Measuring the Dead from the Living: Using Existing Equipment Stock to Estimate Measure Lives

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Discussion Overview

- Background
- Methodology and Results
- Benefits, Limitations, Planned Improvements
Background: Great New Data – What to Do with It?

- In 2016 MA had completed large C&I baseline study w/ 800+ sites
- Rich data on age mix of HVAC equipment from manufacturer nameplates
- How can data be used to help EE programs?
- First idea: stock turnover analysis

Figure 1: Age distribution of PTACs by electric PA
Effective Useful Life (EUL): Median # of years a measure is installed & operational

Persistence study – most common method for estimating EUL
- Surveys/site visits capture failure/removal of measures in early years
- Apply parametric distributions – e.g., Weibull curve – to project long-term failure rate
- EUL = When 50% of units no longer in use

Disadvantages of persistence study
- Long time to get results
- High data collection costs
New Methodology: Calculate EUL from Snapshot of Age Data

- Takes elements of traditional persistence study – e.g., Weibull curve
- But applies them in new way to new data
- Step #1: Calculate installation rate
  - Historical national AC shipment data from AHRI, DOE
  - Assume installation one year after shipment
  - Don’t need actual # installations, only relative #s.
Step #2: Calculating Expected Age Distribution
Step #3: Calibration and EUL Calculation

- Get data on actual unitary age mix from MA baseline study

- Find parameters of best-fitting Weibull curve to match observed age distribution

- Calculate median of that Weibull (EUL) and confidence bounds
### Results

- EULs in 7-9 year range, lower than 15-year EUL for unitary HVAC in MA TRM
- MA decided to reduce EUL for unitary HVAC to 12 years due to this study
- Didn’t go lower than 12 years b/c method was new, had some limitations

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<th>AC type</th>
<th>Excluding cases with unknown year</th>
<th>Including cases with unknown year</th>
<th>Basic imputation</th>
<th>Alternative imputation</th>
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</table>
Benefits of Methodology

- **Based in reality**: Derives EULs by leveraging data on actual ages of equipment in the field
- **Low data collection costs**:
  - Photograph of HVAC nameplate
  - Publicly-available databases of nameplates
  - Assuming you’re going to be onsite for other reasons
- **Differentiated EULs for different type of HVAC equipment**
- **Timelier results vs. traditional persistence studies**
Limitations of Methodology

- Possible biases due to missing age data:
  - ~ 1/3 of MA HVAC equipment lacked a manufacture date
  - If undated equipment correlates with old age, could bias EUL lower
- Assumes that MA HVAC installation rates mirror national trends
- Limited to equipment which has accessible manufacturer nameplate info (e.g., HVAC)
Planned Improvements of Methodology

Planned Improvements in 2019

- **MA-specific installation rates**: Using MA tax data and Dodge NC data to estimate MA-specific trends in NC and additions of new cooling sq. footage
- **More precise age imputation**: Looking closer at why equipment was undated – e.g., worn-out nameplate vs. nameplate being inaccessible
Questions?

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