

Memorandum

To: Rhode Island Energy

From: Lima Hossain and Doug Bruchs, Cadeo

Date: August 11th, 2023

Re: Measure Life Study: Findings Summary

Introduction

Reliable measure life assumptions are critical for understanding the impact of Rhode Island Energy's energy efficiency programs on lifetime energy savings. For this reason, Cadeo reviewed measure life assumptions to ensure the accuracy of measure life values for prescriptive measures in the state's 2023 Technical Reference Manual (TRM) and Rhode Island Energy's benefit-cost ratio (BCR) models.

To prioritize the review process, Cadeo classified every prescriptive measure in the TRM and BCR model based on its contribution toward the portfolio's total expected combined net lifetime MMBtu energy savings in 2023. Through this process, we identified 8 high priority measures (measures responsible for >3% of total expected savings), 15 medium priority measures (between 1% and 3% of expected savings), and 45 low priority measures (measure responsible for <1% of expected savings) for review.

In total, Cadeo reviewed 68 prescriptive gas and electric measures across all sectors (commercial, residential, and income eligible), including every high and medium measure and a subset of low measures. Collectively, the measures included in the review represent 85% of the total lifetime energy savings expected for prescriptive measures for 2023.

The study did not include custom measures because their definitions vary in their level of detail. This variability makes it difficult, if not impossible, to evaluate the appropriateness of an average measure life value without collecting and reviewing detailed project data for a representative sample of custom projects, which would optimally happen as part of a dedicated custom program impact evaluation.

This review ensures that Rhode Island Energy leverages the best possible available sources for measure life assumptions, which in turn will increase the reliability and accuracy of Rhode Island Energy's reported lifetime energy savings.

Study Goals

The two primary research goals of this study are:

- 1 |** Ensure all measure life assumptions (all sectors and fuels) align with the most recent research and evaluation efforts in Rhode Island and industry best practices for prescriptive measures.
- 2 |** Recommend updated measure life values for prescriptive measures, when appropriate and possible, using existing information.

Memo Organization

This memo summarizes Cadeo's key recommendations as well as our methodology and key findings for Tasks 2 & 3.

The memo includes four sections:

- Recommendations: Measure Life Updates
- Methodology
- Key Findings: Current Source Scoring
- Key Findings: Research Alternative Sources

Cadeo also developed a separate **Measure Life Study Documentation** workbook as a supplementary deliverable to Rhode Island Energy. Given the breadth and depth of details the team reviewed, we chose the workbook format, which is better suited to document our analysis. The workbook further details the measure prioritization, current source scoring, and measures that are flagged for alternative sources research for every reviewed measure.

Recommendations: Measure Life Updates

Measure Life Source and Value Updates

In total, our team identified and recommended a new measure life source and value for 21 of the 68 (31%) reviewed measures, broken down by measure priority group as follows:

- **High:** 2 of the 8 (25%)
- **Medium:** 6 of the 15 (40%)
- **Low:** 13 of the 45 (29%)

Of the 21 recommended changes, 10 resulted in a longer measure life – thereby increasing the lifetime savings associated with the measure. Conversely, 11 resulted in a shorter measure life, which has the opposite effect. Collectively, the net impact of these recommended updates has a small, yet positive, impact on Rhode Island's overall expected lifetime savings for prescriptive measures. As shown in Table 1: , replacing the existing sources and associated EUL values with

those recommended by Cadeo in this memo results an increase of 0.3% in expected portfolio-level lifetime energy savings for Rhode Island Energy prescriptive measures.¹

Table 1: Expected Lifetime Savings Analysis in Millions of MMBTUs

Sector and Fuel Type	Using Existing EULs	Using New EULs	Net Change (MMBTUs)	Net Change (%)
Residential	13,971	22,820	8,849	63.3%
C&I	2,335,793	2,333,626	-2,167	-0.1%
Income Eligible	450	438	-12	-2.7%
Electric	2,335,677	2,333,446	-2,231	-0.1%
Gas	14,537	23,438	8,901	61.2%
Total	2,350,214	2,356,884	6,670	0.3%

Table 2 details the recommended measure life source and value updates for high and medium priority measures. Appendix B includes the 13 low priority measure updates also recommended by the team.

¹ Using the unit and annual savings planned for 2023.

Table 2: Recommended Updates for Measure Life Sources and Values

Measure Name, Fuel, & Sector	Existing Measure Life	Recommended Measure Life	Net Change in EUL	Rationale for Change	Existing Source	Recommended Source
High						
Wi-Fi Thermostat Electric, Gas Income Eligible & Residential	15	11	-4	The existing source lacks citation, making its origin, robustness, and age uncertain. The recommended new source offers an empirical analysis of recent field data from Nest and other smart thermostat manufacturers, although it is not specific to Rhode Island, it aligns with the Illinois TRM and is 7 years more recent than the existing source.	Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats.	2017 Residential Smart Thermostat Workpaper, prepared by SCE and Nest for SCE (Work Paper SCE17HC054, Revision #0)
Electric Resistance to MSHP Electric Residential	18	17	-1	The recommended source is 15 years newer than the existing one and incorporates region-specific data, including survey information from Connecticut program participants.	GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.	Michaels Energy. 2022. X2001A: Connecticut Measure Life/EUL Update Study-Residential Measures.
Medium						
Replacement Refrigerator Electric Income Eligible	19	15	-4	The existing source lacks citation, leading to uncertain robustness. The recommended source is 3 years more recent, offers a robust analysis, and aligns with the Illinois TRM.	Environmental Protection Agency (2018). Savings Calculator for Energy Star Qualified Appliances Savings Calculator.	DOE Technical Support Document: Refrigerators, Refrigerator-freezers, and Freezers. EERE-2017-BT-STD-0014-0030
Heat Pumps Electric Income Eligible	18	20	2	The recommended source is 15 years newer than the existing one and incorporates region-specific data, including survey information from Connecticut program participants.	GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.	Michaels Energy. 2022.X2001A: Connecticut Measure Life/EUL Update Study-Residential Measures. Connecticut Energy Efficiency Board.
Mini-Split Heat Pump Electric Income Eligible	18	17	-1	The recommended source is 15 years newer than the existing one and incorporates region-specific data, including survey information from Connecticut program participants.	GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.	Michaels Energy. 2022.X2001A: Connecticut Measure Life/EUL Update Study-Residential Measures Connecticut Energy Efficiency Board.

Measure Name, Fuel, & Sector	Existing Measure Life	Recommended Measure Life	Net Change in EUL	Rationale for Change	Existing Source	Recommended Source
Programmable Thermostat Gas C&I	15	11	-4	The existing source lacks citation, making its origin, robustness, and age uncertain. The recommended new source offers an empirical analysis of recent field data from Nest and other smart thermostat manufacturers, although it is not specific to Rhode Island, it aligns with the Illinois TRM and is 7 years more recent than the existing source.	Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats	2017 Residential Smart Thermostat Workpaper, prepared by SCE and Nest for SCE (Work Paper SCE17HC054, Revision #0)
Refrigerator Recycling Electric C&I	8	4	-4	The 8-year duration for C&I refrigerator recycling in the Rhode Island TRM is longer than other New England recommendations. Massachusetts includes a 4-year measure life for both C&I and Residential refrigerator recycling, which aligns with other identified sources and is closer to the 5-year value used in Connecticut and New York TRMs.	GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.	MA TRM (source for this measure life is unlisted)
ERV Gas, C&I	20	15	-5	Other regional TRMs (i.e. MA) include ERVs as a custom measure, with the option to select different measure lifetimes (10, 15, or 20 years) depending on the custom project details. We propose that RI considers a similar approach as MA, given the similarities between the state's programs. In our experience, ERV lifetime can vary depending on if it's a standalone unit (i.e. fans/coils only), or if it's part of an HVAC unit that includes a compressor. The ERV measure in the RI Energy TRM states that it is not a standalone unit so if the team plans to stick with the single prescriptive measure approach the 15-year measure lifetime would be most appropriate.	NMR Group, Inc. (2011). Massachusetts Appliance Turn-In Program Evaluation Integrated Report Findings.	Assumed service life limited by controls - "Demand Control Ventilation Using CO2 Sensors," pg. 19, by US Department of Energy Efficiency and Renewable Energy.

Measure Life Source Updates

The team also identified one high priority, two medium priority, and five low priority measures with new sources, but the measure life values remained the same. For these measures, the team recommends updating the source for the measure life value. Table 3 lists all the high, medium, and low priority measures with recommended measure life sources.

Table 3: Recommended Updates for Measure Life Sources Only

Measure Name, Fuel, & Sector	Existing Measure Life	Rationale for Change	Existing Source	Recommended Source
High				
Weatherization Electric, Gas Income Eligible	20	The existing source lacks clarity on the methodology for RI-specific measure life values. The recommended source is 11 years more recent than the existing source and details a robust review of measure life values.	GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.	Navigant ComEd Effective Useful Life Research Report, May 2018
Medium				
Infrared Heat, Low Intensity Gas C&I	17	The existing source provides an estimate of the measure life value. The recommended source is 10 years more recent and provides a robust analysis of the measure life assumptions.	Nexant (2006). DSM Market Characterization Report. Prepared for Questar Gas.	GDS Associates, Inc. "Natural Gas Efficiency Potential Study." DTE Energy. July 29, 2016.
Home Energy Report, Existing Dual Fuel Electric, Gas Residential	1	The existing source lacks citation, making its robustness uncertain. The recommended source is 5 years more recent and evaluates region-specific data. The C-Team mentioned that the industry consensus is to treat HERS as having a one-year measure life. If the program provides messaging continuously, this leads to correct reporting of total cumulative savings and avoids claiming some of the savings twice as implied if the measure life value is more than one-year.	Opinion Dynamics with Navigant Consulting (2012). Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report July 2012. Prepared for Massachusetts EEAC & Behavioral Research Team.	NMR.1606 Eversource Behavior Program Persistence Evaluation. October 15, 2017
Low				
VARICOMP Electric C&I	13	The recommended source is 11 years more recent than existing source and provides a robust analysis of the measure life value.	Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.	DOE Technical Support Document: Air Compressors. EERE-2013-BT-STD-0040-0082
VSD Electric C&I	13	The recommended source is 11 years more recent than existing source and provides a robust analysis of the measure life value.	Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.	DOE Technical Support Document: Air Compressors. EERE-2013-BT-STD-0040-0082

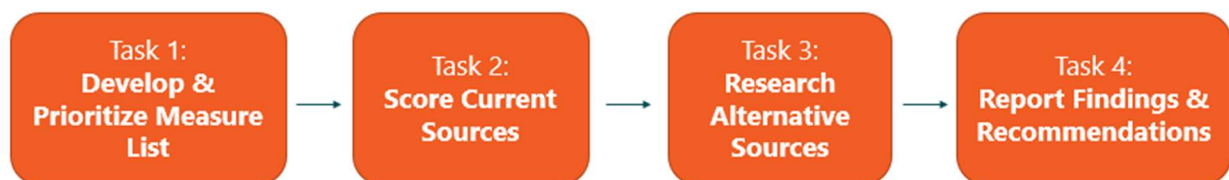
Measure Name, Fuel, & Sector	Existing Measure Life	Rationale for Change	Existing Source	Recommended Source
Low-Flow Showerhead Gas C&I	10	The recommended source is 9 years more recent than existing source and provides a robust analysis of the measure life value.	GDS Associates, Inc. and Summit Blue Consulting (2009), Natural Gas Energy Efficiency Potential in Massachusetts.	Navigant ComEd Effective Useful Life Research Report, May 2018
Programmable Thermostats Electric C&I	15	The recommended source is 16 years more recent than the existing source. The team could not verify the robustness of the source however, the recommended source aligns with the MA TRM.	Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.	2021 (Guidehouse) WiFi and Programmable Thermostat Impacts
Air Chiller Electric C&I	23	The recommended source is 12 years more recent than existing source.	GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.	Navigant ComEd Effective Useful Life Research Report, May 2019

Lastly, our team's review process also identified a few editorial updates for the TRM and/or BCR model (i.e., updating a broken link or spelling errors), which we have documented in the previously mentioned supplementary workbook.

Methodology

Error! Reference source not found. illustrates the four tasks we completed for this study.

Figure 1: Roadmap of Tasks



For Task 1, Cadeo focused on developing the measure list of each prescriptive measure in the TRM and BCR model. We then prioritized the list of measures based on their respective contributions toward the portfolio's total expected lifetime energy savings in 2023. The measure

prioritization exercise helped the team identify the most impactful measures (i.e., the high and medium priority measures) on which to focus their review. However, we also wanted to ensure representation of low priority measures. Upon consulting with Rhode Island Energy, the team identified a subset of 45 low priority measures (25 selected by Cadeo for measures in the TRM model and 20 selected by Rhode Island Energy for measures in the BCR model) to also review. Table 4 details the total number of high, medium, and low priority measures with the thresholds and percent of portfolio savings contribution for each priority category.

Table 4: Measure Prioritization

Priority Ranking	Count of Measures	Percent of Portfolio Savings	Definition (Measures Responsible for...)	List of Measures
High	8	54%	>3% of Portfolio Savings	<ul style="list-style-type: none"> • Cooking Equipment Upstream • Interior Lighting • Combo Condensing Boilers • Cooking Equipment • Weatherization • Electric Resistance to MSHP • Wi-Fi Thermostat • Weatherization
Medium	15	24%	Between 3% and 1% of Portfolio Savings	<ul style="list-style-type: none"> • EMS • LED • Heat Pumps • Upstream Lighting • Upstream Lighting • Programmable Thermostat • Infrared Heat, Low Intensity • Water Heating Boiler • ERV • Home Energy Report, Existing Dual Fuel • Forced Hot Water Boiler • Programmable Thermostat • Mini-Split Heat Pump • Replacement Refrigerator • Refrigerator Recycling
Low	271	22%	<1% of Portfolio Savings	
Total	294	100%		

In Task 2, the team scored each measure's measure life source based on its origin, robustness, and age, as shown in Table 5. Measure life sources scored as "strong" indicate the current values are reliable and appropriate for use in Rhode Island, while "weak" indicates the measure life value source is less reliable for continued use and that Rhode Island Energy should consider adopting an alternative value. Sources rated as "moderate" fall between these two scores and required greater subjectivity.

Table 5: Scoring Guidelines

Key Factor	Strong	Moderate	Weak
Source Origin	From primary research sponsored by RI Energy and/or appropriately piggybacked ² from Massachusetts	From research completed outside RI, but a similar climate or market, or a national source customized for RI	Data source not cited, unavailable, or not appropriate for RI
Source Robustness	Detailed primary research (e.g., metered data)	Focused secondary research (e.g., energy modeling)	High-level research (e.g., literature review)
Source Age	2017–present	2012–2016	Before 2012

Specifically, **Cadeo flagged any measure life sources scored as weak in any of the three categories (origin, robustness, and age) for potential replacement with an alternative source.** Because the measures are important to Rhode Island Energy’s overall portfolio, **we investigated potential replacement sources for any high, medium, and subset of low priority measures that scored as weak or moderate in the categories described in Table 5.** In other words, unless a source for a measure scored as high in all three categories, our team explored the possibility that a better source could exist for the measure.

For Task 3, our team investigated the potential existence of a better source of measure life information for each measure we flagged with weak or moderate scores in the three rating categories (origin, robustness, or age). The team determined that an alternative source is “better” if the new source did not have any weak scores in any of the three rating categories after applying the same scoring process described above in Table 5. The team recognizes there is some subjectivity to the scoring process and may recommend adoption of an alternative source—potentially as a stopgap—even if it reflects an imperfect but marginal improvement relative to the existing source.

Key Findings: Current Source Scoring

Using the scoring approach described in Task 2 of the Methodology section, Cadeo flagged 52 measures for potential updates. Table 6 shows the number and percentage of measures we flagged for updates based on the scoring guidelines (Table 5) with the measure priority breakdown. The team then researched alternative sources for replacement for the flagged measures, further described in the next section.

² DNV GL, Rhode Island Piggybacking Diagnostic Study, January 14, 2020, <http://rieermc.ri.gov/wp-content/uploads/2020/09/rhode-island-piggybacking-diagnostic-study-final-final-report-20200114.pdf>.

Table 6: Measures Flagged for Update

Priority Ranking	# of measures reviewed	# flagged for update	% flagged for update
High	8	6	75%
Medium	15	9	60%
Low	45	37	82%
Total	68	52	76%

Key Findings: Research Alternative Sources

Cadeo researched alternative sources, including those used in other TRMs³, primary research studies and DOE technical support documents for updated information on measure life assumptions. The team reviewed the alternative sources in detail to ensure the new source matched the measure life definition listed in the Rhode Island Energy TRM⁴. Table 7 describes our findings for alternative sources for the 52 measures we flagged for update in the previous task. Alternative sources were recommended if they scored better than the existing sources based on the scoring guidelines. For measures with no better sources found, alignment with other regional TRMs or stakeholder groups (MA Common Assumption) was noted where possible.

Table 7: Total Measures Reviewed and Count of Measures with Updates

Priority Ranking	# of measures with recommended updates	# of measures with no "better" source
High	3	3
Medium	7	3
Low	19	17
Total	29	23

³ Cadeo reviewed the underlying sources in other regional TRMs (e.g., MA, CT, NY, IL, and Mid-Atlantic) to identify alternative sources for any measures that were flagged for update in Task 2.

⁴ RI Energy TRM definition, Measure life includes equipment life and the effects of measure persistence. Equipment life is the number of years that a measure is installed and will operate until failure. Measure persistence takes into account business turnover, early retirement of installed equipment, and other reasons measures might be removed or discontinued.

Appendix A

Measure Consolidation

In total, the combined electric and natural gas benefit-cost ratio (BCR) models have more than 400 measure entries.⁵ However, for the purpose of reviewing measure lives, many of these measure entries are duplicative. For example, our team identified 18 measure entries for faucet aerators, which were differentiated by the water heating fuel (electric, natural gas, heating oil, and propane) and program delivery channel (retail, market-rate direct install, income-eligible direct install). All 18 aerator entries currently rely on the same average measure life value and source. Essentially, the model assumes that the measure life of an aerator, once installed, is independent of the fuel used to heat the water and is consistent across residential home types. Our team assessed the validity of such assumptions during our review and the single sourcing for faucet aerator measure life effectively allowed the team to review one source for all 18 BCR measure entries.

By applying this type of distillation process for all prescriptive measures across all sectors (i.e., identifying consistent measure names and measure lives across BCR entries), our team identified about 300 “unique” measures and measure life values for review. The team then assigned a priority ranking based on each measure’s expected savings contribution (in metric million British thermal units) to total portfolio savings as documented in the BCR models. Specifically, we multiplied each measure’s per-unit lifetime savings by the expected number of installations in 2023. We used the resulting value to identify each measure as high, medium, or low priority. Our team also determined the appropriate thresholds detailed in the documentation workbook for each priority category.

⁵ At Rhode Island Energy’s suggestion, our team scoped and reviewed the measures within the BCR models (as we anticipate they will be more granular than the TRM) before proceeding to the TRM to ensure we cover all unique prescriptive measures.

Appendix B

Table 8: List of recommended updates to measure life values and sources with scoring notes

Measure Name, Fuel, & Sector	Existing Measure Life	Origin	Robustness	Age	Existing Source Scoring/Notes	Flagged for Update	New Source Name	New Measure Life	Origin	Robustness	Age	New Source Scoring/Notes
High												
Wi-Fi Thermostat Electric, Gas Income Eligible & Residential	15	Weak	Weak	Weak	Scored weak in all categories.	Yes	2017 Residential Smart Thermostat Workpaper, prepared by SCE and Nest for SCE (Work Paper SCE17HC054, Revision #0)	11	Moderate	Moderate	Strong	Scored strong/moderate in origin, robustness, and age categories.
Electric Resistance to MSHP Electric Residential	18	Moderate	Weak	Weak	Scored moderate/weak in origin, robustness, and age categories.	Yes	Michaels Energy. 2022. "X2001A: Connecticut Measure Life/EUL Update Study-Residential Measures." Connecticut Energy Efficiency Board.	17	Strong	Strong	Strong	Scored strong in all categories.
Medium												
Replacement Refrigerator Electric Income Eligible	19	Weak	Weak	Weak	Scored weak in all categories.	Yes	DOE Technical Support Document: Refrigerators, Refrigerator-freezers, and Freezers. EERE-2017-BT-STD-0014-0030	15	Moderate	Strong	Strong	Scored strong/moderate in origin, robustness, and age categories.
Heat Pumps Electric Income Eligible	18	Strong	Moderate	Weak	Scored moderate/weak in robustness and age categories.	Yes	Michaels Energy. 2022. "X2001A: Connecticut Measure Life/ EUL Update Study-Residential Measures." Connecticut Energy Efficiency Board.	20	Strong	Strong	Strong	Scored strong in all categories.
Mini-Split Heat Pump Electric Income Eligible	18	Moderate	Weak	Weak	Scored moderate/weak in origin, robustness, and age categories.	Yes	Michaels Energy. 2022. "X2001A: Connecticut Measure Life/ EUL Update Study-Residential Measures."	17	Strong	Strong	Strong	Scored strong in all categories.

Measure Name, Fuel, & Sector	Existing Measure Life	Origin	Robustness	Age	Existing Source Scoring/Notes	Flagged for Update	New Source Name	New Measure Life	Origin	Robustness	Age	New Source Scoring/Notes
Connecticut Energy Efficiency Board.												
Programmable Thermostat Gas C&I	15	Weak	Weak	Weak	Scored weak in all categories.	Yes	2017 Residential Smart Thermostat Workpaper, prepared by SCE and Nest for SCE (Work Paper SCE17HC054, Revision #0)	11	Strong	Moderate	Strong	Scored strong/moderate in origin, robustness, and age categories.
Refrigerator Recycling Electric C&I	8	Moderate	Strong	Weak	Scored moderate/weak in origin and age categories.	Yes	MA TRM (source for this measure life is unlisted)	4	Strong	Weak	Strong	Scored strong in origin and age categories.
ERV Gas, C&I	20	Moderate	Weak	Weak	Scored moderate/weak in origin, robustness, and age categories.	Yes	Assumed service life limited by controls - "Demand Control Ventilation Using CO2 Sensors", pg. 19, by US Department of Energy Efficiency and Renewable Energy.	15	N/A	N/A	N/A	Other regional TRMs (i.e. MA) include ERVs as a custom measure, with the option to select different measure lifetimes (10, 15, or 20 years) depending on the custom project details. We propose that RI considers a similar approach as MA, given the similarities between the state's programs.
Low												
Refrigerator Electric Residential	12	Weak	Weak	Weak	Scored weak in all categories.	Yes	DOE Technical Support Document: Refrigerators, Refrigerator-freezers, and Freezers. EERE-2017-BT-STD-0014-0030	15	Moderate	Strong	Strong	Scored strong/moderate in origin, moderate, and age categories.

Measure Name, Fuel, & Sector	Existing Measure Life	Origin	Robustness	Age	Existing Source Scoring/Notes	Flagged for Update	New Source Name	New Measure Life	Origin	Robustness	Age	New Source Scoring/Notes
MSHP Electric Income Eligible	18	Moderate	Weak	Weak	Scored moderate/weak in origin, robustness, and age categories.	Yes	Michaels Energy. 2022. "X2001A: Connecticut Measure Life/EUL Update Study-Residential Measures." Connecticut Energy Efficiency Board.	17	Strong	Strong	Strong	Scored strong in all categories.
Clothes Washer Most Efficient Electric Residential	11	Weak	Weak	Weak	Scored weak in all categories.	Yes	DOE Technical Support Document: Residential Clothes Washers. EERE-2017-BT-STD-0003-0020	14	Moderate	Strong	Strong	Scored strong/moderate in origin, moderate, and age categories.
HP Water Heaters Electric Income Eligible	10	Moderate	Weak	Weak	Scored moderate/weak in origin, robustness, and age categories.	Yes	Navigant Consulting (2018). Water Heating, Boiler, and Furnace Cost Study (RES 19) Add-On Task.	13	Strong	Strong	Strong	Scored strong in all categories.
AirChiller Electric C&I	23	Strong	Moderate	Weak	Scored moderate/weak in robustness and age categories.	Yes	As recommended in Navigant 'ComEd Effective Useful Life Research Report', May 2018. (http://deeresources.com/deer0911planning/downloads/EUL_Summary_10-1-08.xls).	23	Moderate	Weak	Strong	Scored strong/moderate in origin and age categories.
Refrigerated Air Dryer Electric C&I	15	Moderate	Weak	Weak	Scored moderate/weak in origin, robustness, and age categories.	Yes	As recommended in Navigant 'ComEd Effective Useful Life Research Report', May 2018. (http://deeresources.com/deer0911planning/downloads/EUL_Summary_10-1-08.xls).	13	Moderate	Weak	Strong	Scored strong/moderate in origin and age categories.
Faucet Aerator Gas C&I	7	Moderate	Weak	Weak	Scored moderate/weak in origin, robustness, and age categories.	Yes	MA TRM (source for this measure life is unlisted)	3	Strong	Weak	Strong	Scored strong in origin and age categories.
VSD Compressor (15<=HP<=75) Electric C&I	15	Moderate	Weak	Weak	Scored moderate/weak in origin,	Yes	DOE Technical Support Document: Air Compressors. EERE-2013-BT-STD-0040-0082	13	Moderate	Strong	Moderate	Scored strong/moderate in origin,

Measure Name, Fuel, & Sector	Existing Measure Life	Origin	Robustness	Age	Existing Source Scoring/Notes	Flagged for Update	New Source Name	New Measure Life	Origin	Robustness	Age	New Source Scoring/Notes
					robustness, and age categories.							robustness, and age categories.
Furnace Gas C&I	18	Moderate	Strong	Weak	Scored moderate/weak in origin and age categories.	Yes	DOE Technical Support Document: Commercial Warm Air Furnaces. EERE-2013-BT-STD-0021-0050	23	Moderate	Strong	Moderate	Scored strong/moderate in origin, robustness, and age categories.
Furnace w/ECM Gas HVAC	18	Moderate	Weak	Weak	Scored moderate/weak in origin, robustness, and age categories.	Yes	DOE Technical Support Document: Commercial Warm Air Furnaces. EERE-2013-BT-STD-0021-0050	23	Moderate	Strong	Moderate	Scored strong/moderate in origin, robustness, and age categories.
Water Heater Gas C&I	20	Moderate	Strong	Weak	Scored moderate/weak in origin and age categories.	Yes	DOE Technical Support Document: Commercial Water Heating Equipment. EERE-2021-BT-STD-0027-0001	17	Moderate	Strong	Strong	Scored strong/moderate in origin, robustness, and age categories.
Early Retirement Clothes Washer Electric Income Eligible	12	Weak	Weak	Weak	Scored weak in all categories.	Yes	DOE Technical Support Document: Residential Clothes Washers. EERE-2017-BT-STD-0014-0030	14	Moderate	Strong	Strong	Scored strong/moderate in origin, robustness, and age categories.
VRF HP Electric Gas	15	Moderate	Weak	Weak	Scored moderate/weak in origin, robustness, and age categories.	Yes	DNV GL (2018). Expected Useful Life (EUL) Estimation for Air-Conditioning Equipment from Current Age Distribution Memo. 2018_DNVGL_P73_EUL_Estimation_Results_to_Date	17	Strong	N/A	Strong	Unable to identify report link however, updated source aligns with MA TRM. Link is to the closest report available.

Measure Name, Fuel, & Sector	Existing Measure Life	Origin	Robustness	Age	Existing Source Scoring/Notes	Flagged for Update	New Source Name	New Measure Life	Origin	Robustness	Age	New Source Scoring/Notes
Duct Insulation_MF Gas C&I	25	Strong	Moderate	Weak	Scored moderate/weak in robustness and age categories.	Yes	National Grid Staff Estimate (2010) MA SBS-DI Duct Sealing and Insulation Scenario and Deemed Savings. NGrid_MA_SBS-DI_Duct_Sealing_and_Insulation_Scenario_and_Deemed_Savings_6-22-10	20	Strong	Weak	Weak	While still an old source, and a National Grid Staff Estimate, recommend aligning with MA as a more conservative estimate, and for consistency across the State Programs.