

Appliance Saturation Surveys

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Building Blocks for Aggregate Residential Load Profiles

are End-Use Profiles of:

1. Electric heating
2. Central air conditioning
3. Electric Water Heating
4. Baseload

Building Blocks for Aggregate Residential Load Profiles

The load profiles come from interval metered load research sample

To obtain aggregate class profiles need customer numbers having combinations of the first three categories,

e.g., number of customers having electric heating, central air conditioning and electric water heating

Saturation Surveys

The customer numbers are used to “blow up” the end-use profiles to a class level

The customer numbers come from saturation surveys

Residential Saturation Survey

Questions 1 to 4 are the priority questions providing the key components for these customer counts.

Information is provided on the main and supplementary heating fuel source, presence of air conditioning and electric water heating.

Residential Saturation Survey

Question 5 provides information on window/portable air conditioning.

The other questions provide a better calibration of end-use profiles, e.g., utility with larger saturation rates of non-space conditioning appliances should be allocated a larger baseload profile

Seasonal Saturation Survey

The seasonal saturation survey includes additional questions primarily related to the extent of occupancy through the year.

Depending on the response regarding occupancy, the seasonal profiles could differ significantly across months.

Sample Size Principles for Appliance Saturation Surveys

Target is to be within plus or minus 3% of the true saturation rate 95% of the time.

This target leads to the following sample sizes.

Random Sampling

The first two columns of Table 1 illustrate the appropriate sample sizes for Random Sampling according to the customer size of the class.

Notice that after the customer size increases beyond 50,000, the sample size increases very little

Proportionate Sampling

Another strategy is proportionate sampling.

This strategy takes account of possible homogeneity within kWh strata.

The last column of Table 1 illustrates the appropriate sample size for Proportionate Sampling according to the customer size of the class.

Proportionate Sampling

To implement proportionate sampling a frequency distribution is required by (six) strata.

Using the total sample size for proportionate sample, and the proportion of customers in each stratum, a required number of survey participants in each kWh stratum is surveyed

Best Efforts

Where a LDC undertakes the above and does not meet the target sample sizes, it means the sample estimates have a larger dispersion than being within plus or minus 3% of the true saturation rate 95% of the time

But with this “best effort estimate”, along with kWh frequency distributions, more reliable estimates are still achievable.

Sharing Saturation Rates Across Subclasses

If saturation rates are identical across subclasses, no need to do separate surveys

How do we know if saturation rates are identical?

Sharing Saturation Rates Across Subclasses

If kWh frequency distributions look similar, no need to distinguish between two subclasses with respect to saturation rates (either borrow saturation rates from other subclass or pool the two populations for survey purposes)

In Table 2 of “General Principles...” is an outline of how to record frequency distributions of subclasses, followed by a chi-square test statistic for determining whether two subclasses look similar.

Sharing Saturation Rates Across Different Utilities

Above methodology can be extended to determine if saturation rates can be borrowed from another utility.

However, annual kWh distributions are only proxies for information about saturation rates.

Sharing Saturation Rates Across Different Utilities

For example,

- Two utilities may have identical saturation rates for air conditioning, and yet due to differences in temperature, the utility with hotter summers may show a higher proportion of annual kWh above 16,500.
- One utility may have a higher electric heating saturation rate and a lower air conditioning saturation rate, but the climate difference between utilities is enough to produce roughly similar annual kWh frequencies.

Sharing Saturation Rates Across Classes of Different Utilities

Should limit sharing to utilities in close geographic proximity, utilities that would produce similar sample sizes and to those who satisfy the chi-square criterion