table for these PAs, the participant count is likely underestimated.

It's important to recognize the role of upstream lighting data in these tables. Upstream programs provide incentives higher up on the distribution chain, such as stores that sell customers efficient bulbs, fixtures, etc., at a discount. While those upstream lighting sales result in sizeable savings for the PAs, those sales are only captured at the store level, and the data is not available to tell us which individual customer participated by purchasing the discounted equipment. As a result:

- Participation rates are likely to be conservative, since households in an efficiency program that participate at all in the program don't get counted as participants.
- While upstream lighting participation doesn't get counted, upstream lighting savings do. This means that dividing savings by participants is unlikely to result in an accurate average savings level. (This is not the case for graphics that don't include any upstream data.)

Additionally, customers who participate through multifamily programs can get counted at a master meter level rather than individually. This is another way that participation numbers can look lower than they actually are.
Cross-initiative movement

This figure shows how locations went from one initiative to another within 2016. The left column shows the first initiative locations participated in (lead), and the right column shows what initiative they participated in afterward (lag). Thicker lines between initiatives indicate more locations participating.

**Electric cross-initiative participant movement, 2016**

- **Lead**
  - New Construction
  - Multi-Family
  - Lighting
  - Home Energy Services - Measures
  - Heating & Cooling Equipment
  - Consumer Products

- **Lag**
  - New Construction
  - Multi-Family
  - Lighting
  - Home Energy Services - Measures
  - Heating & Cooling Equipment
  - Consumer Products

The chart below shows the number of locations, the participation rate, and the savings achieved statewide from 2013-2016. While this includes upstream savings, which contribute greatly to portfolio savings, the data is not available to show upstream participants in the participant count. Savings from behavior/feedback programs are not included here.
Electric location-level low-income block group savings rates

Unique billing and tracking electric savings by quintile bins, by proportion of households below 200% of the poverty index (excludes USL and HER participants)

<table>
<thead>
<tr>
<th>Quintile population savings rate (no USL or HER)</th>
<th>Quintile range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Low % households &lt;200% poverty index</td>
<td>Zero to 8.97</td>
</tr>
<tr>
<td>2</td>
<td>8.97 to 16.1</td>
</tr>
<tr>
<td>3</td>
<td>16.1 to 25.3</td>
</tr>
<tr>
<td>4</td>
<td>25.3 to 42.1</td>
</tr>
<tr>
<td>5 - High % households &gt;200% poverty index</td>
<td>42.1 to 100</td>
</tr>
</tbody>
</table>

The above table summarizes the electric savings ratios by block group quintile, based on the number of households below 2x the poverty index (excludes USL and HER participants; Boston in inset map).

Scatterplot of 2016 electric block group savings contribution ratio (excludes USL and HER participants)

This scatterplot illustrates the electric savings contribution ratios in 2016 relative to the proportion of households below 200% of the poverty index in block groups across Massachusetts. It shows:
- Which quintile each block group falls into
- Each block group’s savings contribution ratio for 2016

Location-level savings contribution ratio for block groups in quintile 5 for households below 200% of the poverty index (excludes USL and HER participants; Boston in inset map)

This map shows the savings contribution ratios for block groups falling into the 5th quintile (with ~42% to 100% of its households below 2x the poverty index). The urban area land use filter is not used in this map, this causes larger rural block groups, such as the yellow one in the southwestern part of the state, to stand out much more than they would with the urban area filter on.

Electric location-level renter block group savings rates

Unique billing and tracking locations electric savings by quintile bins, by proportion of renter-occupied households (excludes USL and HER participants)

<table>
<thead>
<tr>
<th>Quintile population savings rate (no USL or HER)</th>
<th>Quintile range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Low renter ratio</td>
<td>Zero to 10.3</td>
</tr>
<tr>
<td>2</td>
<td>10.5 to 24.4</td>
</tr>
<tr>
<td>3</td>
<td>24.4 to 45.0</td>
</tr>
<tr>
<td>4</td>
<td>45.0 to 67.0</td>
</tr>
<tr>
<td>5 - High renter ratio</td>
<td>67.0 to 100</td>
</tr>
</tbody>
</table>

The above table summarizes the electric location savings ratios by block group quintile based on the number of renter-occupied housing units. As previously, this analysis captures PA savings at the block-group level, and the reader should use caution when extending block group results to individual accounts or sub-populations.

Scatterplot of 2016 electric block group savings contribution ratio (excludes USL and HER participants)

This scatterplot illustrates electric savings contribution ratios in 2016 relative to renter ratio for block groups across Massachusetts. Higher block group renter ratios indicate more renter-occupied households.

Location-level contribution ratio for block groups in quintile 5 for renter-occupied households (Boston in inset map)

This map shows the location-level savings contribution ratios for block groups that fall into the 5th quintile (with 67% to 100% of renter-occupied households). The urban area land use filter is not used in this map. With the notable exception of the military base on Cape Cod, block groups in the 5th quintile tend to be concentrated in urban core areas. Boston in particular contains many block groups falling in the quintile with the highest proportion of renter-occupied housing. Visually, there appears to be overlap between this map and the electric poverty index quintile map. It is possible that the Boston area and the surrounding suburbs have a unique geographic sub-population of block groups high in both renters and low-income households that may merit special program design and outreach considerations.
The following charts show time series of gas participation rates and savings rates.

**GAS SUMMARY**

**Gas location participation**

**Gas savings achieved**

**Cross-initiative movement**

This figure shows how locations went from one initiative to another within 2016. The left column shows the first initiative locations participated in (lead), and the right column shows what initiative they participated in afterward (lag). Thicker lines between initiatives indicate more locations participating.

**Gas cross-initiative participant movement, 2016**

- **Lead**
  - New Construction
  - Multifamily Retrofit
  - Home Energy Services - Measures
  - Heating & Cooling Equipment

- **Lag**
  - New Construction
  - Multifamily Retrofit
  - Home Energy Services - Measures
  - Heating & Cooling Equipment

**Number of unique gas locations, participation rate, and savings achieved 2013-2016**

- **Location participation**
  - 2013
  - 2014
  - 2015
  - 2016
  - 2013-2016

- **Savings achieved**
  - 2013
  - 2014
  - 2015
  - 2016
  - 2013-2016
Gas location-level low-income block group savings rates

Unique billing and tracking gas savings by quintile bins, by proportion of households below 200% of the poverty ratio (excludes HER participants)

<table>
<thead>
<tr>
<th>Quintile range</th>
<th>2016 therm consumption</th>
<th>2016 therm savings (no USL or HER)</th>
<th>Quintile population savings rate (no USL or HER)</th>
<th>Quintile range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Low % households &lt;200% poverty index</td>
<td>252,894,641</td>
<td>2,892,665</td>
<td>1.14%</td>
<td>Zero to 8.56</td>
</tr>
<tr>
<td>2</td>
<td>235,061,579</td>
<td>2,531,624</td>
<td>1.08%</td>
<td>8.56 to 15.6</td>
</tr>
<tr>
<td>3</td>
<td>235,198,213</td>
<td>2,503,284</td>
<td>1.06%</td>
<td>15.6 to 24.7</td>
</tr>
<tr>
<td>4</td>
<td>211,648,447</td>
<td>1,759,684</td>
<td>0.83%</td>
<td>24.7 to 41.4</td>
</tr>
<tr>
<td>5 - High % households &lt;200% poverty index</td>
<td>197,812,810</td>
<td>1,625,640</td>
<td>0.62%</td>
<td>41.4 to 100</td>
</tr>
<tr>
<td>No ACS Data</td>
<td>56,724</td>
<td>16</td>
<td>Not Calculated</td>
<td>N/A</td>
</tr>
<tr>
<td>Grand Total</td>
<td>1,132,672,414</td>
<td>202,936,657</td>
<td>1.00%</td>
<td></td>
</tr>
</tbody>
</table>

The above table summarizes the gas savings ratios by block group quintile, based on the number of households below 2x the poverty index. The poverty index is used instead of income ranges because it better captures household composition and relationships (e.g., age, number of occupants, retirees). As in past years, the reader should use caution when applying block group results to a particular account or sub-population. This is especially true for gas block groups, as not all customers in the block group are served (or even have the option of gas service), and there is additional potential for misalignment between the ACS quintile variable and the PA-served population.

Scatterplot of 2016 gas block group savings contribution ratio (excludes HER participants)

This scatterplot illustrates the gas savings contribution ratios in 2016 relative to the proportion of households below 2x the poverty index in block groups across Massachusetts. It shows:

- Which quintile each block group falls into
- Each block group’s savings contribution ratio for 2016
- The scatterplot—which is scaled by therm consumption—illustrates the variability within quintiles, the existence of outlier points, and the similarities between block groups across adjacent quintiles, particularly when the block groups fall near the quintile breakpoints.

Location-level savings contribution ratio for block groups in quintile 5 for households below 200% of the poverty index (excludes HER participants; Boston in inset map)

This map shows the savings contribution ratios for block groups falling into the 5th quintile (with ~41% to 100% of its households below 2x the poverty index). The location dynamic is slightly different than electric; in particular, the contribution ratios for block groups in the Fitchburg and Lawrence areas are higher for gas than for electric, while the savings contribution ratios in Boston trend slightly lower for gas. The urban area land use filter is not used in this map.

Gas location-level renter block group savings rates

Unique billing and tracking locations gas savings by quintile bins, by proportion of renter-occupied households (excludes HER participants)

<table>
<thead>
<tr>
<th>Quintile range</th>
<th>2016 therm consumption</th>
<th>2016 therm savings</th>
<th>Quintile population savings rate (no USL or HER)</th>
<th>Quintile range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Low renter ratio</td>
<td>242,646,713</td>
<td>2,819,874</td>
<td>1.16%</td>
<td>Zero to 10.2</td>
</tr>
<tr>
<td>2</td>
<td>244,898,721</td>
<td>2,622,818</td>
<td>1.07%</td>
<td>10.2 to 24.8</td>
</tr>
<tr>
<td>3</td>
<td>234,808,895</td>
<td>2,342,445</td>
<td>1.00%</td>
<td>24.8 to 45.2</td>
</tr>
<tr>
<td>4</td>
<td>234,004,935</td>
<td>1,884,410</td>
<td>0.84%</td>
<td>45.2 to 66.5</td>
</tr>
<tr>
<td>5 - High renter ratio</td>
<td>235,061,579</td>
<td>1,641,350</td>
<td>0.88%</td>
<td>66.5 to 100%</td>
</tr>
<tr>
<td>No ACS data</td>
<td>57,691</td>
<td>16</td>
<td>Not Calculated</td>
<td>N/A</td>
</tr>
<tr>
<td>Grand Total</td>
<td>1,132,672,414</td>
<td>11,312,913</td>
<td>1.00%</td>
<td></td>
</tr>
</tbody>
</table>

The above table summarizes the gas location savings ratios by block group quintile based on the number of renter-occupied housing units. As previously, this analysis captures PA savings at the block-group level, and the reader should use caution when extending block group results to individual accounts or sub-populations.

Scatterplot of 2016 gas block group savings contribution ratio (excludes HER participants)

This scatterplot illustrates gas savings contribution ratios in 2016 relative to renter ratio for block groups across Massachusetts. Higher block group renter ratios indicate more renter-occupied households.

The scatterplot shows variability within quintiles. Some of the block groups with larger savings contribution ratios correspond with both a high proportion of renter-occupied households and a larger relative amount of PA consumption. As the bottom map shows, block groups with the highest renter ratios tend to exist in large cities, where rental homes are more likely to be in multi-unit buildings.

Location-level savings contribution ratio for block groups in quintile 5 for renter-occupied households (excludes HER participants; Boston in inset map)

This map shows the location-level savings contribution ratios for block groups that fall into the 5th quintile (with ~66.5% to 100% of renter-occupied households). The urban area land use filter is not used in this map.
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