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

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Discussion Overview

Background

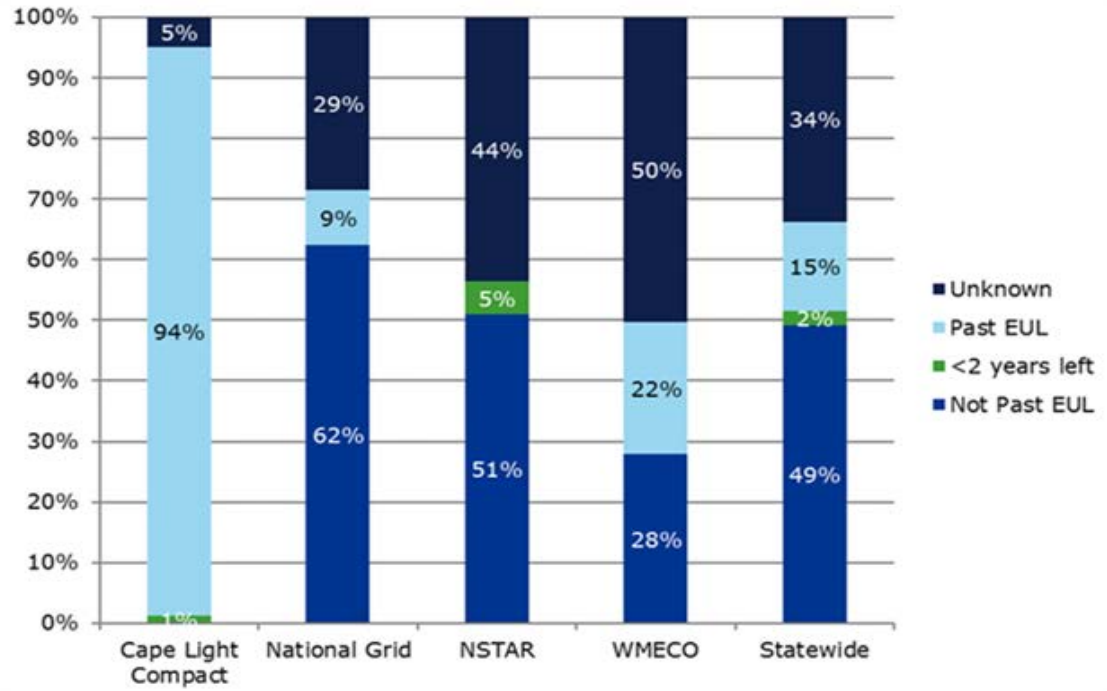
Methodology and Results

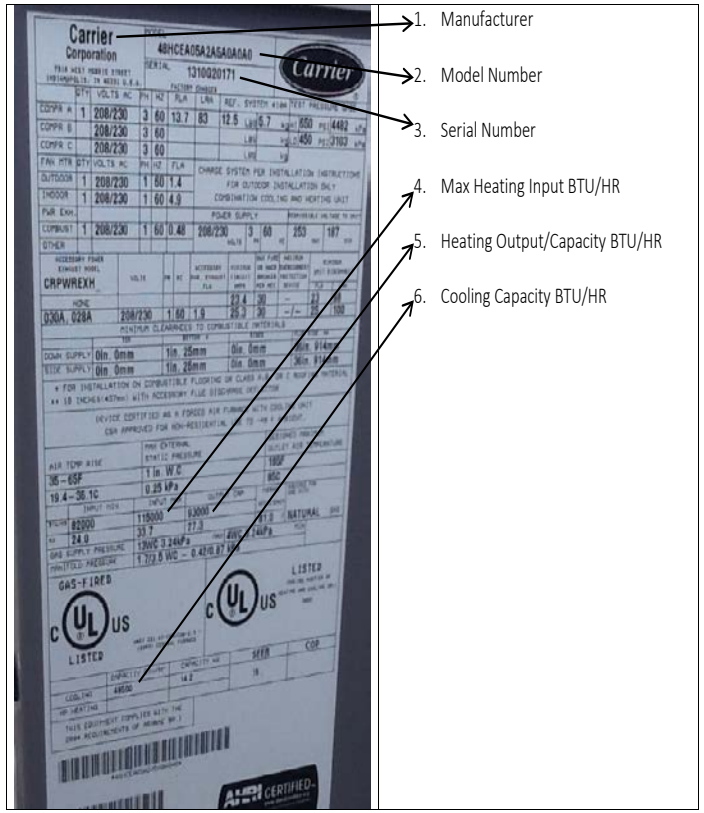
Benefits, Limitations, Planned Improvements

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

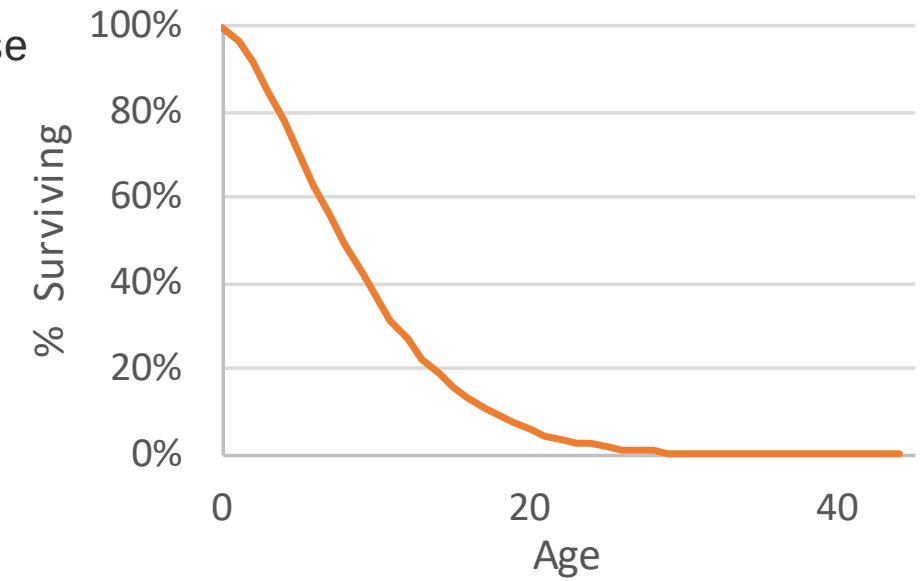
Figure 1: Age distribution of PTACs by electric PA





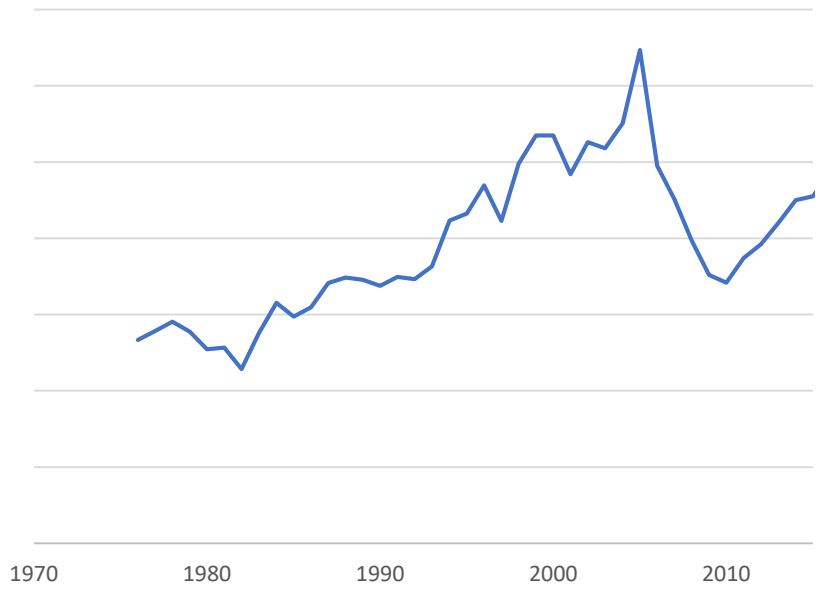
Background: Traditional Persistence Studies

- 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

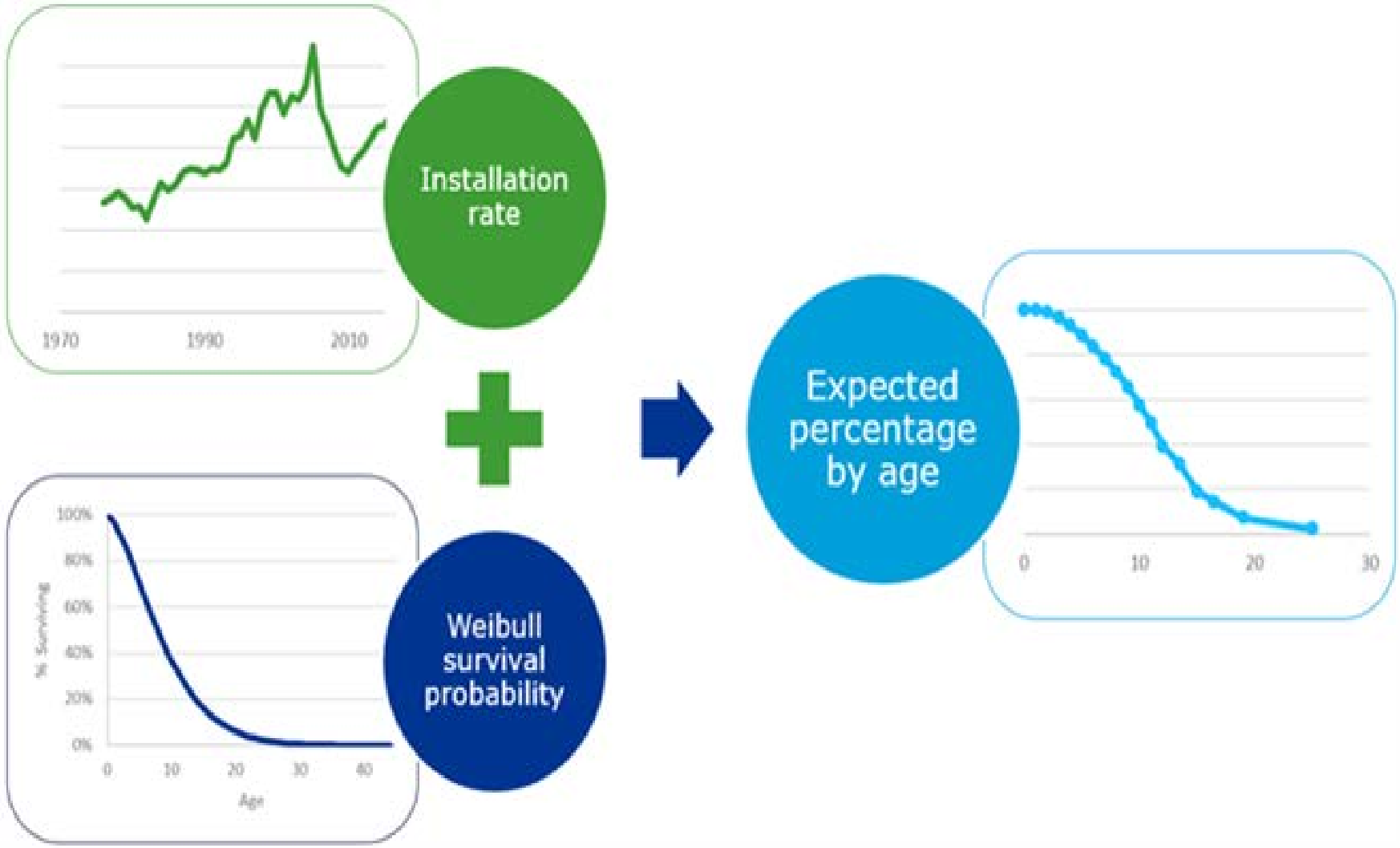


New Methodology: Calculate EUL from Snapshot of Age Data

- 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.

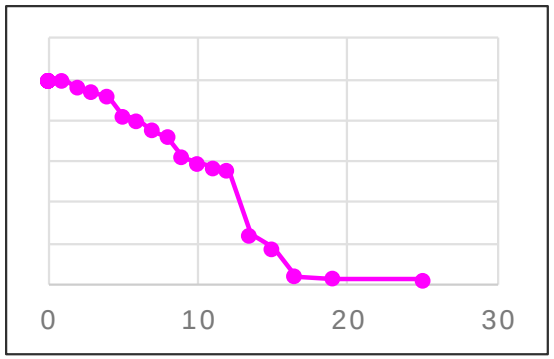


Step #2: Calculating Expected Age Distribution

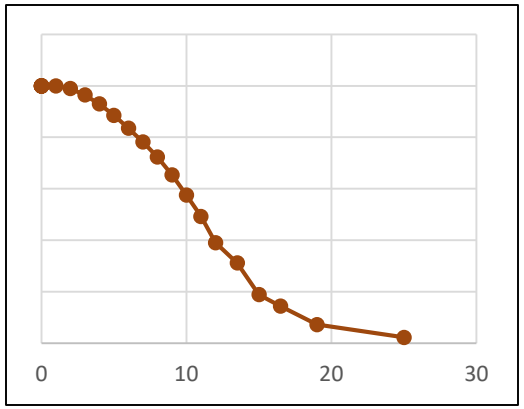


Step #3: Calibration and EUL Calculation

- 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 then 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

AC type	Excluding cases with unknown year	Including cases with unknown year	
		Basic imputation	Alternative imputation
Split system AC condensing unit	7.1	7.1	7.1
Split system heat pump	n/a	n/a	n/a
Package RTU AC	8.0	8.9	9.3
Package system heat pump	6.3	6.7	8.2
Mini split AC	3.7	7.1	10.5
Packaged terminal AC (PTAC)	4.6	8.5	22.4
Mini split heat pump	37.2	35.1	19.9

Benefits of Methodology

Benefits

- *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

Limitations

- *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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