CADMUS



Focus on Energy Calendar Year 2023 Evaluation Report Addendum

May 16, 2025

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Introduction

Wisconsin Administrative Code § PSC 137.05(12)[1] establishes that an independent third-party measure the cost-effectiveness of Focus on Energy programs each calendar year (CY). Additional guidance from the Commission received during Quadrennial Planning Process IV (QPP IV) directs Focus on Energy's third-party evaluator to review updated avoided costs annually,[2] as well as adopt an annually escalating carbon value in cost-effectiveness calculations.[3]

In the process of reviewing CY 2024 avoided cost updates, the evaluation team discovered that an incorrect input had been used in the calculation of CY 2023 avoided capacity values. The original workbook referenced the 2023 Narrow Constrained Area Mitigation Threshold Memo [4] Table 1, which informs regional mitigation threshold prices in terms of dollars per MWh, instead of the regional net revenue values in table note 3, which provide net revenues per kW-year. The difference was substantial enough to warrant recalculation of avoided capacity benefits, resulting in an increase in annual avoided capacity costs of approximately $48.29 per kW in CY 2023 (with total avoided capacity value changing from $129.04/kW to $177.33/kW). Revising this value in the CY 2023 mTRC test produces a cost-effectiveness result that is approximately 5% higher than the original estimate.

In the CY 2023 cost-effectiveness test, the evaluation team applied the updated QPP IV market value of carbon ($24.77/ton) to avoided carbon emissions produced across the entire lifetime of CY 2023 energy savings, consistent with the calculation approach applied in all previous quadrenniums. Following discussions with PSC staff and the program administrator, Quadrennium IV commission guidance regarding escalation of the carbon value was reviewed and reinterpreted to apply a 7% growth rate factor each year within the calculation of lifecycle benefits. For example, annual savings for a measure might extend for 12 years, in which first-year savings should be valued using $24.77/ton of avoided CO_2, while second-year savings would be valued at $26.50/ton, and so on. As with the other energy-based avoided costs, emissions are discounted annually by 2% under the Focus on Energy cost-effectiveness framework. Using this approach, the total value of avoided CY 2023 emissions increased from roughly $168M to more than $244M. This revision further increases the mTRC by roughly 11%, in addition to the 5% increase driven by adopting an updated avoided capacity benefit.

This addendum provides updated cost-effectiveness testing outcomes for the CY 2023 Focus on Energy portfolio, based on the application of the two adjustments described above. Descriptions of the cost-effectiveness tests, their inputs, and data sources presented in the revised Appendix I below are

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1 Wisconsin Administrative Code Chapter PSC 137, https://docs.legis.wisconsin.gov/code/admin_code/psc/137

2 QPP IV Final Decision of 11/14/2022, https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=453081

3 QPP IV Order of 12/21/2023, https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=487366

4 Narrow Constrained Area Mitigation Thresholds. Effective 6/5/2023, https://cdn.misoenergy.org/2023_NCA_Threshold_Update_FINAL629129.doc

unchanged from the CY 2023 Evaluation Report. Updated values accounting for the aforementioned adjustments are denoted by italicized table values.

Appendix I. Cost-Effectiveness and Emissions Methodology and Analysis

When developing potential offerings, APTIM, the Focus on Energy administrator, assesses the cost-effectiveness of offering designs prior to their implementation. The administrator, in collaboration with the Public Service Commission of Wisconsin (PSC) and the evaluation team, developed a cost-effectiveness calculator tool. Because maintaining consistency between planning and evaluation approaches is critical to understanding offering performance compared with expectations, the evaluation team used the same calculator to evaluate cost-effectiveness in CY 2023. These findings are presented in this appendix.

The PSC considers the modified total resource cost (TRC) test to be the primary test in assessing the cost-effectiveness of both individual offerings and the entire Focus on Energy portfolio.[5] The PSC also directs that three additional tests be conducted for advisory purposes. These are an expanded TRC test that includes net economic benefits, the utility administrator cost test (UAT), and the societal test. Beginning with the CY 2020 evaluation, the PSC approved the inclusion of the avoided costs associated with reduced needs for transmission and distribution (T&D) infrastructure.[6] This inclusion continued into Quadrennium IV.[7]

Net-to-gross (NTG) ratios can have a significant effect on the results of the tests. NTG ratios are applied to adjust the energy savings impacts of the offerings so they reflect only the net gains that result. Therefore, NTG ratios account for energy savings that would have been achieved without the efficiency offerings as well as participant spillover (when NTG is less than 1, savings are removed; when NTG is greater than 1, savings are added). In all cases, the savings are multiplied by NTG.

On the cost side, expenditures that would have occurred without the efficiency effort are also removed. Costs that would not have occurred in the absence of the offerings—such as delivery and administrative costs—are not impacted by NTG.

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[5] The use of the modified TRC test as the primary cost-effectiveness test is directed by the PSC. Public Service Commission of Wisconsin. September 3, 2014. Quadrennial Planning Process II – Scope. Order PSC Docket 5-FE-100, REF#: 215245. Order was updated on November 14, 2022. Quadrennial Planning Process IIV. Order PSC Docket 5-FE-104, REF#: 453081. http://apps.psc.wi.gov/vs2015/ERF_view/viewdoc.aspx?docid=453081.

[6] The calculation method and inclusion of avoided transmission and distribution costs are directed by the PSC. Public Service Commission of Wisconsin. March 10, 2021. Quadrennial Planning Process III. Order PSC Docket 5-FE-101, REF#: 406591. https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=406591.

[7] November 14, 2022. Quadrennial Planning Process IV. Order PSC Docket 5-FE-104, REF#: 453081. http://apps.psc.wi.gov/vs2015/ERF_view/viewdoc.aspx?docid=453081

Test Descriptions

The evaluation team, as well as the administrator in developing its cost-effectiveness calculator, use methods adapted from the California Standard Practice Manual, the conventional standard of cost-effectiveness analysis for energy efficiency programs in the United States.[8] This section describes the four tests—the modified TRC test, the expanded TRC test, the UAT, and the societal test.

Modified Total Resource Cost Test

The TRC test is the most commonly applied test for evaluating the cost-effectiveness of energy efficiency and renewable resource programs around the country. Applications range across states and utility jurisdictions, from the standard TRC test to the societal test, which expands the test inputs to provide a more holistic societal perspective. The TRC test includes total participant and administrator costs and estimates benefits in the form of avoided utility costs. Common modifications to the standard TRC test often involve reducing the discount rate or including various environmental and other non-energy benefits (such as emissions reduction benefits). Wisconsin's version of the modified TRC test accounts for the standard TRC test costs and benefits and is modified to also include monetized benefits of reduced emissions (carbon dioxide, sulfur oxide, and nitrogen oxide) due to saving energy.

In CY 2023, the evaluation team used the modified TRC test to determine if the offerings were cost-effective from a regulatory perspective (as directed by the PSC) and, where feasible, measured the overall impacts of the benefits and costs of these offerings on the State of Wisconsin. In general, the test compares all benefits and costs that can be measured with a high degree of confidence, including any net avoided emissions that have commission-established values. The test's purpose is to determine if the total costs residents, businesses, and Focus on Energy incur for operating the offerings are outweighed by the total benefits they receive.

In simple terms, the benefit/cost value of the modified TRC test is the ratio of avoided utility and environmental costs from avoided energy consumption to the combination of administrative costs, delivery costs, and net participant incremental measure costs.

The benefit/cost equation used for the modified TRC test is:

$$TRC\frac{B}{C} = \frac{[Value\ of\ Gross\ Saved\ Energy + Value\ of\ Gross\ Avoided\ Emissions] * NTG}{[Adminstrative\ Costs\ +\ Delivery\ Costs + (Incremental\ Measure\ Cost\ * NTG)]}$$

Where:

$$Value\ of\ Gross\ Saved\ Energy = Net\ Gross\ Savings\ x\ Utility\ Avoided\ Costs$$

[8] California Public Utilities Commission. July 2002. *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects*. http://www.calmac.org/events/SPM_9_20_02.pdf

Expanded Total Resource Cost Test with Net Economic Benefits

The evaluation team investigated the impact of expanding the TRC to include net economic benefits for the CY 2023 offerings. The evaluation team conducts an analysis of economic benefits every two years and issues the results separately from the evaluation reports.

This is the benefit/cost equation used for the expanded TRC test with net economic benefits:

$$TRC\frac{B}{C} = \frac{[(Value\ of\ Gross\ Saved\ Energy + Value\ of\ Gross\ Avoided\ Emissions) * NTG + Net\ Economic\ Benefits]}{[Adminstrative\ Costs\ +\ Delivery\ Costs + (Incremental\ Measure\ Cost\ * NTG)]}$$

Utility Administrator/Offering Administrator Cost Test (UAT)

The evaluation team also assessed the portfolio's cost-effectiveness using the UAT, which measures the net benefits and costs of the offerings as a resource option from the perspective of the Focus on Energy administrator. In Wisconsin, the UAT represents the collective perspectives of the participating utilities that hire and fund the administrator.

The UAT, previously called the revenue requirements test, effectively estimates the impacts on utility revenue requirements (the costs of providing service) by comparing the benefits of avoided utility costs from avoided energy consumption with the combined costs of operating the offering, such as incentive payments, administrative costs, and delivery costs. A positive benefit/cost ratio indicates that the offering improves an energy system's operational cost-effectiveness.

For this evaluation, the UAT's benefit/cost value indicates whether the combined revenue requirements from all participating utilities increase or decrease as a result of the Focus on Energy offerings. The net benefits determined with the UAT indicate the estimated dollar value of the change in the combined revenue requirements from all participating utilities. The NTG ratio impacts only the benefit side of the UAT because none of the costs would have occurred absent the effort and, therefore, all are kept in the test (not subtracted from the denominator).

The benefit/cost equation used for the UAT follows:

$$UAT\frac{B}{C} = \frac{[Value\ of\ Gross\ Saved\ Energy * NTG]}{[Participant\ Incentives +\ Adminstrative\ Costs\ +\ Delivery\ Costs]}$$

Societal Test (SCT)

In addition to the expanded TRC, the evaluation team investigated the impact of several non-energy benefits, such as health, water, purchase deferral, property value, and arrearage benefits, that are included in the CY 2023 offerings. These non-energy benefits are estimated for the purposes of reporting the results of the societal test.

The benefit/cost equation used for the societal test is the following:

$$SOC\frac{B}{C} = \frac{[(Value\ of\ Gross\ Saved\ Energy + Value\ of\ Gross\ Avoided\ Emissions) * NTG + Net\ Economic\ Benefits + NEBs]}{[Adminstrative\ Costs\ +\ Delivery\ Costs + (Incremental\ Measure\ Cost\ * NTG)]}$$

A more detailed discussion of the various non-energy benefits in the societal test is presented below.

Non-Energy Benefits

Table I-1 summarizes the non-energy benefits from the five metrics that were quantified in the societal test. The five metrics are health benefits, water benefits, purchase deferral benefits, property value benefits, and income-qualified arrearage benefits. Each benefit is further described in the following sections.

Table I-1. Non-Energy Benefits Results Summary

Benefit	Value	Unit
Health Benefit	$0.0326	per kWh
Water Benefits - Residential	$0.01033	per gallon
Water Benefits - Commercial	$0.00973	per gallon
Purchase Deferral	Measure specific	Measure specific
Property Values	$9,226	per home
Arrearages	$25.66	per participant

Health Benefits

The evaluation team estimated the value of health benefits accumulated by reduced emissions attributable to the offering activity. The team followed the method recommended by the U.S. Environmental Protection Agency (EPA) using the benefits per kilowatt-hour (BPK) tool. The EPA introduced the BPK tool in late fall 2019, using data from 2017, to help interested parties estimate health benefits from reduced emissions. The EPA last updated the tool in May 2021 using data from 2019. In 2023, a literature scan confirmed that the 2021 update remained the most up-to-date version.

The BPK tool relies on the AVoided Emissions and geneRation Tool (AVERT) regional inputs, which specify the blend of electric generation sources (coal, natural gas, hydroelectric, other renewables, etc.) and the downstream effects of particulate generation from those sources as determined in the Co-Benefits Risk Assessment (COBRA) health impacts screening and mapping tool.

BPK values are determined using the following equation:

$$BPK_{t,r} = \frac{HealthBenefits_{t,US}}{GenerationChange_{t,r}}$$

Where:

$BPK_{t,r}$ = Annual monetized public health benefits per kilowatt-hour (c/kWh) for each energy efficiency/renewable energy technology type (t) and AVERT region (r)

$Health\ Benefits_{t,US}$ = Aggregated monetized public health benefits from emissions reductions for each type of energy efficiency/renewable energy technology (t) for the contiguous United States (US) in 2019 dollars

Generation Change$_{t,r}$ = Change in electricity generation for each energy efficiency/renewable energy technology type (t) and AVERT region (r)

The effects of these emissions are then tied to the negative health outcomes associated with inhalation of those particulates. The in-depth methodology for the calculation of these benefits is available in a 2021 report on public health and energy from the EPA.[9] Figure I-1 shows a snapshot from the EPA's report for the included health inputs, along with the savings associated with each input.

Figure I-1. U.S. EPA Snapshot of Included Health Inputs

Health Endpoint	Age Range
Mortality[a]	25–99
Infant Mortality[b]	0–0
Acute Myocardial Infarction, Nonfatal[c]	0–24
Acute Myocardial Infarction, Nonfatal[c]	25–44
Acute Myocardial Infarction, Nonfatal[c]	45–54
Acute Myocardial Infarction, Nonfatal[c]	55–64
Acute Myocardial Infarction, Nonfatal[c]	65–99
Acute Myocardial Infarction, Nonfatal[d]	0–24
Acute Myocardial Infarction, Nonfatal[d]	25–44
Acute Myocardial Infarction, Nonfatal[d]	45–54
Acute Myocardial Infarction, Nonfatal[d]	55–64
Acute Myocardial Infarction, Nonfatal[d]	65–99
Hospital Admissions, All Cardiovascular (less-acute myocardinal infraction)	18–64
Hospital Admissions, All Cardiovascular (less-acute myocardinal infraction)	65–99
Hospital Admissions, All Respiratory	65–99
Hospital Admissions, Asthma	0–17
Hospital Admissions, Chronic Lung Disease	18–64
Asthma Emergency Room Visits (Smith et al. 1997)	0–99
Asthma Emergency Room Visits (Stanford et al. 1999)	0–99
Acute Bronchitis	8–12
Lower Respiratory Symptoms	7–14
Upper Respiratory Symptoms	9–11
Minor Restricted Activity Days	18–64
Work Loss Days	18–64
Asthma Exacerbation (cough, shortness of breath, or wheeze)	6–18

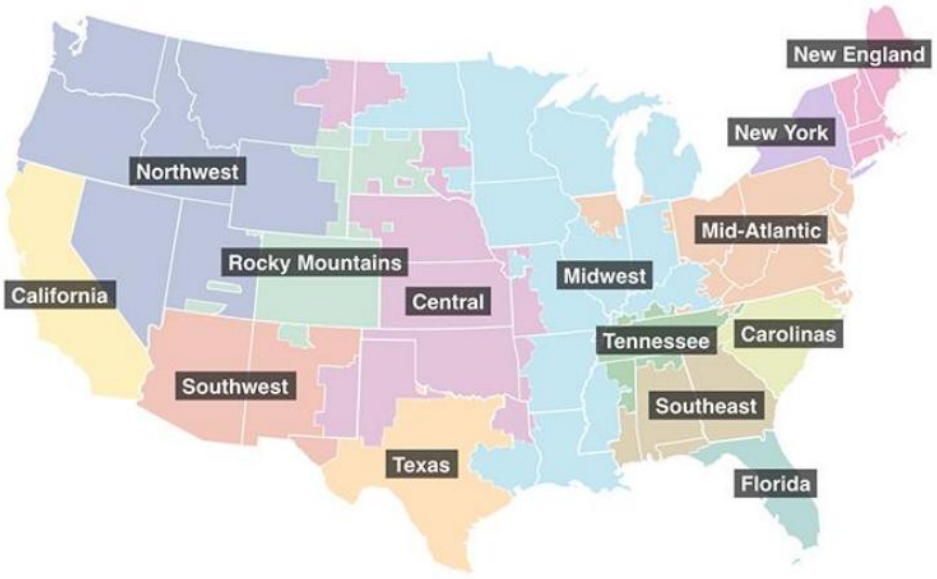
[a] Mortality value after adjustment for 20-year lag.
[b] Infant mortality value is not adjusted for 20-year lag.
[c] Based on Russell (1998).
[d] Based on Wittels (1990).

Source: U.S. Environmental Protection Agency

[9] U.S. Environmental Protection Agency. May 2021. *Public Health Benefits per kWh of Energy Efficiency and Renewable Energy in the United States: A Technical Report.* https://www.epa.gov/sites/default/files/2021-05/documents/bpk_report_second_edition.pdf

To determine Wisconsin-specific values, the evaluation team used the cost of emissions generated across the AVERT region that covers the state (Midwest, as shown in Figure). The team assumed a 2% discount rate to comply with decisions by the PSC for Quadrennial Planning Process IV, the current Focus on Energy period.

Figure I-2. EPA AVERT Regions



Source: U.S. Environmental Protection Agency.

The inputs specific to Wisconsin health benefits are a low estimate value of 3.26 cents/kWh, a median estimate of 5.23 cents/kWh, and a high estimate value of 7.01 cents/kWh, as presented in Table I-2. The evaluation team determined that the lowest value was the most appropriate to use because it provides the most conservative estimate of offering-induced health benefits.

Table I-2. Wisconsin-Specific Health Benefits

Region	Technology	Cents/kWh (Low Estimate)	Cents/kWh (Median Estimate)	Cents/kWh (High Estimate)
Midwest - Wisconsin	Uniform energy efficiency	3.26	5.23	7.01

The team generated aggregated health benefits by applying the 3.26 cents/kWh to the first five years of lifecycle program savings, a shorter period than claimed for lifetime emissions benefits in the modified TRC. This is in line with EPA recommendations not to extend savings beyond the five-year threshold because of the uncertainty in the share of generation each region is expected to draw from various fuel sources during that period and for the likelihood of revisions to health savings assumptions as the tool is regularly updated. For example, coal generation is expected to start being supplanted by natural gas and renewable sources, which are less polluting than coal and which may substantially reduce the risk of certain specific negative healthcare outcomes while leaving others unaffected.

However, the cents per kWh value used in societal test is only one among a wide potential range of estimates, depending on both BPK inputs and estimated EUL of program measures, which could represent the "real" health benefits accruing from Focus on Energy savings. In Table I-3, the team presents the results of varying the length of the EUL of benefit application, along with low, median, and high cents/kWh benefit assumptions.

Table I-3. Portfolio Health Benefits by Scenario

Scenario	Total Health Benefits (Low Estimate)	Total Health Benefits (Median Estimate)	Total Health Benefits (High Estimate)
5-Year EUL	$55,156,711	$88,487,606	$118,603,847
10-Year EUL	$105,250,523	$168,852,832	$226,320,909
Full Measure Life EUL	$178,610,604	$286,544,005	$384,067,587

Given the wide range of benefits, as the evaluation team begins research on updating the valuation of emissions benefits accruing from program activity, it will likewise re-evaluate and, if needed, update health benefits assumptions to accommodate a better understanding of the changing generation profile's impact on Wisconsin health outcomes in future years.

Water Benefits

The evaluation team estimated participant water delivery and wastewater bill savings attributed to reductions in volumetric water consumption accrued over the lifetime of efficient measures installed. These benefits are estimated for each offering by the following equation:

$$\sum_{Measure=1}^{n} Units_{Measure} \times PV(Water\ Savings\ Per\ Unit_{Measure} \times Marginal\ Cost\ of\ Water, EUL_{Measure})$$

Where PV indicates a present value function that takes annual bill savings and the number of periods as inputs, and n indicates the count of unique measures installed within a particular offering.

The marginal cost of water is then shown in this equation:

$$Marginal\ Cost\ of\ Water = (Marginal\ Cost\ of\ Water\ Delivery\ + Marginal\ Cost\ of\ Wastewater\ Service)$$

The evaluation team acquired input data from various sources:

- Measure quantity ($Units_{Measure}$) data were provided directly by Focus on Energy on an offering-by-offering basis.
- Volumetric water savings attributed to the efficient measure relative to some baseline measure ($Water\ Savings\ Per\ Unit_{Measure}$) were provided by Focus on Energy, which calculated the savings using the Wisconsin Technical Reference Manual (TRM). The evaluation team scaled the savings data by the NTG ratio for each offering.
- The water delivery rate ($Marginal\ Cost\ of\ Water\ Delivery$) was estimated using a weighted averaging algorithm from a sample of 25 water utilities in Wisconsin. This sample includes the 10 largest water utilities in Wisconsin, a random sample of 10 utilities from the smallest 50% of

utilities in Wisconsin, and a random sample of five additional utilities in Wisconsin, where size is measured by an average number of customers served.[10]

- From these 25 utilities, the evaluation team calculated average marginal (volumetric) delivery rates for each utility for both residential and commercial sectors by taking the arithmetic mean of the highest and lowest rate tiers charged by each utility.[11] The team then calculated overall rate estimates by taking weighted averages of these utility-specific averages for both residential and commercial sectors, where each utility's weight is proportional to the utility's average number of customers relative to the sum of each utility's average number of customers for all utilities included in the sample. The final water delivery rate estimates for Wisconsin are $3.96 and $3.91 per 100 cubic feet for residential and commercial sectors, respectively.

  Table I-4 summarizes the weighted averaging algorithm applied to residential rates in Wisconsin by showing intermediate calculation outputs.[12]

Table I-4. Residential Water Rate Algorithm Example

Utility Size Bracket	Rank by Gallons Sold	Utility Name	Average Number of Customers	Weight (Utility Customers/ Customers in Sample)	Highest/Lowest Tier Rates	Rate Average
Top 10	1	Milwaukee Water Works	160,775	33.74%	$2.46	$2.46
	2	Madison Water Utility	71,429	14.99%	Low: $4.60; High: $10.52	$7.56
	3	Racine Water Works Commission	34,493	7.24%	Low: $2.41; High: $3.11	$2.76
	4	Green Bay Water Utility	36,091	7.57%	Low: $1.89; High: $2.66	$2.28
	5	City of Oshkosh Water Utility	23,979	5.03%	Low: $4.26; High: $5.12	$4.69
	6	Janesville Water Utility	25,735	5.40%	Low: $2.19; High: $3.70	$2.95
	7	Appleton Water Department	28,334	5.95%	Low: $4.68; High: $6.08	$5.38
	8	Fond Du Lac Water Utility	16,315	3.42%	Low: $4.31; High: $4.74	$4.53

[10] Utility sales data was acquired from the PSC's E-Services Portal. The evaluation team used 2022 and 2023 water sales data. Public Service Commission of Wisconsin. March 2024. E-Services Portal: Municipal Annual Report Data. https://apps.psc.wi.gov/ARS/WEGSqueries/default.aspx

[11] Utility tariff data were acquired from the Public Service Commission of Wisconsin's E-Services Portal. Public Service Commission of Wisconsin. March 2024. E-Services Portal: Utility Tariffs. https://apps.psc.wi.gov/RATES/tariffs/default.aspx?tab=4

[12] Some participants obtain water from sources outside of conventional water delivery from a water utility, such as from natural bodies of water. These participants are not subject to the same marginal cost of delivery charged by water utilities. Because of an inability to reliably identify the source of water saved by program participants, the evaluation team conservatively assumes a water bill savings of $0 for those larger customers.

Utility Size Bracket	Rank by Gallons Sold	Utility Name	Average Number of Customers	Weight (Utility Customers/ Customers in Sample)	Highest/Lowest Tier Rates	Rate Average
	9	City of Waukesha Water Utility	20,749	4.35%	Low: $5.82; High: $9.64	$7.73
	10	Kenosha Water Utility	31,406	6.59%	Low: $1.76; High: $2.26	$2.01
Random Sample of 10 from Smallest 50%	338	Crandon Water and Sewer Utility	745	0.16%	Low: $2.65; High: $3.92	$3.28
	365	Arlington Water Utility	323	0.07%	$11.41	$11.41
	392	Hixton Municipal Water Utility	209	0.04%	Low: $6.12; High: $6.95	$6.54
	402	Town of Farmington Sanitary District	300	0.06%	Low: $5.35; High: $9.00	$7.18
	404	Lannon Municipal Water Utility	486	0.10%	$5.54	$5.54
	426	Clyman Utility Commission	141	0.03%	$1.22 Low:; High: $1.58	$1.40
	507	Loganville Municipal Water and Sewer Utility	144	0.03%	$5.12	$5.12
	508	Lowell Municipal Water And Sewer Utility	117	0.02%	$6.90	$6.90
	515	Stone Lake Sanitary District	140	0.03%	$4.60	$4.60
	535	Town of Knight Municipal Water Utility	114	0.02%	Low: $5.68; High: $6.04	$5.86
Random Sample of Five from Through-out	97	Brookfield Municipal Water Utility	13,196	2.77%	Low: $3.95; High: $4.80	$4.38
	157	Village of Pewaukee Water Utility	2,178	0.46%	Low: $3.20; High: $3.85	$3.47
	175	Ripon Water Utility	3,095	0.65%	Low: $1.63; High: $2.14	$1.89
	253	Redgranite Water Utility	434	0.09%	Low: $1.88; High: $2.15	$2.02
	451	Village of Allouez Water	5,567	1.17%	Low: $6.35; High: $10.30	$8.33
Final Rate Estimate						**$3.96**

- The wastewater service rate ($Marginal\ Cost\ of\ Wastewater\ Service$) estimate was constructed from a population-weighted average of marginal (volumetric) wastewater charges for 326 (41%) Wisconsin wastewater service territories. The evaluation team acquired population and volumetric charge data from the Wisconsin Sewer User Charge Survey Report.[13] The final water wastewater estimate is $3.77 per 100 cubic feet for both residential and commercial. This estimate accounts for the prevalence of utilities with no volumetric

[13] MSA Professional Services, Inc. October 2019. *The Cost of Clean: Wisconsin Sewer User Charge Survey Report.*

wastewater charge. The team used the same values and method as in 2019 due to a lack of updated data on wastewater service rates for 2023.

- The evaluation team conducted a well water pump analysis to estimate the water delivery rate for the population that uses privately owned wells and pump systems rather than being connected to the municipal system. According to the research, 31% of the Wisconsin population uses privately owned wells.[14] The team applied a weighted average to the water delivery rates to reflect both water delivery types and calculated the water delivery rate for residential as $0.00569 per gallon.
- The commercial sector costs of $3.37 for delivery and $3.24 for wastewater per 100 cubic feet of water equates to $0.0053 per gallon. This figure does not assume any well water for commercial use.
- The expected useful life of an efficient measure ($EUL_{Measure}$) was provided by the TRM.
- The evaluation team assumed a real annual interest rate of 2%.

Purchase Deferral

Purchase deferral benefits account for the avoided costs of future baseline measure replacement in cases where the useful life of an efficient measure exceeds the useful life of the baseline measure it replaces. The evaluation team estimated purchase deferral benefits for lighting and non-lighting measures.

Lighting

The team estimated purchase deferral benefits for lighting measures on an EUL basis, where the lifetime of efficient measures (fixtures and lamps) tends to exceed that of their corresponding baseline measures.

The evaluation team assumed that participants of Focus on Energy offerings would have replaced each baseline measure with an identical baseline or equivalent at regular intervals equal to the baseline measure's useful life. Purchase deferral benefits are estimated for each offering by the following generalized expression:

$$\sum_{Measure=1}^{n} Units_{Measure} \times PV(Avoided\ Replacement\ Costs_{Measure})$$

Where PV indicates a present value function and $Avoided\ Replacement\ Costs$ refers to the value of avoided baseline measure replacements over the lifetime of the efficient measure.

For each efficient measure installed, the evaluation team attempted to identify a corresponding baseline measure from the Mid-Atlantic TRM, which contains a study of purchase deferral benefits for lighting

[14] Wisconsin Department of Natural Resources. *Wisconsin Public Water Systems 2020 Annual Drinking Water Report.* June 2021. https://dnr.wisconsin.gov/sites/default/files/topic/DrinkingWater/2020AnnualDrinkingWaterReport.pdf

measures.[15] Where available, the team used the present value of purchase deferral benefits provided explicitly by the Mid-Atlantic TRM.

In cases where the Mid-Atlantic TRM did not provide purchase deferral benefit estimates or the efficient measure installed through a Focus on Energy offering was not an exact match, the team conducted research to identify the EUL (in life-hours and years) and the cost of the baseline measure indicated in the TRM. The team used these two inputs to estimate benefits accrued from each avoided baseline replacement over the lifetime of the efficient measure, reduced by the Focus on Energy discount rate of 2%. The implementation of the full Energy Independence and Security Act (EISA) in 2023 greatly reduced the theoretical benefits from purchase deferral, as most short-lived screw-based incandescent and halogen lamps were no longer available for purchase, and as the Focus on Energy portfolio largely phased out incenting most screw based LED lighting measures.

Non-Lighting

The evaluation team estimated purchase deferral benefits for non-lighting measures on an equipment maintenance cost deferral basis. The team leveraged EUL benchmarking data for the period of July 2020 to June 2021 to prioritize significant non-lighting measures based on the MMBtu saving contribution. For the identified measures, the team reviewed the Non-Energy Impacts study in the Mass Save TRM.[16] Benefits arising from equipment maintenance costs were reviewed for available measures.

Based on the aforementioned sources, the team estimated purchase deferral benefits for the following non-lighting measures:

- Residential boilers
- Residential furnaces
- Residential thermostats
- Residential/retail ductless mini-split heat pumps

Based on the sourced data, the evaluation team estimated benefits accrued from avoided equipment maintenance costs over the lifetime of the non-lighting measure and applied the Focus on Energy discount rate of 2%.

Finally, the evaluation team scaled the calculated savings by the NTG ratio for each offering.

Property Values

Participating in energy efficiency programs can increase the value of a home and the associated property. Customers who participate in whole-home programs, such as Home Performance with ENERGY STAR, are most likely to see increases in property values.

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[15] Northeast Energy Efficiency Partnerships. October 2019. *Mid-Atlantic Technical Reference Manual, Version 9.* https://neep.org/sites/default/files/resources/Mid_Atlantic_TRM_V9_Final_clean_wUpdateSummary%20-%20CT%20FORMAT.pdf

[16] Non-Energy Benefits. *Massachusetts Technical Reference Manual.* May 2020. https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/12190505

In 2012, Cadmus completed a study for People Working Cooperatively (PWC), a provider of whole-home weatherization for low-income individuals in Cincinnati, that researched the impact of low-income whole-home weatherization programs on home value.[17] Through this study, Cadmus found a $7,000 increase in property value for participants in the PWC program compared with nonparticipants with similar homes. A more recent study done in 2021 by Oak Ridge National Laboratory confirms that a whole-home weatherization project would increase property value for low-income customers.[18] Though these studies were specific to low-income customers, the team maintains that the increase in property value can be applied to all customers who complete a whole-home weatherization project.

Many factors can impact home value, which makes it difficult to measure this benefit. To adjust for inflation from 2012, the net present value (NPV) of $7,000 is calculated as $9,226 per home. Therefore, for Wisconsin Focus on Energy, the evaluation team used an NPV benefit of $9,226 per whole-home participant (both Tier 1 and Tier 2) of the Insulation and Air Sealing offering within Trade Ally Solutions (formerly Home Performance with ENERGY STAR Program).

Arrearages

Outstanding customer debt incurs costs to the utility and the customer, including the costs associated with financing (carrying costs, bad debt write-offs), shutoffs, reconnections, sending notices, and collecting debts. Low-income programs provide customers with the opportunity to reduce monthly bills, which in turn lowers the probability they will carry debt and, among those who do carry debt, helps reduce the overall total.

Several utilities have included the reduced arrearage costs associated with providing low-income program benefits in their societal tests. However, there does not appear to be a universally agreed-upon per-participant value associated with these benefits. Limited primary research is available, but what does exist is not recent. Nevertheless, the evaluation team reviewed two benchmarking analyses (Skumatz Economic Research Associates, Inc., and Cadmus in 2010 and Skumatz Economic Research Associates, Inc., 2014[19,20]), which compiled several potential inputs related to the utility benefits associated with low-income programs.

The 2014 study found a typical arrearage-related carrying cost of $2.50 per participant, with an additional $1.75 associated with the paying of bad debt and $2.15 in total costs from shutoffs and reconnects, notices, and customer calls/collections. These direct arrearage costs sum to $6.40. An

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17 Cadmus. December 2012. *PWC 2009 Ohio Program Services Evaluation Report.* Prepared for People Working Cooperatively. http://www.pwchomerepairs.org/Assets/PWC_2009_Evaluation_FIN/AL_DEC12.pdf

18 Oak Ridge National Laboratory. March 2021. *Addressing Non-Energy Impacts of Weatherization.* ORNL_SPR-2020_1840.pdf

19 Skumatz Economic Research Associates, Inc., and Cadmus. 2010. *Non Energy Benefits: Status, Findings, Next Steps, and Implications for Low Income Program Analyses in California – Revised Report.*

20 Skumatz Economic Research Associates, Inc. 2014. *Non-Energy Benefits / Non-Energy Impacts (NEBS/NEIS) and Their Role & Values In Cost-Effectiveness Tests: State Of Maryland.*

additional $13 per customer was also attributed to reduced low-income subsidy payments and discounts if the program was strictly low-income. Figure I-3 shows a snapshot of the study's findings.

Figure I-3. Typical Utility Costs Associated with Customer Debt

NEB Estimates from Multiple Weatherization Studies: Dollar and Percentage Analysis	Dollar NEB Values Range Low-High	Typical Value	Percent NEB Values Range Low-High	Typical Value	Notes
UTILITY PERSPECTIVE					
Payment-related					
Carrying cost on arrearages	$1.50 - $4.00	$2.50	0.6% - 4.4%	2.0%	Total arrearages $2-$100; $20-30 typical
Bad Debt Write-offs	$0.50 - $3.75	$1.75	0.4% - 2.0%	0.7%	
Reduced LI subsidy pymt/discounts	$3.00 - $25.00	$13.00	3.9% - 29.0%	16.4%	IF low income program
Shutoffs / Reconnects	$0.10 - $3.65	$0.65	0.1% - 4.4%	0.5%	
Notices	$0.05 - $1.50	$0.60	0.1% - 1.8%	0.9%	
Customer calls / collections	$0.40 - $1.60	$0.90	0.2% - 1.9%	0.6%	

Source: Skumatz Economic Research Associates, Inc., 2014

Therefore, for Focus on Energy, the evaluation team recommends that a per-participant value of $25.49 ($19.40 from 2014 adjusted for inflation) be applied to Tier 2 customers in the Insulation and Air Sealing offering in Trade Ally Solutions based on the results of the most direct benchmarking research available.

The evaluation team reviewed other, more recent evaluations of the impact of various program designs on the amount of debt participants carry. One of these programs, a prepayment program in the upper Midwest, showed evidence that customers were able to eliminate approximately $68 in total debt after participating in the program for at least one calendar year. However, key differences between that program design and the low-income offerings in Wisconsin make direct comparisons difficult. These differences include the targeting and/or opening of that offering to customers who are not low-income. That is, the total debt paid off through that prepayment program is not necessarily comparable to the debt held by strictly low-income customers in Focus on Energy's offerings in Wisconsin.

Interpreting Test Results

No single benefit/cost test can provide a comprehensive understanding of program performance or impacts in isolation. The results of tests that measure overall program cost-effectiveness, such as the modified TRC test, should be reviewed along with the results of other tests, such as the UAT. Such a multi-perspective approach warrants a clear understanding of the tradeoffs among the tests.

Test results summarize the impact of the Focus on Energy portfolio of programs from different perspectives, with test scores above 1.0 indicating that portfolio benefits outweigh the costs associated with generating those benefits. A modified TRC test score above 1.0 suggests that Focus on Energy is providing a net benefit, with energy and emissions benefits weighed against administrator and participant costs. The UAT score above 1.0 suggests that administrator costs, including incentives and program management and implementation, are outweighed by the avoided energy and capacity benefits. The expanded TRC and SCT compare the same system-wide costs as the modified TRC against those same benefits, with additional benefits accruing from economic activity and non-energy benefits also included.

Because of changes in avoided electric energy and natural gas costs and in emissions allowance prices for Quadrennium IV, the cost-effectiveness results reported for Focus on Energy here are not directly

comparable with results from the CY 2019-CY 2022 quadrennium. The changes to avoided costs decreased the benefit/cost test results across all offerings when compared with the avoided costs used in the previous quadrennium. This was particularly substantial for electricity generation and capacity benefits.

Additionally, starting in CY 2023, Market Effects for Residential New Construction (RNC) and Residential Retail programs were included in overall net savings. As a result, the results of those programs are not comparable between years. For example, the exclusion of Market Effects results in a modified TRC of 0.80 for the RNC Program, but with their inclusion, the modified TRC increases to 14.5. In CY 2022, program results excluded market effects, and the RNC program modified TRC was 0.31.

Energy Avoided Costs

The PSC established the methodology to estimate electric and natural gas avoided energy costs for quadrennium IV under PSC docket 5-FE-104 (PSC REF#: 453081). The approach represents a continuation of the avoided cost methodology previously used in Quadrenniums II and III. The source for electric energy avoided costs is based on the Midcontinent Independent Transmission System Operator (MISO) forecasted locational marginal price (LMP), that is, the average of LMPs across Wisconsin nodes. Avoided natural gas costs are calculated based on Energy Information Administration 2023 Annual Energy Outlook forecasts of Henry Hub prices, adjusted using Wisconsin City Gate prices and retail prices.

Compared with the previous quadrennium, avoided electricity generation costs calculated using updated price forecasts for the current quadrennium evaluation are lower by approximately 5% to 8% in early years (CY 2023 to CY 2026), to more than 60% in the furthest out years (CY 2040 to CY 2050). The primary driver of the lower trend in avoided electric energy costs is the anticipated ramp-up of zero-fuel-cost renewable energy sources, particularly grid-scale solar, in MISO's most recent forecast modeling. Changes to avoided natural gas and avoided T&D benefits were also lower than in the previous quadrennium.

The PSC established the step-by-step methodology to estimate avoided electric capacity costs for the current quadrennium under PSC docket 5-FE-104 (PSC REF#: 453081).[21] The approach relies upon MISO-established Cost of New Entry (CONE) values as well as MISO Narrow Constrained Area net revenues to calculate avoided capacity costs. This methodology aligns with the PSC's decision for the CY 2019-CY 2022 quadrennium that, for the purposes of evaluating Focus on Energy, avoided capacity costs shall be based on the unit costs of a peaker plant.

The forecast model decreases the verified gross energy savings by the conventional attribution factor of NTG to derive net savings. The net savings are then increased by the line loss factor of 8% to account for avoided distribution losses. Table I-5 shows the assumptions for the CY 2022 (the final year of Quadrennium III of Focus on Energy) and CY 2023 (the first year of Quadrennium IV of Focus on Energy)

[21] Public Service Commission of Wisconsin. November 14, 2022. Quadrennial Planning Process IV. Order PSC Docket 5-FE-104, REF#: 453081. https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=453081

evaluation avoided costs used for the cost-effectiveness tests. Table I-6 shows avoided electric generation costs, Table I-7 shows avoided electric capacity costs, and Table I-8 shows avoided natural gas costs for 2023 through 2050.

Table I-5. REVISED Avoided Costs Summary

Avoided Cost	CY 2022	CY 2023
Electric Energy ($/kWh)[a]	$0.03093–$0.05429	$0.0299–$0.0210
Electric Capacity ($/kW year)	$131.38–$182.67	*$177.33–$194.34*
Gas ($/therms)	$0.546–$0.797	$0.463–$0.621
Transmission and Distribution ($/kW year)	$66.47–$68.88	$49.25–$54.29
Avoided Cost Inflation	0%	0%
Real Discount Rate	2%	2%
Line Loss	8%	8%

[a] The CY 2023 cost-effectiveness analyses used a time series that deflates from $0.0299 to $0.0210 over 25 years in the forecast model.

Table I-6. Avoided Electric Generation Costs

Year	Avoided Generation ($/kWh-Yr)	Year	Avoided Generation ($/kWh-Yr)
2023	$0.0299	2039	$0.0158
2024	$0.0292	2040	$0.0161
2025	$0.0286	2041	$0.0165
2026	$0.0280	2042	$0.0168
2027	$0.0273	2043	$0.0171
2028	$0.0267	2044	$0.0175
2029	$0.0260	2045	$0.0178
2030	$0.0254	2046	$0.0182
2031	$0.0248	2047	$0.0185
2032	$0.0241	2048	$0.0189
2033	$0.0223	2049	$0.0192
2034	$0.0205	2050	$0.0196
2035	$0.0187	2051	$0.0199
2036	$0.0169	2052	$0.0203
2037	$0.0151	2053	$0.0206
2038	$0.0154	2054	$0.0210

Table I-7. REVISED Avoided Electric Capacity Costs

Year	Avoided Capacity Cost ($/kW-Yr)	Year	Avoided Capacity Cost ($/kW-Yr)
2023	*$177.33*	2039	*$173.64*
2024	*$176.06*	2040	*$174.97*
2025	*$174.29*	2041	*$176.31*
2026	*$172.53*	2042	*$177.66*
2027	*$170.77*	2043	*$179.01*
2028	*$169.02*	2044	*$180.37*
2029	*$167.27*	2045	*$181.73*
2030	*$165.54*	2046	*$183.11*
2031	*$163.80*	2047	*$184.49*
2032	*$172.55*	2048	*$185.87*
2033	*$172.22*	2049	*$187.27*
2034	*$171.91*	2050	*$188.67*
2035	*$171.59*	2051	*$190.07*
2036	*$171.29*	2052	*$191.49*
2037	*$170.99*	2053	*$192.91*
2038	*$172.31*	2054	*$194.34*

Table I-8. Avoided Natural Gas Costs

Year	Avoided Natural Gas Cost ($/kW-Yr)	Year	Avoided Natural Gas Cost ($/kW-Yr)
2023	$0.463	2039	$0.571
2024	$0.451	2040	$0.571
2025	$0.464	2041	$0.571
2026	$0.480	2042	$0.568
2027	$0.490	2043	$0.564
2028	$0.511	2044	$0.564
2029	$0.530	2045	$0.565
2030	$0.538	2046	$0.567
2031	$0.541	2047	$0.571
2032	$0.551	2048	$0.579
2033	$0.561	2049	$0.588
2034	$0.566	2050	$0.595
2035	$0.569	2051	$0.601
2036	$0.569	2052	$0.608
2037	$0.568	2053	$0.614
2038	$0.571	2054	$0.621

Avoided Transmission and Distribution Costs

In its Final Decision of June 1, 2020, the PSC directed the Evaluation Work Group (EWG) to propose to the PSC a method for calculating avoided T&D costs to be used for the purpose of evaluating Focus on Energy (PSC REF#: 390566). In its Final Decision of March 10, 2021, the PSC approved the EWG's recommended methodology to estimate avoided electric T&D costs for Quadrennium III under PSC docket 5-FE-101 (PSC REF#: 406591), with the direction to incorporate avoided T&D costs into a parallel analysis of benefits achieved by Focus on Energy offerings in Quadrennial Planning Process III and to revisit avoided T&D costs in the Quadrennial Planning Process IV.

As stated in the commission order:[22]

> "In order to reduce the year-to-year variability of the costs, a four-year running average of the total miles and the annualized cost per mile per kW-Year are multiplied to get the average cost per kW-Year. For projecting values in future years, this approach escalates the most recent average Midcontinent Independent System Operating (MISO) Cost of New Entry (CONE) value by a growth factor that takes into account inflation and construction costs. The growth factor is calculated by taking the four-year average of construction cost growth as determined by the Wisconsin Department of Transportation in the Chained Fisher Construction Cost Index, and subtracting inflation (U.S. Bureau of Labor Statistics Consumer Price Index, Midwest Region[23]), over the same period."

Following the approval for calculating avoided T&D costs, the evaluation team, using the method specified above, established estimated avoided T&D costs per kW for each year from CY 2018 to CY 2051. Table I-9 lists these values, which are based on the PSC's Order in docket 5-FE-101.[24]

T&D benefits were reviewed during the Quadrennial Planning Process IV (PSC Docket 5-FE-104). In its Final Decision in Quadrennial Planning Process IV, the PSC directed the Focus on Energy EWG, or EWG and a third-party, to propose a recommendation to the Commission that would revise the methodology for calculating avoided T&D benefits.[25] The evaluation team is currently researching a new T&D benefits calculation methodology, and the EWG will likely approve a revised methodology in the coming year. The T&D values in Table I-9 are likely to be updated in the current quadrennium.

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[22] Public Service Commission of Wisconsin. March 10, 2021. Quadrennial Planning Process III. Order PSC Docket 5-FE-101, REF#: 406591. https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=406591.

[23] Bureau of Labor Statistics Midwest CPI Summaries available here: Midwest CPI Summaries : Midwest Information Office : U.S. Bureau of Labor Statistics (bls.gov)

[24] Public Service Commission of Wisconsin. January 20, 2021. Quadrennial Planning Process III. Order PSC Docket 5-FE-101, REF#: 403255. https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=403255

[25] Public Service Commission of Wisconsin. November 14, 2022. Quadrennial Planning Process IV. Order PSC Docket 5-FE-104, REF#: 453081. https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=453081

Table I-9. Calculated and Forecasted Avoided T&D Costs

Year	Avoided T&D Cost ($/kW-Yr)	Year	Avoided T&D Cost ($/kW-Yr)
2023	$49.25	2039	$50.12
2024	$48.98	2040	$50.35
2025	$48.78	2041	$50.60
2026	$48.65	2042	$50.85
2027	$48.58	2043	$51.11
2028	$48.55	2044	$51.38
2029	$48.56	2045	$51.65
2030	$48.62	2046	$51.93
2031	$48.70	2047	$52.21
2032	$48.81	2048	$52.49
2033	$48.95	2049	$52.78
2034	$49.10	2050	$53.07
2035	$49.28	2051	$53.37
2036	$49.47	2052	$53.67
2037	$49.67	2053	$53.98
2038	$49.89	2054	$54.29

Emissions Benefits

The modified TRC benefit/cost calculations include the benefit of avoiding three air pollutants that are regulated under the Clean Air Act. These are carbon dioxide, sulfur dioxide, and nitrogen oxide. Determining the emissions benefits requires three key parameters: lifecycle net energy savings, emissions factors or a tool that uses emissions factors, and the dollar value of the displaced emissions.

Emissions factors are the rate at which the criteria pollutants are emitted per unit of energy generated and are most often expressed in tons of pollutant per energy unit. Electric is in tons/megawatt hour (MWh), and gas is in tons/thousand therms (MThm). The product of the emissions factor and the net energy savings is the total weight of air pollutants offset or avoided by the program.

The product of the total tonnage of pollutant saved and the discounted annual dollar value of the reduced emissions per ton is, therefore, the avoided emissions benefit, as shown in this equation:

$$Value\ of\ Avoided\ Emissions = \sum_{Years=MeasureEUL}^{n} PV\ (Annual\ Emissions\ Factor * Annual\ Emissions * Annual\ Market\ Value\ of\ Emissions)$$

For CY 2023, the evaluation team assessed the electric emissions benefits for Focus on Energy using AVERT, a tool developed by the EPA to calculate avoided emissions from renewable energy and energy efficiency programs. AVERT is a spreadsheet-based model that uses historical hourly generation and emissions data to determine the individual power plants that are likely to be displaced by energy efficiency or renewable energy during each hour of the year.

To use AVERT to calculate electric emissions benefits, the lifecycle net electric savings for Focus on Energy needed to be attributed to an AVERT region. Previously, Wisconsin was allocated to two regions; however, in 2020, the EPA revised its regions, and now Wisconsin falls into a single region.

Savings for Focus on Energy offerings are run through a region-specific version of AVERT to calculate the electric emissions benefits per offering. AVERT uses a model from the previous year to compare the electricity generation avoided by the Focus on Energy offerings during each hour of the year with the hourly generation information to determine the quantity of emissions displaced.

Table I-10 lists the gas emissions factor and allowance prices. For CY 2023, the electric emissions scalar was 793 tons of carbon dioxide per GWh. Note that this can be used to estimate avoided tons of carbon from electric savings; however, it is not exact, will not apply for any other years or regions, and will vary in results based on input GWh.

Table I-10. Emissions Factors and Allowance Price

Service Fuel Type	Carbon Dioxide	Nitrogen Oxide	Sulfur Dioxide
Electric Emissions Factor (Tons/MWh)	0.793	0.0005	0.0004
Gas Emissions Factor (Tons/MThm)	5.85	N/A	N/A
Allowance Price ($/Ton)	$24.77	$7.50	$2

For CY 2023, as in previous years, the evaluation team continued to obtain allowance prices for nitrogen oxide and sulfur dioxide emissions from the EPA's Cross State Air Pollution Rule, most recently updated in 2023.[26] The team used the carbon dioxide emissions price in the PSC's Order, docket 5-FE-104, PSC REF#: 487366, which states, "For the purposes of evaluating Focus in Quad IV, a starting point market-based value of $24.77 per ton of avoided carbon emissions is reasonable and in the public interest."[27] Further, this value will increase by 7% in each year of Quad IV.

The natural gas emissions factor has remained constant since the CY 2011 evaluation report and is derived from a best practice greenhouse gas inventory method developed by the California Energy Commission.[28]

Table I-11 lists the total avoided emissions by gas type in tons.

[26] Progress Report - Program Compliance and Market Activity | US EPA. https://www.epa.gov/power-sector/progress-report-program-compliance-and-market-activity

[27] Public Service Commission of Wisconsin. June 6, 2018. Quadrennial Planning Process IV. Order PSC Docket 5-FE-104, REF#: 487366. https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=487366

[28] California Air Resources Board. 2019. *California Greenhouse Gas Emissions for 2000 to 2017.* https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2017/ghg_inventory_trends_00-17.pdf

Table I-11. Total Emissions Benefits by Gas Type

Year	Carbon Dioxide	Nitrogen Oxide	Sulfur Oxide
CY 2022 Tons of Emissions Avoided	6,241,182	3,003	4,008
CY 2023 Tons of Emissions Avoided	6,844,843	2,437	3,006

Table I-12 lists the emissions benefits for all programs by segment. The substantial increase in relative benefits between CY 2022 and CY 2023is primarily due to the increase in per-ton emissions benefits, which grew from $15 in CY 2022 to a first year value of $24.77 in CY 2023, which is then increased by 7% per year over the full measure life of all measures in the portfolio. Additionally, proportionally higher natural gas savings in CY 2023 compared to CY2022 resulted in somewhat higher emissions reductions over the years, as the overall emissions factor for electricity generation has decreased slightly, but the natural gas emissions factor has remained unchanged.

Table I-12. REVISED Total Emissions Benefits by Segment

Year	Residential	Nonresidential	Midstream [a]	Total [b]
CY 2022 Emissions Benefits	$24,980,488	$59,520,395	$737,740	**$93,649,181**
CY 2023 Emissions Benefits	*$48,554,654*	*$187,153,229*	*$9,005,016*	***$244,712,899***

Offering Costs

Focus on Energy's fiscal agent, the accounting firm Wipfli, provided the CY 2023 offering costs to the evaluation team, which represent all costs associated with running the efficiency offerings (including administration and delivery costs). Note that incentive costs are not included as TRC costs because they are deemed transfer payments, which is consistent with industry guidelines defining the TRC test. Incentive costs, however, are used for other tests, such as the UAT.

Incremental Costs

The gross incremental costs are the additional costs incurred by participants as a result of purchasing efficient equipment over and above a baseline non-qualified product. The evaluation team derived the gross incremental cost values used in this CY 2023 evaluation from the incremental cost study conducted by the administrator, implementers, and evaluation team in CY 2023. This study established up-to-date incremental costs for all measures based on the best available data, including historical Focus on Energy program data and independent research from other state programs.

Wisconsin Bill Payer Impacts

The evaluation team determined average annual and projected lifetime values in total bill savings attributable to reductions in energy consumption due to program behavior. These results, shown in Table I-13, were not applied to any cost-effectiveness test, but are provided here for informational purposes. To calculate bill impacts, the evaluation team collected annual 2023 residential and nonresidential electricity rates from utility websites for Alliant Energy, WPL, WE Energies, Madison Gas and Electric, Upper Peninsula Power Company, Xcel Energy (Northern States Power), and Wisconsin Public Service Corporation. Annual 2023 Natural Gas rates were gathered from the Energy Information

Administration (EIA) website.[29] Rates are then weighted using the same population-based ratios as were applied to develop avoided electric generation costs.

Table I-13. Bill Savings Inputs

	Weighted Average Rate ($/kWh or Therms)	Annual Net Bill Savings	Average Measure Life	Total Projected Lifetime Bill Savings
Residential Rate (kWh)	$0.1480	$9,663,757	11	$96,177,879
Nonresidential Rate (kWh)	$0.1379	$40,137,408	16	$553,573,448
Residential Rate (Therms)	$1.0530	$7,304,619	15	$91,688,000
Nonresidential Rate (Therms)	$0.8324	$11,799,429	15	$155,567,783

Cost-Effectiveness Results by Test

Table I-14 presents the inputs and results from the modified TRC test for the Focus on Energy CY 2023 energy efficiency and renewable resource portfolio. Application of the modified TRC test showed that net statewide benefits to residents, businesses, and Focus on Energy from the CY 2023 offerings were $444,006,753.

Table I-14. REVISED CY 2023 Sector-Level and Overall Results, Modified Total Resource Cost Test

	Residential	Nonresidential	Midstream	Total
Administrative Costs	$1,089,405	$1,632,259	$180,821	$2,902,485
Delivery Costs	$10,527,443	$20,066,587	$1,760,187	$32,354,216
Incremental Measure Costs	$93,683,658	$146,546,603	$6,383,948	$246,614,209
Total TRC Costs	**$105,300,506**	**$168,245,449**	**$8,324,956**	**$281,870,910**
Electric Benefits (kWh)	$15,285,221	$103,574,468	$4,832,685	$123,692,374
Capacity Benefits (kW)	*$33,863,255*	*$126,768,248*	*$1,988,873*	*$162,620,376*
Gas Benefits	$36,558,418	$98,380,352	$13,468,326	$148,407,096
Emissions Benefits	*$48,554,654*	*$187,153,229*	*$9,005,016*	*$244,712,899*
T&D Benefits	$9,669,618	$36,214,570	$560,731	$46,444,919
Total TRC Benefits	***$143,931,166***	***$552,090,867***	***$29,855,631***	***$725,877,664***
TRC Benefits Minus Costs	***$38,630,660***	***$383,845,418***	***$21,530,675***	***$444,006,753***
TRC Benefit/Cost Ratio	***1.37***	***3.28***	***3.59***	***2.58***

Table I-15 presents the inputs and results from the expanded TRC test for the Focus on Energy CY 2023 energy efficiency and renewable resource portfolio. The expanded TRC test includes economic benefits from the portfolio. As expected, the inclusion of economic benefits increases the expanded TRC score substantially from the modified TRC.

[29] Retrieved April 9, 2024. https://www.eia.gov/dnav/ng/NG_PRI_SUM_DCU_SWI_A.htm

Table I-15. REVISED CY 2023 Overall Results, Expanded Total Resource Cost Test

	Total
Administrative Costs	$2,902,485
Delivery Costs	$32,354,216
Incremental Measure Costs	$246,614,209
Total TRC Costs	**$281,870,910**
Electric Benefits (kWh)	$123,692,374
Capacity Benefits (kW)	*$162,620,376*
Gas Benefits	$148,407,096
T&D Benefits	$46,444,919
Emissions Benefits	*$244,712,899*
Economic Benefits[a]	$444,835,241
Total TRC Benefits	***$1,170,712,905***
TRC Benefits Minus Costs	***$888,841,994***
TRC Benefit/Cost Ratio	***4.15***

[a] Cadmus. May 8, 2024. *Focus on Energy 2019-2022 Quadrennium Economic Impacts.* 2019-2022 Quad Economic Impacts Final Report (focusonenergy.com)

Table I-16 presents the inputs and results from the UAT for the CY 2023 Focus on Energy portfolio. The results indicate that the benefits generated by the portfolio far outweighed the combined costs of operating the programs.

Table I-16. REVISED CY 2023 Overall Results, Utility Administrator Cost Test

	Residential	Nonresidential	Midstream	Total
Incentive Costs	$22,650,877	$28,712,721	$3,744,005	$55,107,604
Administrative Costs	$1,089,405	$1,632,259	$180,821	$2,902,485
Delivery Costs	$10,527,443	$20,066,587	$1,760,187	$32,354,216
Total UAT Costs	**$34,267,726**	**$50,411,566**	**$5,685,013**	**$90,364,305**
Electric Benefits (kWh)	$15,285,221	$103,574,468	$4,832,685	$123,692,374
Capacity Benefits (kW)	*$33,863,255*	*$126,768,248*	*$1,988,873*	*$162,620,376*
Gas Benefits	$36,558,418	$98,380,352	$13,468,326	$148,407,096
T&D Benefits	$9,669,618	$36,214,570	$560,731	$46,444,919
Total UAT Benefits	***$95,376,512***	***$364,937,638***	***$20,850,615***	***$481,164,765***
UAT Benefits Minus Costs	***$61,108,786***	***$314,526,072***	***$15,165,602***	***$390,800,460***
UAT Benefit/Cost Ratio	***2.78***	***7.24***	***3.67***	***5.32***

Table I-17 shows the inputs and results from the societal test for CY 2023 energy efficiency and renewable resource offerings. As expected, the estimated overall benefit/cost value from the societal test is the highest of all the tests, excluding the UAT, including the same costs as the modified TRC, with additional non-energy benefits. When interpreted within the context of the modified TRC test results, these findings suggest that Focus on Energy activities provide substantial additional benefits, generating additional value in terms of personal health cost savings, water savings, lighting purchase deferrals, property values, and arrearage repayment assistance. Benefits from the residential offerings were 1.74

times greater than the costs, while the benefits from the nonresidential offerings outweighed the costs by a factor of 3.58.

Table I-17. REVISED CY 2023 Sector-Level and Overall Results, Societal Test

	Residential	Nonresidential	Midstream	Total
Administrative Costs	$1,089,405	$1,632,259	$180,821	$2,902,485
Delivery Costs	$10,527,443	$20,066,587	$1,760,187	$32,354,216
Incremental Measure Costs	$93,683,658	$146,546,603	$6,383,948	$246,614,209
Total Non-Incentive Costs	**$105,300,506**	**$168,245,449**	**$8,324,956**	**$281,870,910**
Electric Benefits (kWh)	$15,285,221	$103,574,468	$4,832,685	$123,692,374
Capacity Benefits (kW)	*$33,863,255*	*$126,768,248*	*$1,988,873*	*$162,620,376*
Gas Benefits	$36,558,418	$98,380,352	$13,468,326	$148,407,096
Emissions Benefits	*$48,554,654*	*$187,153,229*	*$9,005,016*	*$244,712,899*
T&D Benefits	$9,669,618	$36,214,570	$560,731	$46,444,919
Health Benefits	$6,471,553	$46,000,969	$3,770,477	$56,243,000
Water Benefits	$10,027,081	$76,604	$244,052	$10,347,736
Purchase Deferral Benefits	$687,921	$4,550,500	$1,535,400	$6,773,821
Other Non-Energy Benefits [a]	$21,893,287	$0	$0	$21,893,287
Economic Benefits	N/A	N/A	N/A	$444,835,241
Total SOC Benefits	***$183,011,008***	***$602,718,940***	***$35,405,559***	***$1,265,970,749***
SOC Benefits Minus Costs	***$77,710,502***	***$434,473,491***	***$27,080,604***	***$984,099,838***
SOC Ratio	***1.74***	***3.58***	***4.25***	***4.49***

[a] Includes Property Values and Arrearages

Cost-Effectiveness Results by Offering

Table I-18 and Table I-19 provide the sector-level and overall results of the cost-effectiveness analysis shown by core efficiency offerings and renewables. Incentive costs are provided below, but they are not included in the TRC calculation. The TRC ratio equals the total TRC benefits divided by the total non-incentive costs. Table I-20 provides UAT test results, and Table I-21 provides societal test results.

Table I-18. REVISED CY 2023 Overall Cost-Effectiveness Analysis with Portfolio Breakout

Focus on Energy Benefits and Costs	Full Portfolio	Core Programs Alone	Renewables Alone
Incentives	$55,107,604	$49,209,627	$5,897,976
Modified TRC Benefits ($ millions)	*$725,877,664*	*$581,288,145*	*$144,589,518*
Modified TRC Costs ($ millions)	$281,870,910	$189,961,124	$91,909,786
Portfolio Modified TRC Ratio	***2.58***	***3.06***	***1.57***

Table I-19. REVISED CY 2023 Overall with Renewables Separate Cost-Effectiveness Analysis, Modified Total Resource Cost Test

	Residential	Nonresidential	Midstream	Renewables	Total
Administrative Costs	$928,986	$1,486,583	$180,821	$306,095	$2,902,485
Delivery Costs	$8,977,238	$18,275,685	$1,760,187	$3,341,106	$32,354,216
Incremental Measure Costs	$47,450,233	$104,517,443	$6,383,948	$88,262,585	$246,614,209
Total Non-Incentive Costs	**$57,356,458**	**$124,279,711**	**$8,324,956**	**$91,909,786**	**$281,870,910**
Electric Benefits (kWh)	$8,403,730	$87,765,538	$4,832,685	$22,690,421	$123,692,374
Capacity Benefits (kW)	*$15,313,358*	*$85,060,022*	*$1,988,873*	*$60,258,123*	*$162,620,376*
Gas Benefits	$36,558,418	$98,380,352	$13,468,326	-	$148,407,096
Emissions Benefits	*$35,083,091*	*$156,204,849*	*$9,005,016*	*$44,419,943*	*$244,712,899*
T&D Benefits	$4,368,286	$24,294,872	$560,731	$17,221,031	$46,444,919
Total TRC Benefits	***$99,726,883***	***$451,705,632***	***$29,855,631***	***$144,589,518***	***$725,877,664***
TRC Benefits Minus Costs	***$42,370,425***	***$327,425,921***	***$21,530,675***	***$52,679,732***	***$444,006,753***
TRC Ratio	***1.74***	***3.63***	***3.59***	***1.57***	***2.58***

Table I-20. REVISED CY 2023 Overall with Renewables Separate Cost-Effectiveness Analysis, Utility Administrator Cost Test

	Residential	Nonresidential	Midstream	Renewables	Total
Incentive Costs	$19,315,453	$26,150,169	$3,744,005	$5,897,976	$55,107,604
Administrative Costs	$928,986	$1,486,583	$180,821	$306,095	$2,902,485
Delivery Costs	$8,977,238	$18,275,685	$1,760,187	$3,341,106	$32,354,216
Total Non-Incentive Costs	**$29,221,678**	**$45,912,437**	**$5,685,013**	**$9,545,177**	**$90,364,305**
Electric Benefits (kWh)	$8,403,730	$87,765,538	$4,832,685	$22,690,421	$123,692,374
Capacity Benefits (kW)	*$15,313,358*	*$85,060,022*	*$1,988,873*	*$60,258,123*	*$162,620,376*
Gas Benefits	$36,558,418	$98,380,352	$13,468,326	-	$148,407,096
T&D Benefits	$4,368,286	$24,294,872	$560,731	$17,221,031	$46,444,919
Total UAT Benefits	***$64,643,791***	***$295,500,783***	***$20,850,615***	***$100,169,575***	***$481,164,765***
UAT Benefits Minus Costs	***$35,422,114***	***$249,588,347***	***$15,165,602***	***$90,624,398***	***$390,800,460***
UAT Ratio	***2.21***	***6.44***	***3.67***	***10.49***	***5.32***

Table I-21. REVISED CY 2023 Overall with Renewables Separate Cost-Effectiveness Analysis, Societal Test

	Residential	Nonresidential	Midstream	Renewables	Total
Incentive Costs	$19,315,453	$26,150,169	$3,744,005	$5,897,976	$55,107,604
Administrative Costs	$928,986	$1,486,583	$180,821	$306,095	$2,902,485
Delivery Costs	$8,977,238	$18,275,685	$1,760,187	$3,341,106	$32,354,216
Incremental Measure Costs	$47,450,233	$104,517,443	$6,383,948	$88,262,585	$246,614,209
Total Non-Incentive Costs	**$57,356,458**	**$124,279,711**	**$8,324,956**	**$91,909,786**	**$281,870,910**
Electric Benefits (kWh)	$8,403,730	$87,765,538	$4,832,685	$22,690,421	$123,692,374
Capacity Benefits (kW)	*$15,313,358*	*$85,060,022*	*$1,988,873*	*$60,258,123*	*$162,620,376*
Gas Benefits	$36,558,418	$98,380,352	$13,468,326	$0	$148,407,096
Emissions Benefits	*$35,083,091*	*$156,204,849*	*$9,005,016*	*$44,419,943*	*$244,712,899*
T&D Benefits	$4,368,286	$24,294,872	$560,731	$17,221,031	$46,444,919
Health Benefits	$4,097,621	$40,547,306	$3,770,477	$7,827,595	$56,243,000
Water Benefits	$10,027,081	$76,604	$244,052	$0	$10,347,736
Purchase Deferral	$687,921	$4,550,500	$1,535,400	$0	$6,773,821
Other Non-Energy Benefits [a]	$21,893,287	$0	$0	$0	$21,893,287
Economic Benefits	N/A	N/A	N/A	N/A	$444,835,241
Total SOC Benefits	***$136,432,793***	***$496,880,042***	***$35,405,559***	***$152,417,113***	***$1,265,970,749***
SOC Benefits Minus Costs	***$79,076,335***	***$372,600,331***	***$27,080,604***	***$60,507,327***	***$984,099,838***
SOC Ratio	***2.38***	***4.00***	***4.25***	***1.66***	***4.49***

[a] Includes property values and arrearages

Table I-22 provides the residential offerings cost-effectiveness analysis. Incentive costs are provided below, but they are not included in the modified TRC calculation. The mTRC ratio equals the total mTRC benefits divided by the total non-incentive costs.

Table I-22. REVISED CY 2023 Residential and Midstream Offerings Modified TRC Cost-Effectiveness Analysis

	Direct to Customer			Trade Ally Solutions			Multifamily		RNC	Renewable Rewards	Midstream	
	Packs	OLM	Retail	Heating and Cooling	Insulation and Air Sealing	Tribes	Multifamily	EDA/EDR/PEP	Residential	Residential	Midstream	CBO
Incentive Costs	$3,699,968	$552,206	$147,295	$7,280,532	$2,789,417	$274,315	$923,414	$704,756	$2,943,550	$3,335,425	$707,195	$3,036,810
Administrative Costs	$177,952	$26,559	$7,084	$350,161	$134,158	$13,193	$44,412	$33,896	$141,572	$160,419	$34,764	$146,057
Delivery Costs	$1,719,633	$256,649	$68,458	$3,383,771	$1,296,436	$127,493	$429,175	$327,549	$1,368,073	$1,550,204	$348,769	$1,411,418
Incremental Measure Costs	$3,115,068	$1,558,429	$148,513	$17,200,952	$12,179,320	$188,682	$8,847,696	$4,211,573	$0	$46,233,425	$2,741,943	$3,642,005
Total Non-Incentive Costs	**$5,012,653**	**$1,841,636**	**$224,055**	**$20,934,884**	**$13,609,915**	**$329,369**	**$9,321,283**	**$4,573,018**	**$1,509,645**	**$47,944,048**	**$3,125,476**	**$5,199,480**
Electric Benefits (kWh)	$1,384,122	$880,335	$74,991	-$2,264,001	$1,004,160	$3,367	$663,323	$3,095,843	$3,561,590	$6,881,491	$326,100	$4,506,585
Capacity Benefits (kW)	*$808,794*	*$50,133*	*$41,546*	*$977,776*	*$3,735,436*	*$22,375*	*$461,074*	*$3,593,743*	*$5,622,481*	*$18,549,897*	*$294,535*	*$1,694,338*
T&D Benefits	$227,835	$14,242	$11,566	$279,708	$1,067,542	$6,393	$130,137	$1,028,186	$1,602,677	$5,301,333	$83,972	$476,758
Gas Benefits	$3,931,035	$1,038,893	$5,428	$16,683,230	$3,571,606	$81,611	$1,686,350	$3,646,304	$5,913,959	$0	$546,848	$12,921,479
Emissions Benefits	*$2,503,643*	*$1,142,017*	*$3,576,817*	*$3,752,643*	*$3,718,137*	*$48,186*	*$1,903,108*	*$6,445,288*	*$11,993,253*	*$13,471,563*	*$537,097*	*$8,467,919*
Total TRC Benefits	***$8,855,428***	***$3,125,620***	***$3,710,347***	***$19,429,356***	***$13,096,881***	***$161,932***	***$4,843,993***	***$17,809,364***	***$28,693,961***	***$44,204,283***	***$1,788,552***	***$28,067,078***
TRC Benefits Minus Costs	***$3,842,775***	***$1,283,984***	***$3,486,292***	***-$1,505,528***	***-$513,034***	***-$167,437***	***-$4,477,290***	***$13,236,347***	***$27,184,316***	***-$3,739,765***	***-$1,336,924***	***$22,867,599***
TRC Ratio Benefits	***1.77***	***1.70***	***16.56***	***0.93***	***0.96***	***0.49***	***0.52***	***3.89***	***19.01***	***0.92***	***0.57***	***5.40***

Table I-23 provides nonresidential offerings cost-effectiveness analysis. Incentive costs are provided below, but they are not included in the modified TRC calculation. The mTRC ratio equals the total mTRC benefits divided by the total non-incentive costs.

Table I-23. REVISED CY 2023 Nonresidential Offerings Modified TRC Cost-Effectiveness Analysis

	Agribusiness	Business and Industry		Large Industrial		Schools and Government			Renewable Rewards
	Agriculture	C&I	EDA/EDR	Large Ind	EDA/EDR	Schools	Government	EDA/EDR	Business
Incentive Costs	$2,388,735	$6,626,807	$1,340,949	$9,766,800	$189,175	$2,562,501	$2,029,967	$851,218	$2,562,552
Administrative Costs	$135,795	$376,720	$76,230	$555,222	$10,754	$145,673	$115,399	$48,390	$145,676
Delivery Costs	$1,669,426	$4,631,306	$937,155	$6,825,767	$132,210	$1,790,866	$1,418,692	$594,894	$1,790,902
Incremental Measure Costs	$7,063,516	$30,556,335	$7,780,662	$37,443,454	$799,719	$6,545,601	$8,077,592	$6,250,565	$42,029,160
Total Non-Incentive Costs	**$8,868,736**	**$35,564,361**	**$8,794,047**	**$44,824,443**	**$942,683**	**$8,482,140**	**$9,611,683**	**$6,893,850**	**$43,965,738**
Electric Benefits (kWh)	$10,183,690	$25,884,886	$5,284,967	$31,396,550	$508,223	$3,768,025	$7,625,698	$2,954,187	$15,808,930
Capacity Benefits (kW)	*$9,421,592*	*$26,886,776*	*$7,651,572*	*$26,142,872*	*$784,784*	*$4,843,521*	*$6,661,221*	*$2,667,683*	*$41,708,226*
T&D Benefits	$2,692,467	$7,678,565	$2,189,150	$7,460,969	$224,530	$1,382,896	$1,903,057	$763,237	$11,919,698
Gas Benefits	$1,595,805	$19,177,222	$1,746,772	$64,374,009	$596,777	$5,843,061	$2,435,053	$2,611,652	$0
Emissions Benefits	*$14,149,050*	*$39,908,599*	*$9,046,302*	*$66,659,963*	*$1,057,375*	*$7,420,981*	*$12,074,871*	*$5,771,530*	*$30,948,380*
Total TRC Benefits	***$38,042,605***	***$119,536,048***	***$25,918,763***	***$196,034,363***	***$3,171,689***	***$23,258,483***	***$30,699,902***	***$14,768,289***	***$100,385,235***
TRC Benefits Minus Costs	***$29,173,869***	***$83,971,686***	***$17,124,717***	***$151,209,920***	***$2,229,006***	***$14,776,344***	***$21,088,218***	***$7,874,440***	***$56,419,497***
TRC Ratio	***4.29***	***3.36***	***2.95***	***4.37***	***3.36***	***2.74***	***3.19***	***2.14***	***2.28***

Cost-Effectiveness Results for Renewables

Table I-24 lists the CY 2022 and CY 2023 cost-effectiveness results, with renewables excluded and with renewables included.

Table I-24. REVISED Cost-Effectiveness Results for Focus on Energy Portfolio

Calendar Year	Residential	Nonresidential	Midstream	Renewables	Total
CY 2022: Modified TRC Test Result with Renewables	1.55	2.93	1.38	N/A	**2.36**
CY 2022: Modified TRC Test Result Renewables Excluded	1.80	3.06	1.38	1.36	**2.36**
CY 2023: Modified TRC Test Result with Renewables	*1.37*	*3.28*	*3.59*	*N/A*	***2.58***
CY 2023: Modified TRC Test Result Renewables Excluded	*1.74*	*3.63*	*3.59*	*1.57*	***2.58***