

Early Replacement Measures Study

v5.1

Framework and Priority Measures

Updates Based on Stakeholder Feedback

August 2024





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Background

- In the January 2024 EWR Collaborative, Guidehouse presented literature review results for the Early Replacement (ER) Measures Study. The purpose of the study is to develop a framework which identifies the key considerations for developing workpapers to claim savings for measures that are replaced before the end of the equipment's useful life.
- With the ER framework, workpapers will be developed for Priority ER measures for inclusion in the 2025 Michigan Energy Measures Database (MEMD). Priority ER measures were identified using stakeholder interviews and inputs from utility Implementation Contractors.

Literature Review Findings

ER Parameters	Summary of Findings	Key Differentiations
Eligibility	<ul style="list-style-type: none"> • Most jurisdictions define Early Replacement (ER) as replacement of existing equipment which is in working condition. • Some utilities have additional eligibility criteria based on equipment age. 	<ul style="list-style-type: none"> • The equipment age criterion is defined differently across the jurisdictions: <ul style="list-style-type: none"> ○ New York¹, Vermont, New Orleans, Minnesota, Ohio – before the end of EUL/expected life/useful life; ○ Mid Atlantic – before the natural end of life; ○ Illinois – in working condition or in need of minor repairs even if beyond EUL. • Vermont requires ER projects to provide evidence of prior contact with the customer replacing functioning equipment for energy savings purpose. • Mid-Atlantic TRM only offer certain measures such as ER of Room AC and Refrigerators through Low Income or Home Performance Program (direct install). • Certain measure types in the MA and PA TRMs require the existing equipment be retired or recycled and permanently removed from the grid.
Measure Effective Useful Life (EUL)	<ul style="list-style-type: none"> • ER measures use the same measure life (EUL) as replace on burnout (ROB). 	<ul style="list-style-type: none"> • Common parameter for both ER and ROB. No differentiation identified.
Remaining Useful Life (RUL)	<ul style="list-style-type: none"> • Typically, set at 1/3 of measure's EUL; however, it is recommended RUL in future TRMs to be informed from program data² 	<ul style="list-style-type: none"> • New York TRM requires the RUL data to be collected by the program administrator. • IL TRM uses RUL= 1/2 EUL for Income Qualified (IQ) Room AC measure and RUL=1/3 EUL for non-IQ customers.

1. New York offers a semi-custom analysis to calculate savings for replacement of equipment well past its EUL and with a history of significant repair and high energy consumption.
2. Based on California Public Utilities Commission 2008 Database for Energy Efficiency Resources (DEER).

Literature Review Findings

ER Parameters	Summary of Findings	Key Differentiations
Existing Efficiency	Actual value. Most jurisdiction use one of the following sources to determine deemed value: <ul style="list-style-type: none"> • Program data from past evaluation, OR • Past federal minimum efficiency standards. 	<ul style="list-style-type: none"> • Mid Atlantic and VT TRMs provide deemed savings values instead of deemed efficiency values for equipment. e.g., refrigerator measure.
Annual Hours of Use (HOU)	Use current measure HOU for all replacement types (ER or ROB).	Common parameter for both ER and ROB. No differentiation identified.
Incremental Cost	Standardized approach ¹ to determine incremental cost for ER measures is the new high efficiency equipment cost subtract the Present Value (PV) of the cost that is avoided in the future for a code minimum standard efficiency equipment.	<ul style="list-style-type: none"> • Massachusetts, New Hampshire – ER cost is not specified. • Pennsylvania – ER cost is defined as the full cost of equipment replacement. • Minnesota – Certain measures use full cost as ER cost.

1. [Understanding Cost-Effectiveness of Energy Efficiency Programs, DOE 2008.](#)



Early Replacement Framework

ER Framework Structure

Sections	Contents	Description
1 - ER Key Concepts	1.1 Early Replacement Definition 1.2 EWR Measure Replacement Types	Definitions of ER, Replace on Burnout (ROB) and New Construction (NC) and other terms used in the framework
2 - ER Measure Categorization	2.1 Eligibility Criteria 2.2 Algorithm <ul style="list-style-type: none"> 2.2.1 First Year Savings 2.2.2 Midlife Adjusted Savings 2.2.3 Lifetime Savings 2.3 Key Parameters <ul style="list-style-type: none"> 2.3.1 Existing Equipment Efficiency 2.3.2 Effective Useful Life 2.3.3 Remaining Useful Life 2.3.4 Annual Hours of Use 2.4 Incremental Cost	Detailed measure categorization to go over ER eligibility, algorithm, key parameters and incremental cost
3 - Maintenance & Update Process	3.1 New and Modified ER Measure Submission 3.2 MEMD Review	Brief introduction to the process and timeline of ER workpaper maintenance and update

ER Definition and Replacement Types

REPLACEMENT TYPE	DEFINITION
Natural Replacement (NR)	<ul style="list-style-type: none"> For measures where the customer could have replaced or installed a code minimum efficiency equipment absent utility program intervention; the utility program influences the efficiency level of the product purchased but not whether a product would be purchased.
Early Replacement (ER)	<ul style="list-style-type: none"> For measures which are replacements of existing equipment which is in good working condition or require minimal repair with high efficiency equipment before the customer otherwise would have absent a utility program. (i.e., it is reasonable to conclude that it could have continued to function in the absence of the program)
New Construction (NC)	<ul style="list-style-type: none"> For measures installed at the time of a new facility construction, or as part of a major renovation, e.g. a facility capacity expansion.

The main difference between the ER and NR replacements is the baseline efficiency. The ER energy savings is calculated based on the *existing equipment efficiency* whereas the NR energy savings is calculated based on the applicable *code minimum efficiency level at the time of replacement*. NC projects have the same baseline of applicable code minimum efficiency as NR projects.

ER measures encourage the replacement of old and inefficient equipment before the end of their useful life. This leads to additional first year energy savings and lifetime savings compared to NR.

Eligibility Criteria

Early Replacement measures offered to Residential Single Family, Multi-Family and C&I customers should meet following core eligibility criteria:

- Equipment in good working condition or requiring minor repairs which is <20% of replacement cost
- Utility programs caused the Early Replacement to happen before the end of the equipment life

Additional Guidance

Distribution Channel

- Fuel switching measures and Midstream and Upstream programs will be excluded from claiming ER savings¹.
- Eligible **distribution channels** include Direct Install/Audit and Downstream programs.

Distribution Channel	Default Replacement Type for ER Measures
Direct Install/Audit	<ul style="list-style-type: none"> • Early Replacement (if other ER eligibility criteria is met)
Downstream	<ul style="list-style-type: none"> • Natural Replacement • However, evaluators will determine a deemed “Early Replacement Rate” which can be applied to claim <i>higher</i> ER savings for a portion of a program. <ul style="list-style-type: none"> • <i>ER rate should be determined on measure level and revised at an agreed upon frequency.</i> • <i>For first year application of a new ER measure, reference of applicable ER rate can be taken from other programs/jurisdictions.</i> • <i>Evaluators could conduct customer surveys of program participants to determine what % total furnace replacements were Early Replacement caused by the program and apply this deemed ER Rate to furnace replacement savings in the program.</i>

Additional Guidance

- The **age of the existing equipment** which is being replaced will be used to determine the remaining useful life (RUL) of the measure, i.e.

$$RUL = \frac{1}{3} * EUL \text{ (or measure life) for equipment replaced **within** measure life}$$

$$RUL = \frac{1}{6} * EUL \text{ for equipment replaced **after** measure life}$$

For example, for gas furnace with measure life of 21 years

- RUL = 7 years for early replacement of a furnace <21 year's old and*
 - RUL = 3 years for furnace >21 year's old.*
- If the age of existing equipment cannot be determined, the replacement type will be considered as Natural Replacement.

Additional Guidance

Program Design and Evaluation

- Utilities will work with their Program Implementers and independent evaluators to determine:
 - How the program convinced the customers to replace functional equipment earlier than they otherwise would have.
 - Appropriate documentation required to verify ER measure eligibility based on measure type, complexity, and feasibility.

Example Documentation for Equipment in Working Condition

- Customer interviews/surveys conducted by evaluator
- Maintenance logs
- Customer affidavits at the time of implementation or customer response in program application
- For equipment of a large capacity, a video showing operational status of equipment before the replacement, or a photo of power meter attached to unit to show operational status.

Example Documentation for Equipment Age

- Photo of Equipment Nameplate with Serial Number and/or Manufacture Year¹. For example, A Rheem water heater with a serial number of “1209D1234” suggests manufacturing date of Dec 2009 based on the first 4 digits of the serial number.

Additional Guidance

Workpapers

- ER workpapers should be developed using the ER Framework for measures already in the MEMD.
- ER workpapers should also include measure-specific criteria for ER measures. *For example, Gas Furnace Workpaper should have additional criteria that excludes projects with existing high efficiency condensing gas furnaces to be eligible for ER savings.*

NTG

- NTG=1 can be applied during the existing equipment's remaining useful life, after which NTG = 0.92 (NTG = 1 for income eligible) will be applied.
 - *For example, furnace with 21-year measure life will have NTG =1 for first 7 years (which further increases savings) and NTG=0.92 for remaining 14 years of measure life.*

RUL, EUL, and HOU

The ER framework also presents details of the EUL, AEUL, RUL and HOU to be used in ER measures.

ER Parameters	Proposed Approach
Effective Useful Life (EUL)	ER measures use the same EUL/measure life as replace on burnout (ROB), which is available in the MEMD for the purpose of determining ER measure RUL when preparing the MEMD workpapers. Typically measure life is point at which approximately 50% of installed measures are still operable and providing savings. ¹
Remaining Useful Life (RUL)	<p>Determined using existing equipment age and EUL²:</p> $RUL = \frac{1}{3} * EUL \text{ for equipment replaced within measure life}$ $RUL = \frac{1}{6} * EUL \text{ for equipment replaced after measure life}$ <p><i>For example, RUL = 7 years for early replacement of a furnace <21 year's old and RUL = 3 years for furnace >21 year's old.</i></p>
Annual Hours of Use (HOU)	Use current measure HOU from MEMD for all replacement types (ER and ROB). For custom projects, the actual HOU of existing equipment should be used.

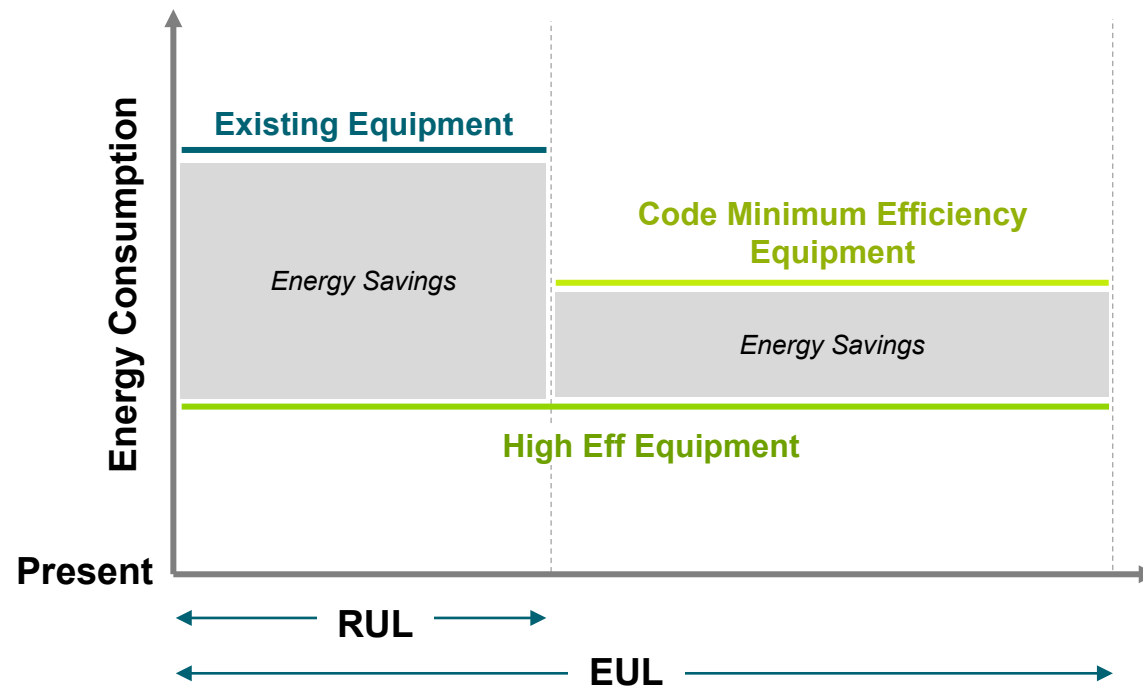
Algorithm

A dual-baseline methodology will be applied when quantifying savings for all early replacement measures.

First Year Savings = Existing Equipment Consumption – High Eff Equipment Consumption

Midlife Adjusted Savings = Code Min Eff Equipment Consumption – High Eff Equipment Consumption

Lifetime Savings = First Year Savings*RUL + Midlife Adjusted Savings*(EUL-RUL)



Existing Equipment Efficiency

For MEMD ER workpapers, deemed efficiency can be identified using one of following approaches with option (1) as the preferred approach:

(1) Program participant data¹ of ER project existing equipment efficiency;

- *Current utility programs may not be collecting existing equipment efficiency, so this data is most likely not available for most measures but could be collected during measure implementation in future to update measure savings.*

(2) Past federal minimum efficiency standards in effect at the estimated manufacture date of the existing equipment².

The actual efficiency of the existing equipment can be used instead of deemed efficiency values if available when determining the First Year Energy Savings.

1. At least one year of program participant data from Michigan utilities for programs offering the specific measure should be used for this purpose. This data could include nameplate efficiency or actual in-situ operating efficiency.

2. The estimated manufacture date of the existing equipment can be calculated to be at 2/3 of measure life ago.

Incremental Cost

ER measures result in increased energy savings with higher incremental costs compared to natural replacement. Incremental Cost for ER measures can be calculated following the National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources (NSPM)¹.

The following calculation tool can be used to estimate Incremental Costs for ER measures and can be provided as an attachment with Early Replacement measure workpapers.



Early Replacement
Incremental Cost

New and Modified ER Measure Submission

After MEMD workpaper drafts are developed according to this ER Framework, the next steps are the submission of the draft workpapers for review and the inclusion into the MEMD.

The maintenance and update process and timelines of ER workpapers will be consistent with existing MEMD measure maintenance and update process as outlined in the MEMD Overview & Maintenance Process Manual.

Workpaper	Description	Guidance	Submission Timeline
New ER Measure	ER measures not already available in MEMD will be considered as “ New Measure ” workpapers.	Measure sponsors/authors are required to draft a workpaper using the MEMD Workpaper Template and the ER Framework.	April 1 st
Modified ER Measure	Modifications to existing ER measures in the MEMD.	Measure sponsors/authors are required to update the existing ER Workpaper.	May 1 st

Workpaper reviews and revisions happen from the submission time through August.

The final MEMD will be published on the Michigan Public Service Commission (MPSC) in October.



Priority ER Measures

Priority Measures

Guidehouse identified following four ER priority measures for 2025 MEMD based on literature review, discussion with utilities and various program implementation contractors:

1. Boiler (Res, C&I, MF)
2. Central AC (Res, C&I, MF)
3. Furnace (Res, C&I, MF)
4. Water Heater (Res, MF)



Timeline and Next Steps

Early Replacement Framework: Proposed Schedule

- Present the draft ER Framework to the EWR Collaborative to collect feedback (today).
- After we get alignment/address comments Guidehouse propose to:
 - Begin drafting workpapers for 4 priority measures and
 - Integrate the Framework into a redline version of the MEMD Manual which will be submitted to the MPSC.

Milestone	Framework (PowerPoint)	ER Workpapers (Up to 12 Priority Measures)	Framework Incorporated into MEMD Manual
Present to EWR Collaborative	2/20/24		
EWR Collaborative comments provided to Guidehouse	3/1/24		
Submit finalized framework slide deck to MPSC	3/15/24		
Submit workpaper drafts to MPSC (One priority measure)		4/1/24	
Submit workpaper drafts to MPSC (Three priority measure)		4/15/24	
<i>Proposed - Framework incorporation into MEMD Manual draft</i>			5/1/24
<i>Proposed - MPSC post updated MEMD Manual on website</i>			6/1/24

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