



Evaluation of ComEd's CY2019 Total Resource Cost Test

Energy Efficiency / Demand Response Plan:
Calendar Year 2019 (CY2019)
(2019.01.01 to 2019.12.31)

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Prepared by:

Sagar Deo
Guidehouse

Palak Thakur
Guidehouse

Karen Maoz
Guidehouse





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Submitted to:

ComEd
Three Lincoln Centre
Oakbrook Terrace, IL 60181

Submitted by:

Guidehouse (which acquired Navigant in 2019)
150 N. Riverside, Suite 2100
Chicago, IL 60606

Contact:

Randy Gunn, Managing Director
312.583.5714
Randy.Gunn@Navigant.com

Jeff Erickson, Director
608.497.2322
Jeff.Erickson@Navigant.Com

Rob Neumann, Associate Director
312.583.2176
Rob.Neumann@Navigant.com

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1. OVERVIEW

As part of Guidehouse's evaluation of ComEd's energy efficiency programs for calendar year 2019, we developed the program input values and calculated program level cost effectiveness for the Utility Cost Test (UCT) and the Illinois Total Resource Cost (TRC) test using a Guidehouse developed spreadsheet tool (supplemented with the Guidehouse-developed PROcess model in Analytica). The focus of this review is on the basis and reasonableness of the assumptions used to conduct the Illinois TRC test, with the results of the UCT also reported. Guidehouse created a cost model and built up the analysis at the measure and program level to conduct the 2019 cost analysis. The summary of the program level inputs in the accompanying workbook and Analytica model is available separate from this report. ComEd and the Illinois Commerce Commission (ICC) have provided comments to the detail in this report and the resulting TRCs and UCTs.

The savings numbers and cost-benefit results included in this report are reflective of ComEd's Energy Efficiency Portfolio Standard (EEPS) programs. Additionally, for programs that are jointly implemented by ComEd and one or more Illinois gas utilities (including Nicor Gas, Peoples Gas (PG), or North Shore Gas (NSG)), only the electric portion of the program savings and cost-benefit calculations are included here.¹ The combined joint calculations for these programs will be shared in a follow-up memo.

The Illinois TRC test is defined in the Illinois Power Agency Act (see 20 ILCS 3855/1-10) as follows²:

"Total resource cost test" or "TRC test" means a standard that is met if, for an investment in energy efficiency or demand-response measures, the benefit-cost ratio is greater than one. The benefit-cost ratio is the ratio of the net present value of the total benefits of the program to the net present value of the total costs as calculated over the lifetime of the measures. A total resource cost test compares the sum of avoided electric utility costs, representing the benefits that accrue to the system and the participant in the delivery of those efficiency measures and including avoided costs associated with reduced use of natural gas or other fuels, avoided costs associated with reduced water consumption, and avoided costs associated with reduced operation and maintenance costs, as well as other quantifiable societal benefits, to the sum of all incremental costs of end-use measures that are implemented due to the program (including both utility and participant contributions), plus costs to administer, deliver, and evaluate each demand-side program, to quantify the net savings obtained by substituting the demand-side program for supply resources. In calculating avoided costs of power and energy that an electric utility would otherwise have had to acquire, reasonable estimates shall be included of financial costs likely to be imposed by future regulations and legislation on emissions of greenhouse gases. In discounting future societal costs and benefits for the purpose of calculating net present values, a societal discount rate based on actual, long-term Treasury bond yields should be used. Notwithstanding anything to the contrary, the TRC test shall not include or take into account a calculation of market price suppression effects or demand reduction induced price effects.

The Illinois TRC test differs from traditional TRC tests in its requirement to include a reasonable estimate of the financial costs associated with future regulations and legislation on the emissions of greenhouse gases (GHG) and the use of the societal discount rate. This difference adds an additional benefit to investments in efficiency programs that are typically included in the Societal test in other jurisdictions. Guidehouse included avoided GHG costs and the societal discount rate in its TRC calculations. The UCT calculations do not include avoided GHG costs and also use the social discount rate instead of the weighted average cost of capital.

¹ There are programs where ComEd claims savings and those are included in this analysis.

² See Section 1-10 Definitions of the Illinois Power Agency Act:
<http://www.ilga.gov/legislation/ilcs/ilcs5.asp?ActID=2934&ChapterID=5>

Guidehouse initially completed the 2019 cost report in May 2020. ComEd provided input in two iterations mostly for disaggregating program data for finalizing the cost-effectiveness calculations. The final values in this report reflect comments and data provided by ComEd through June 5, 2020. The 2019 avoided costs were lower than the costs provided by ComEd in CY2018. This resulted in an overall reduction in both the TRC and UCT values for the CY2019 portfolio. The portfolio TRC and UCT values went down from CY2018 to CY2019 to 1.33 from 1.78 and 1.29 from 1.85, respectively.³ In the first draft TRC analysis, Guidehouse calculated the CY2019 TRCs using 2018 avoided costs. In short, the CY2019 TRCs would have been similar to the CY2018 TRCs if there was no change in the avoided costs. The Avoided Electric Generation Market cost changed to \$28.06 / MWh from \$31.58 / MWh. Additionally, the CY2019 escalators are decreasing overtime, whereas the CY2018 escalators increased. The Avoided Demand costs decreased from \$148 to \$117 (\$/kW-year) for CY2019 (but no change in the escalators). As a result, the difference for the portfolio TRC was 25% when comparing the CY2019 TRCs using the CY2018 avoided costs versus the CY2019 avoided costs.

1.1 Summary

Table 1-1 below shows a summary of the CY2019 TRC and UCT test values for all the EEPS programs in ComEd's CY2019 portfolio. The values were calculated by Guidehouse. Overall, the CY2019 portfolio aggregate TRC and UCT tests show the portfolio was cost effective, with an aggregate TRC and UCT test value of 1.33 and 1.29 respectively.

Table 1-1. Residential Summary of ComEd Program CY2019 TRC and UCT Test values

Program	Illinois TRC Test	Illinois UCT Test
Appliance Rebates	2.08	1.97
Elementary Education Kits	4.18	2.37
Fridge & Freezer Recycling	1.36	0.71
Residential HVAC	2.42	1.46
Weatherization	0.91	1.23
Single-Family Assessment (Joint w/Nicor Gas & PG and NSG)	0.95	0.58
Residential Behavior	1.56	1.55
Lighting Discount	4.37	2.64
Multi-Family - Market Rate (Joint w/Nicor Gas, PG and NSG)	1.21	0.43
Residential New Construction	0.58	1.52
Residential Total	2.39	1.55
Agriculture	0.47	0.45
Incentives - Custom	0.91	1.75
Business Grocery	0.59	0.80
Virtual Commissioning/RetroCommissioning	0.94	0.82
Industrial Systems	0.97	1.18
Business Instant Discounts	2.91	3.03
Non-Residential New Construction	1.05	1.87
Facility Assessments	0.14	0.14
Business Telecomm	0.72	0.88
Small Business	2.12	1.58
Small Business Kits	4.38	3.45
Incentives - Standard	1.01	2.17
Strategic Energy Management	1.42	1.41
LED Streetlighting	0.95	1.84

³ The biggest difference in the UCT from 2018 to 2019 is that the CY 2018 value uses the WACC whereas the UCT in CY 2019 uses the social discount rate.

Program	Illinois TRC Test	Illinois UCT Test
Nonprofit Retrofits	0.44	0.42
Business Total	1.35	1.70
Affordable Housing New Construction	0.50	0.52
Food Bank LED Distribution	3.48	2.78
Lighting Discounts - Income Eligible	4.39	2.72
Multi-Family IHWAP	0.44	0.33
Multi-Family Retrofits	0.38	0.54
Single Family Retrofit - CBA	0.35	0.50
Single Family Retrofit - IHWAP	0.31	0.22
UIC ERC Low Income Kits	4.35	1.43
Appliance Rebates - IE	2.03	2.21
IE Program Design Pilot	0.14	0.12
Manufactured Housing Retrofit	0.33	0.24
Ductless Heat Pump and Building Envelope Pilot	0.03	0.03
IE Senior Program Design Pilot	0.03	0.03
New Manufactured Housing*	NA	NA
Public Housing Energy Savings	0.32	0.28
Income Eligible Total	1.34	0.91
Residential and Business Total	1.38	1.41
Voltage Optimization (VO)	2.07	1.94
Portfolio Total (w / IE and VO)	1.33	1.29

* The program was discontinued and there were no energy and demand savings for the program as a result the program wasn't evaluated for cost-effectiveness. The costs associated with the program were included while calculating the portfolio level TRC and UCT values.

Source: Guidehouse analysis

1.2 Illinois TRC Equation

The equation used to calculate the Illinois TRC is presented below:

Equation 1. Illinois TRC

$$BCR_{ILTRC} = B_{ILTRC} / C_{ILTRC}$$

Where,

BCR_{ILTRC}	=	Benefit-cost ratio of the Illinois total resource cost test
B_{ILTRC}	=	Present value of benefits of an Illinois program or portfolio
C_{ILTRC}	=	Present value of costs of an Illinois program or portfolio

The benefits of the Illinois TRC are calculated using the following equation:

Equation 2. Illinois TRC Benefits

$$B_{ILTRC} = \sum_{t=1}^N \frac{UAEP_t + UATD_t + UAA_t + EB_t + RC}{(1+d)^{t-1}} + \sum_{t=1}^N \frac{UAC_{at} + PAC_{at}}{(1+d)^{t-1}}$$

The costs of the Illinois TRC are calculated using the following equation:

Equation 3. Illinois TRC Costs

$$C_{ILTRC} = \sum_{t=1}^N \frac{PNIC_t + IMCN_t + UIC_t}{(1 + d)^{t-1}}$$

Where benefits are defined as:

- UAEP_t = Utility avoided electric and capacity production costs in year t
- UATD_t = Utility avoided transmission and distribution costs in year t
- UAA_t = Utility avoided ancillary costs in year t
- EB_t = Environmental Benefits in year t
- UAC_t = Utility avoided supply costs for the alternate fuel in year t
- PAC_t = Participant avoided costs in year t for alternate fuel devices
- RC = NPV of replacement costs of incandescent equivalents

And costs are defined as:

- PNIC_t = Program Non-Incentive costs in year t
- IMCN_t = Net Incremental costs in year t
- UIC_t = Utility increased supply costs in year t

- And:
- d = Societal discount rate

The Illinois TRC test allows for utilities to account for the net present value (NPV) of the avoided cost of purchasing incandescent bulbs that accrues to program participants because of the significantly longer lifetimes of efficient CFLs and LED light bulbs. In general, the avoided cost per bulb is determined by comparing the estimated useful life of efficient and baseline bulbs to determine the number of baseline bulb purchases that are avoided. Based on the average purchase price of baseline bulbs, an NPV is determined by discounting the value of these avoided purchases over the course of the lifetime of the efficient bulb. The Illinois Technical Reference Manual (TRM) provides deemed NPV values per bulb based on efficient bulb-type, socket type (commercial or residential), and lumen range. These benefits were included in the program calculations.

1.3 UCT Equation

The results of the Utility Cost test are also presented in Section 2 of this report. The UCT approaches cost effectiveness from the perspective of the utility, in this case ComEd. It determines whether the energy supply and capacity costs avoided by the utility exceed the overhead and cost outlays that the utility incurred to implement energy efficiency programs. The structure of the calculation is similar to the Illinois TRC with a few key changes. Since the UCT is primarily focused on utility outlays, incentives paid by the utility to either participants or third-party implementers are included in the calculation in place of incremental or participant costs. Additionally, since non-energy benefits accrue to society rather than to the utility implementing energy efficiency programs, these benefits are not included in the UCT formula.

Using the equation terms previously defined for the Illinois TRC equation, the UCT equation is defined as:

Equation 4. UCT

$$BCR_{UCT} = B_{UCT} / C_{UCT}$$

Where,

- BCR_{UCT}** = Benefit-cost ratio of the Utility Cost Test
B_{UCT} = Present value of benefits to a utility of a program or portfolio
C_{UCT} = Present value of costs to a utility of a program or portfolio

The benefits of the UCT are calculated using the following equation:

Equation 5. UCT Benefits

$$B_{UCT} = \sum_{t=1}^N \frac{UAEP_t + UATD_t + UAA_t}{(1+d)^{t-1}} + \sum_{t=1}^N \frac{UAC_{at}}{(1+d)^{t-1}}$$

The costs of the UCT are calculated using the following equation:

Equation 6. UCT Costs

$$C_{UCT} = \sum_{t=1}^N \frac{PNIC_t + UIC_t + PIN_t}{(1+d)^{t-1}}$$

Where the new terms, *PIN_t*, is defined as the program incentives provided by the utility in year *t*.

1.4 Cost-Effectiveness Data Requirements

The data points needed to conduct the Illinois TRC test are provided in Table 1-2 below and are divided into generic and program specific categories. The program specific data points are further subdivided into those that are provided by ComEd versus those that are a result of the Guidehouse's evaluation activities.

Table 1-2. Data Points Needed to Conduct EEPS TRC

Category	Data Point	Source
Generic	• Avoided Energy Costs (\$/kWh)	ComEd
	• Avoided Capacity Costs (\$/kW)	
	• Avoided T&D Electric (\$/kWh)	
	• Avoided Gas Production (\$/Therm) ⁴	
	• Avoided Water Costs (\$/gallon)	
	• Escalation Rates	
	• Environmental Damages (GHG Adders)	
	• Discount Rate	Policy

⁴ From local gas utility

Category	Data Point	Source
Program Specific	• Participants / Measure Count	Guidehouse
	• Verified Ex-Post Energy and Demand Savings	
	• Realization Rate	
	• Net to Gross Ratio	
	• Measure life	
	• Incremental measure costs ⁵	ComEd
	• NPV Replacement Costs	
	• Non-Incentive Costs	
	• Utility Incentive Costs	
	• Direct Install Costs	
• Incremental Measure Costs		

Source: Guidehouse analysis

This document provides a summary of the results for the total ComEd EEPS portfolio and at the program level, the program specific inputs and range of assumptions, a description of each of the data points, the basis of their determination and their reasonableness.

2. SUMMARY OF RESULTS & GENERIC DATA POINTS

A summary of the ComEd EEPS results, separated by benefits and cost components, is presented in Table 2-1 below. The calculations show ComEd's EEPS portfolio is cost effective under all scenarios.

Table 2-1. Summary of ComEd Portfolio (Excluding Income Eligible and Voltage Optimization) Costs & Benefits (\$ in 000's)

Data Point	UCT Test		Illinois TRC Test	
	UCT Benefits	UCT Costs	Illinois ITRC Benefits	Illinois TRC Costs
Avoided Electric Production w/ GHG adder			\$293,569	
Avoided Electric Production w/o GHG adder	\$270,248			
Avoided Electric Capacity	\$198,177		\$198,177	
Avoided Gas Production	-\$25,789		-\$25,789	
Avoided Water			\$8,354	
Non -Incentive Costs		\$131,812		\$131,812
Incentive Costs		\$181,360		
Net Participant Costs			\$105,096	\$288,476
Present Value Totals	\$442,636	\$313,173	\$579,407	\$420,289
Ratio		1.41		1.38

Source: Guidehouse analysis

On the cost side, net participant costs represent the largest component followed by the non-incentive costs of program implementation, such as administration and marketing. For the UCT, the sum of all incentives provided is used in place of net participant costs. The sum of all incentives is less than the sum of all incremental costs. However, the benefits associated with the net present value of the future

⁵ Incremental measure costs come from program tracking data, program contractor invoices, and deemed value sources such as the TRM.

replacement costs of lamps result in a net incremental cost lower than the incentives. Therefore, the TRC ratio exceeds the UCT ratio.

2.1 Avoided Costs

Table 1-2 shows the generic data points used for doing the cost-benefit calculations. The following includes the definitions of each generic data point and their sources. These values are typically updated annually.

- **Avoided Electric Production Costs (\$/MWh)** - Avoided electric production costs are those associated with purchasing energy from PJM.
- **Avoided Electric Capacity Costs (\$/kW-year)** - Avoided electric capacity costs are those associated with the construction of additional electricity generation facilities to meet peak demand. Incremental reductions in the amount of electricity demand during peak hours can delay or eliminate the need to build additional generation. ComEd is a participant in the Reliability Pricing Model ("RPM"), which is PJM's forward capacity market.
- **Avoided T&D Electric (\$/kW)** - Avoided transmission and distribution (T&D) costs are a benefit associated with not needing to build transmission and distribution infrastructure to meet demand at peak times.
- **Avoided Ancillary (\$/kWh)** - Avoided Ancillary is a benefit associated with avoided costs attributable to the Open Access Transmission Tariff that utilities participating in the PJM market.
- **Avoided Gas Costs (\$/therm)** – This value is from the PG and NSG utilities and used to account for gas interactive effects due to lighting.
- **Avoided Water Costs (\$/gal)** – This is to account for savings associated with efficient water fixtures and clothes washers. The Avoided Water Costs of \$7.9/1000 Gallons (as provided by ComEd) was used for the analysis.

2.2 Non-Incentive Costs

Non-incentive costs are program administrator costs (related to energy efficiency) that are not otherwise classified as financial incentives paid to customers or incentives paid to third parties. In other words, non-incentive costs are equal to all program administrator costs minus incentives.

Examples of non-incentive costs include:

- Costs for overhead, labor and materials required to develop, deliver, and administer functions related to the implementation of energy efficiency programs or portfolio. This can include such things as rebate processing, measurement and verification, quality assurance, advertising and marketing, or customer relations, among others.
- Program administrator payment to a third party whose principal purpose is not to reduce the cost of the efficient measure to the customer.
- Program administrator payment to a third party to cover the cost of services that are principally intended to be a form of marketing, as opposed to being truly necessary for any customer implementation of efficient measures, should be classified as non-incentive costs.
- SPIFF is also included in the non-incentive costs.

There are currently some performance-based programs where the third-party program implementer is paid a \$/kWh that includes incentives and non-incentives. Guidehouse worked with ComEd to separate out the costs appropriately.

2.3 Incentives

Incentives⁶ include financial incentives paid to customers plus incentives paid to third parties. Financial incentives paid to customers means payment⁷ made by a program administrator directly to an end-use customer to encourage the customer to participate in an efficiency program and offset some or all of the customer's costs to purchase and install a qualifying efficient measure, ultimately resulting in a reduction in the net price paid by the customer for the efficient measure. This rebate type of incentive is often referred to as a downstream incentive which has the result that the net price to the customer of an energy efficiency program-sponsored measure is reduced by the amount of the incentive.

Incentives paid to third parties mean payment made by a program administrator to a third party that is principally intended to reduce the net price to the customer of purchasing and installing a qualifying efficient measure. Incentives paid to third parties include payments made by a program administrator to trade allies, manufacturers, wholesalers, distributors, contractors, builders, retailers, implementation contractors, or other non-customer stakeholders that are principally intended to defray the incremental cost to the customer of purchasing and installing an efficient measure. Incentives paid to third parties also include payments made by a program administrator to an implementation contractor to cover the full cost of direct installation measures (materials and labor), for the portion not covered by the customer. Incentives paid to third parties also include payment made by a program administrator to a third party to cover the full cost of study-based services (e.g., facility energy audits, energy surveys, energy assessments, retro-commissioning) that are truly necessary for a customer to implement efficient measures, as opposed to being principally intended to be a form of marketing. Incentives paid to third parties also include payment made by a program administrator to an implementation contractor to cover the cost of pickup and recycling of duplicative functioning equipment before its expected life is over (e.g., appliance recycling programs), for the portion not covered by the Customer.

2.4 Incremental Costs

Incremental costs mean the difference between the cost of the efficient measure and the cost of the most relevant baseline measure that would have been installed (if any) in the absence of the efficiency program. Installation costs (material and labor) and Operations and Maintenance (O&M) costs shall be included if there is a difference between the efficient measure and the baseline measure. In cases where the efficient measure has a significantly shorter or longer life than the relevant baseline measure (e.g., LEDs versus halogens), the avoided baseline replacement measure costs should be accounted for in the TRC analysis as a benefit. The incremental cost input in the TRC analysis is not reduced by the amount of any incentives.

Examples of incremental cost calculations include:

⁶ Incentives definitions can be found in Section 8.4 TRC Costs of the Illinois Energy Efficiency Policy Manual Version 1.1. The Illinois TRC test requires that "all incremental costs of end use measures (including both utility and participant contributions)" should be reflected as costs in the TRC test calculation. As long as we ensure that "all incremental costs of end-use measures" are included in the TRC test calculation, there is no need to add Program Administrator Contribution costs (i.e., Incentives) and Participant Contribution costs as separate components to the TRC test. However, Program Administrator Contribution costs (i.e., Incentives) are needed for purposes of calculating the Program Administrator Cost Test/Utility Cost Test (PACT/UCT) since those are a component of the Program Administrator expenses. Most TRC modeling software requires users to input the Incentives as a separate input in addition to providing all Incremental Costs such that the PACT/UCT can be calculated; for this reason, the separate Incentives input in the TRC model is not "used" when calculating the TRC test because these costs are already reflected in the Incremental Cost input, and if the model were to use both the Incentives input and the Incremental Cost input, it would result in double counting of costs in the TRC analysis.

⁷ Payments include non-Measure items of value that would be treated as transfer payments, e.g. gift cards.

- The incremental cost for an efficient measure that is installed in new construction or is being purchased at the time of natural installation, investment, or replacement is the additional cost incurred to purchase an efficient measure over and above the cost of the baseline or standard (i.e., less efficient) measure (including any incremental installation, replacement, or O&M costs if there is a difference between the efficient measure and baseline measure).
- For a retrofit measure where the efficiency program caused the customer to update their existing equipment, facility, or processes, where the customer would not have otherwise made a purchase, the appropriate baseline is zero expenditure, and the incremental cost is the full cost of the new retrofit measure (including installation costs).
- For the early replacement of a functioning measure with a new efficient measure, where the customer would not have otherwise made a purchase for a number of years, the appropriate baseline is a dual baseline that begins as the existing measure and shifts to the new standard measure after the expected remaining useful life of the existing measure ends. Thus, the incremental cost is the full cost of the new efficient measure (including installation costs) being purchased to replace a still-functioning measure less the present value of the assumed deferred replacement cost of replacing the existing measure with a new baseline measure at the end of the existing measure's life.
- For study-based services that are truly necessary for a customer to implement efficient measures, as opposed to being principally intended to be a form of marketing, the incremental cost is the full cost of the study-based service.
- For the early retirement of duplicative functioning equipment before its expected life is over (e.g., appliance recycling programs), the incremental costs are composed of the customer's value placed on their lost amenity, any customer transaction costs, and the pickup and recycling cost. The incremental costs include the actual cost of the pickup and recycling of the equipment because this is assumed to be the cost of recycling the equipment that would have been incurred by the customer if the customer were to recycle the equipment on their own in the absence of the efficiency program. The payment a program administrator makes to the customer serves as a proxy for the value the customer places on their lost amenity and any customer transaction costs.

2.5 Discount Rate

The discount rate is an important determinant of overall cost effectiveness. The avoided electric production, capacity T&D, and ancillary benefits accrue over the life of the measures included in each program. These benefits are discounted to determine the present value of the cumulative benefits. The discount rate should reflect the societal discount rate as defined in the legislation to be the actual, long-term Treasury bond yields. The Societal Discount rate of 2.38% is used to calculate the TRC and UCT.

2.6 Line Losses

Line losses are important to incorporate in the calculation of total benefits. The energy and demand savings included in the evaluations are estimated at the customer or meter level. The savings that accrue to ComEd rate payers are those at the generator level and therefore the estimated savings are increased by the line losses within ComEd's transmission and distribution network.

The line losses of 11.02% are based on ComEd's internal analysis. These line losses are in the higher end of the range that Guidehouse has seen but are reasonable.

2.7 Miscellaneous EEPS Portfolio Costs

In addition to costs allocated directly to energy efficiency programs, there are portfolio level costs not directly incurred by specific programs. These costs may include administrative, research and development, outreach, advertising, evaluation, measurement, and verification, legal, and other expenses. Since statutory costs effectiveness is measured at the portfolio level, ComEd does not allocate these costs to individual programs. Table 2-2 below details all the Portfolio level costs included in the analysis.

Table 2-2. Breakdown of Portfolio Level Costs (\$ in 000's)

Portfolio Level Cost Component	Value (\$)
Measurement & Verification (M&V)	\$ 10,157
R&D	\$ 12,388
Market Research	\$ 12
Legal	\$ 487
Tracking System	\$ 906
Labor (non-program specific)	\$ 5,544
General Program Costs	\$ 2,713
General Education & Awareness	\$ 4,322
Demand Response	\$ 1,159
Dist. Ops. Streetlight Capital	\$ 7,879
On Bill Financing (OBF)	\$ 150
Total	\$ 45,718

Source: Guidehouse analysis of ComEd reconciliation data

3. PROGRAM SPECIFIC DATA

A summary of the components of the cost effectiveness calculations for each program are shown in Table 3-1 for the TRC and UCT calculations. The table includes the value of each benefit and cost component for each program, as well as EEPS totals for each sector. Additionally, for programs that are jointly implemented by ComEd and one or more Illinois gas utility, only the electric portion of the program savings (unless ComEd claims the gas savings) and cost-benefit calculations are included here.



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Table 3-1. ComEd Program Level Benefits, Costs and Illinois TRC Without Gas Data from Joint Programs

Program	Benefits					Costs		Illinois Total Resource Cost (TRC) Test (NPV replacement cost as benefit)			
	Avoided Electric Production (w/GHG adder)	Avoided Electric Capacity	Avoided Water Costs	Avoided Gas Production	NPV Replacement costs	Non-Incentive Costs	Incremental Costs (Net)	Illinois TRC Benefits	Illinois TRC Costs	Illinois TRC Test Net Benefits	Illinois TRC Test
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i) = (b+c+d+e+f)	(j) = (g+h)	(k) = (i-j)	(l) = (i/j)
Appliance Rebates	\$9,645,085	\$11,820,548	\$3,032,808	\$14,916,364	\$0	\$5,116,515	\$13,869,717	\$39,414,806	\$18,986,232	\$20,428,573	2.08
Elementary Education Kits	\$1,689,551	\$1,000,374	\$3,365,664	\$643,124	\$1,197,706	\$871,465	\$1,016,939	\$7,896,418	\$1,888,405	\$6,008,013	4.18
Fridge & Freezer Recycling	\$3,720,794	\$2,442,500	\$0	\$0	\$0	\$2,887,433	\$1,630,318	\$6,163,293	\$4,517,750	\$1,645,543	1.36
Residential HVAC	\$3,504,929	\$5,501,537	\$0	\$1,443,443	\$0	\$1,948,771	\$2,377,964	\$10,449,908	\$4,326,735	\$6,123,173	2.42
Weatherization	\$295,278	\$717,731	\$0	\$0	\$0	\$472,338	\$645,382	\$1,013,009	\$1,117,721	-\$104,711	0.91
Single-Family Assessment (Joint)	\$4,410,587	\$3,062,605	\$227,409	\$2,197	\$2,997,930	\$3,434,561	\$7,863,957	\$10,700,726	\$11,298,518	-\$597,791	0.95
Residential Behavior	\$7,385,588	\$0	\$0	\$0	\$0	\$4,730,303	\$0	\$7,385,588	\$4,730,303	\$2,655,284	1.56
Lighting Discount	\$38,117,517	\$25,466,899	\$0	-\$11,206,334	\$27,216,346	\$4,448,717	\$13,776,813	\$79,594,428	\$18,225,530	\$61,368,898	4.37
Multi-Family - Market Rate (Joint)	\$2,494,650	\$1,400,576	\$1,314,002	-\$359,936	\$720,564	\$1,917,949	\$2,674,022	\$5,569,856	\$4,591,971	\$977,885	1.21
Residential New Construction	\$113,637	\$443,366	\$0	\$0	\$0	\$135,258	\$824,682	\$557,003	\$959,940	-\$402,936	0.58
Residential Total	\$71,377,615	\$51,856,135	\$7,939,883	\$5,438,856	\$32,132,546	\$25,963,311	\$44,679,794	\$168,745,035	\$70,643,105	\$98,101,931	2.39
Agriculture	\$148,929	\$148,067	\$0	\$0	\$0	\$538,926	\$88,227	\$296,996	\$627,153	-\$330,157	0.47
Incentives - Custom	\$9,996,378	\$6,151,350	\$0	-\$60,861	\$0	\$2,534,233	\$15,230,205	\$16,086,867	\$17,764,438	-\$1,677,571	0.91
Business Grocery	\$1,232,269	\$858,338	\$0	-\$170,066	\$158	\$1,266,027	\$2,000,273	\$1,920,700	\$3,266,300	-\$1,345,600	0.59
Virtual Cx/RetroCommissioning	\$10,632,786	\$3,549,793	\$0	\$113,148	\$0	\$7,085,344	\$8,110,636	\$14,295,728	\$15,195,980	-\$900,252	0.94
Industrial Systems	\$5,617,375	\$4,850,171	\$0	\$0	\$0	\$3,246,681	\$7,540,131	\$10,467,546	\$10,786,812	-\$319,266	0.97
Business Instant Discounts	\$40,681,973	\$40,486,005	\$0	-\$21,237,753	\$39,706,194	\$5,053,991	\$29,149,443	\$99,636,419	\$34,203,434	\$65,432,985	2.91
Non-Residential New Construction	\$8,256,539	\$7,828,505	\$0	\$73,776	\$0	\$3,447,474	\$12,014,264	\$16,158,820	\$15,461,738	\$697,082	1.05
Facility Assessments	\$413,454	\$0	\$0	\$54,686	\$0	\$3,411,712	\$0	\$468,140	\$3,411,712	-\$2,943,572	0.14
Business Telecomm	\$917,523	\$473,496	\$0	\$803	\$0	\$993,248	\$944,248	\$1,391,822	\$1,937,496	-\$545,674	0.72
Small Business	\$52,911,625	\$39,450,422	\$44,329	-\$6,223,838	\$15,116,349	\$10,077,725	\$37,782,599	\$101,298,887	\$47,860,324	\$53,438,562	2.12
Small Business Kits	\$1,791,581	\$2,006,984	\$369,567	-\$47,142	\$371,498	\$850,484	\$175,389	\$4,492,489	\$1,025,873	\$3,466,616	4.38
Incentives - Standard	\$58,319,572	\$40,004,940	\$0	-\$3,730,195	\$0	\$10,274,463	\$83,185,879	\$94,594,317	\$93,460,342	\$1,133,975	1.01
Strategic Energy Management	\$3,120,995	\$0	\$0	\$0	\$0	\$1,682,524	\$522,863	\$3,120,995	\$2,205,387	\$915,608	1.42
LED Streetlighting	\$27,581,880	\$904	\$0	\$0	\$17,767,189	\$1,711,963	\$45,985,105	\$45,349,973	\$47,697,068	-\$2,347,095	0.95
Nonprofit Retrofits	\$568,825	\$511,623	\$0	\$0	\$2,237	\$1,377,485	\$1,067,435	\$1,082,685	\$2,444,920	-\$1,362,235	0.44



Evaluation of ComEd's CY2019 Total Resource Cost Test

Program	Benefits				Costs			Illinois Total Resource Cost (TRC) Test (NPV replacement cost as benefit)			
	Avoided Electric Production (w/GHG adder)	Avoided Electric Capacity	Avoided Water Costs	Avoided Gas Production	NPV Replacement costs	Non-Incentive Costs	Incremental Costs (Net)	Illinois TRC Benefits	Illinois TRC Costs	Illinois TRC Test Net Benefits	Illinois TRC Test
Business Outreach						\$6,578,616			\$6,578,616		
Business Total	\$222,191,706	\$146,320,599	\$413,896	-\$31,227,442	\$72,963,625	\$60,130,896	\$243,796,696	\$410,662,384	\$303,927,592	\$106,734,791	1.35
Affordable Housing New Construction	\$648,461	\$567,189	\$0	\$88,493	\$0	\$771,496	\$1,857,637	\$1,304,142	\$2,629,133	-\$1,324,990	0.50
Food Bank LED Distribution	\$9,965,065	\$5,777,529	\$0	-\$2,472,637	\$9,154,853	\$2,699,513	\$3,737,616	\$22,424,809	\$6,437,129	\$15,987,680	3.48
Lighting Discounts - Income Eligible	\$10,497,174	\$6,722,923	\$0	-\$3,075,863	\$8,506,969	\$680,082	\$4,480,048	\$22,651,203	\$5,160,130	\$17,491,073	4.39
Multi-Family IHWAP	\$150,574	\$305,286	\$14,436	\$1,247,617	\$17,339	\$378,735	\$3,540,390	\$1,735,251	\$3,919,126	-\$2,183,875	0.44
Multi-Family Retrofits	\$684,617	\$608,356	\$86,798	\$2,033,859	\$122,092	\$1,786,727	\$7,538,596	\$3,535,723	\$9,325,323	-\$5,789,600	0.38
Single Family Retrofit - CBA	\$791,079	\$1,873,826	\$0	\$1,535,973	\$176,504	\$1,391,340	\$10,944,971	\$4,377,382	\$12,336,311	-\$7,958,929	0.35
Single Family Retrofit - IHWAP	\$510,529	\$764,537	\$9,510	\$69,600	\$65,640	\$956,256	\$3,590,667	\$1,419,815	\$4,546,923	-\$3,127,108	0.31
UIC ERC Low Income Kits	\$2,870,146	\$1,831,871	\$10,587,750	\$1,342,630	\$1,412,442	\$2,002,544	\$2,149,046	\$18,044,839	\$4,151,590	\$13,893,249	4.35
Appliance Rebates - IE	\$1,401,079	\$826,151	\$0	\$0	\$0	\$236,811	\$862,940	\$2,227,230	\$1,099,751	\$1,127,479	2.03
IE Program Design Pilot	\$19,037	\$39,095	\$19,510	\$69,847	\$4,818	\$1,011,108	\$67,289	\$152,306	\$1,078,397	-\$926,091	0.14
Manufactured Housing Retrofit	\$79,055	\$81,715	\$64,917	\$95,123	\$20,121	\$548,056	\$472,767	\$340,931	\$1,020,823	-\$679,892	0.33
Ductless Heat Pump and Building Envelope Pilot	\$6,119	\$273	\$0	\$0	\$0	\$187,603	\$30,553	\$6,392	\$218,155	-\$211,764	0.03
IE Senior Program Design Pilot	\$16,185	\$22,548	\$0	\$58,310	\$3,186	\$3,078,743	\$32,991	\$100,228	\$3,111,734	-\$3,011,506	0.03
New Manufactured Housing	\$0	\$0	\$0	\$0	\$0	\$663,382	\$0	\$0	\$663,382	-\$663,382	0.00
Public Housing Energy Savings	\$468,567	\$275,926	\$19,686	-\$101,159	\$48,331	\$642,850	\$1,582,006	\$711,351	\$2,224,855	-\$1,513,504	0.32
Income Eligible Outreach						\$1,077,553			\$1,077,553		
Income Eligible Total	\$28,107,687	\$19,697,223	\$10,802,607	\$891,792	\$19,532,294	\$18,112,799	\$40,887,517	\$79,031,603	\$59,000,316	\$20,031,286	1.34
Voltage Optimization	\$68,756,472	\$61,422,453	\$0	\$0	\$0	\$62,813,754	\$0	\$130,178,925	\$62,813,754	\$67,365,171	2.07
Portfolio Costs						\$45,718,248			\$45,718,248		
Res and Business Total	\$293,569,321	\$198,176,734	\$8,353,779	-\$25,788,586	\$105,096,171	\$131,812,454	\$288,476,490	\$579,407,419	\$420,288,944	\$159,118,474	1.38
Portfolio Total (w / IE and VO)	\$321,677,007	\$279,296,410	\$19,156,386	-\$24,896,793	\$124,628,464	\$212,739,007	\$329,364,007	\$719,861,475	\$542,103,015	\$177,758,460	1.33

Note: For jointly implemented programs by ComEd and one or more Illinois gas utility, only the electric portion of the program savings and cost-benefit calculations are included here.

* A detailed breakdown of the Overall Portfolio costs can be found in Table 2-2.

Source: Guidehouse analysis

Table 3-2. ComEd Program Level Benefits, Costs and UCT Test Without Gas Data from Joint Programs

Program	Benefits			Costs		Illinois Utility Cost Test (UCT)			
	Avoided Electric Production (w/o GHG adder)	Avoided Electric Capacity	Avoided Gas Production	Non-Incentive Costs	Incentive Costs	Illinois UCT Benefits	Illinois UCT Costs	Illinois UCT Test Net Benefits	Illinois UCT Test
(a)	(b)	(c)	(d)	(e)	(f)	(g) = (b+c+d)	(h) = (e + f)	(i) = (g-h)	(j) = (g/h)
Appliance Rebates	\$8,924,830	\$11,820,548	\$14,916,364	\$5,116,515	\$12,971,220	\$35,661,743	\$18,087,736	\$17,574,007	1.97
Elementary Education Kits	\$1,602,313	\$1,000,374	\$643,124	\$871,465	\$500,361	\$3,245,811	\$1,371,826	\$1,873,984	2.37
Fridge & Freezer Recycling	\$3,645,909	\$2,442,500	\$0	\$2,887,433	\$5,708,654	\$6,088,408	\$8,596,087	-\$2,507,678	0.71
Residential HVAC	\$3,080,198	\$5,501,537	\$1,443,443	\$1,948,771	\$4,939,957	\$10,025,177	\$6,888,728	\$3,136,450	1.46
Weatherization	\$247,161	\$717,731	\$0	\$472,338	\$315,316	\$964,892	\$787,655	\$177,238	1.23
Single-Family Assessment (Joint)	\$4,260,308	\$3,062,605	\$2,197	\$3,434,561	\$9,277,567	\$7,325,109	\$12,712,127	-\$5,387,018	0.58
Residential Behavior	\$7,337,228	\$0	\$0	\$4,730,303	\$0	\$7,337,228	\$4,730,303	\$2,606,924	1.55
Lighting Discount	\$35,386,811	\$25,466,899	-\$11,206,334	\$4,448,717	\$14,390,851	\$49,647,376	\$18,839,568	\$30,807,808	2.64
Multi-Family - Market Rate (Joint)	\$2,390,436	\$1,400,576	-\$359,936	\$1,917,949	\$6,125,517	\$3,431,075	\$8,043,466	-\$4,612,391	0.43
Residential New Construction	\$96,699	\$443,366	\$0	\$135,258	\$219,022	\$540,066	\$354,280	\$185,786	1.52
Residential Total	\$66,971,893	\$51,856,135	\$5,438,856	\$25,963,311	\$54,448,465	\$124,266,885	\$80,411,776	\$43,855,109	1.55
Agriculture	\$131,428	\$148,067	\$0	\$538,926	\$76,359	\$279,496	\$615,285	-\$335,789	0.45
Incentives - Custom	\$8,758,030	\$6,151,350	-\$60,861	\$2,534,233	\$5,938,277	\$14,848,519	\$8,472,510	\$6,376,010	1.75
Business Grocery	\$1,102,046	\$858,338	-\$170,066	\$1,266,027	\$963,005	\$1,790,318	\$2,229,032	-\$438,714	0.80
Virtual Commissioning/RetroCommissioning	\$10,157,156	\$3,549,793	\$113,148	\$7,085,344	\$9,686,979	\$13,820,097	\$16,772,323	-\$2,952,226	0.82
Industrial Systems	\$5,195,925	\$4,850,171	\$0	\$3,246,681	\$5,249,815	\$10,046,096	\$8,496,496	\$1,549,600	1.18
Business Instant Discounts	\$37,957,630	\$40,486,005	-\$21,237,753	\$5,053,991	\$13,822,192	\$57,205,882	\$18,876,183	\$38,329,699	3.03
Non-Residential New Construction	\$7,025,895	\$7,828,505	\$73,776	\$3,447,474	\$4,553,034	\$14,928,176	\$8,000,508	\$6,927,668	1.87
Facility Assessments	\$411,054	\$0	\$54,686	\$3,411,712	\$0	\$465,740	\$3,411,712	-\$2,945,972	0.14
Business Telecomm	\$863,654	\$473,496	\$803	\$993,248	\$526,203	\$1,337,953	\$1,519,451	-\$181,498	0.88
Small Business	\$47,567,186	\$39,450,422	-\$6,223,838	\$10,077,725	\$40,996,391	\$80,793,770	\$51,074,116	\$29,719,654	1.58
Small Business Kits	\$1,614,659	\$2,006,984	-\$47,142	\$850,484	\$184,171	\$3,574,501	\$1,034,655	\$2,539,846	3.45
Incentives - Standard	\$53,575,838	\$40,004,940	-\$3,730,195	\$10,274,463	\$31,175,953	\$89,850,583	\$41,450,416	\$48,400,167	2.17
Strategic Energy Management	\$3,100,559	\$0	\$0	\$1,682,524	\$522,863	\$3,100,559	\$2,205,387	\$895,172	1.41
LED Streetlighting	\$25,264,444	\$904	\$0	\$1,711,963	\$12,056,217	\$25,265,348	\$13,768,180	\$11,497,168	1.84
Nonprofit Retrofits	\$550,229	\$511,623	\$0	\$1,377,485	\$1,160,255	\$1,061,852	\$2,537,740	-\$1,475,888	0.42
Business Outreach				\$6,578,616			\$6,578,616		
Business Total	\$203,275,734	\$146,320,599	-\$31,227,442	\$60,130,896	\$126,911,714	\$318,368,891	\$187,042,610	\$131,326,281	1.70
Affordable Housing New Construction	\$549,630	\$567,189	\$88,493	\$771,496	\$1,557,801	\$1,205,312	\$2,329,297	-\$1,123,984	0.52



Evaluation of ComEd's CY2019 Total Resource Cost Test

Program	Benefits			Costs		Illinois Utility Cost Test (UCT)			
	Avoided Electric Production (w/o GHG adder)	Avoided Electric Capacity	Avoided Gas Production	Non-Incentive Costs	Incentive Costs	Illinois UCT Benefits	Illinois UCT Costs	Illinois UCT Test Net Benefits	Illinois UCT Test
Food Bank LED Distribution	\$9,566,650	\$5,777,529	-\$2,472,637	\$2,699,513	\$1,924,947	\$12,871,541	\$4,624,460	\$8,247,081	2.78
Lighting Discounts - Income Eligible	\$9,907,251	\$6,722,923	-\$3,075,863	\$680,082	\$4,295,342	\$13,554,311	\$4,975,425	\$8,578,886	2.72
Multi-Family IHWAP	\$138,510	\$305,286	\$1,247,617	\$378,735	\$4,680,142	\$1,691,413	\$5,058,877	-\$3,367,464	0.33
Multi-Family Retrofits	\$638,304	\$608,356	\$2,033,859	\$1,786,727	\$4,320,131	\$3,280,519	\$6,106,859	-\$2,826,339	0.54
Single Family Retrofit - CBA	\$676,417	\$1,873,826	\$1,535,973	\$1,391,340	\$6,842,123	\$4,086,216	\$8,233,463	-\$4,147,247	0.50
Single Family Retrofit - IHWAP	\$458,333	\$764,537	\$69,600	\$956,256	\$4,951,109	\$1,292,470	\$5,907,365	-\$4,614,895	0.22
UIC ERC Low Income Kits	\$2,761,746	\$1,831,871	\$1,342,630	\$2,002,544	\$2,149,046	\$5,936,247	\$4,151,590	\$1,784,657	1.43
Appliance Rebates - IE	\$1,370,828	\$826,151	\$0	\$236,811	\$758,002	\$2,196,979	\$994,813	\$1,202,166	2.21
IE Program Design Pilot	\$16,793	\$39,095	\$69,847	\$1,011,108	\$0	\$125,734	\$1,011,108	-\$885,374	0.12
Manufactured Housing Retrofit	\$72,054	\$81,715	\$95,123	\$548,056	\$472,767	\$248,891	\$1,020,823	-\$771,932	0.24
Ductless Heat Pump and Building Envelope Pilot	\$5,122	\$273	\$0	\$187,603	\$0	\$5,395	\$187,603	-\$182,208	0.03
IE Senior Program Design Pilot	\$14,901	\$22,548	\$58,310	\$3,078,743	\$0	\$95,759	\$3,078,743	-\$2,982,984	0.03
New Manufactured Housing	\$0	\$0	\$0	\$663,382	\$0	\$0	\$663,382	-\$663,382	0.00
Public Housing Energy Savings	\$448,371	\$275,926	-\$101,159	\$642,850	\$1,582,006	\$623,138	\$2,224,855	-\$1,601,717	0.28
Income Eligible Outreach				\$1,077,553			\$1,077,553		
Income Eligible Total	\$26,624,910	\$19,697,223	\$891,792	\$18,112,799	\$33,533,417	\$47,213,926	\$51,646,216	-\$4,432,290	0.91
Voltage Optimization	\$60,395,845	\$61,422,453	\$0	\$62,813,754	\$0	\$121,818,298	\$62,813,754	\$59,004,544	1.94
Portfolio Costs				\$45,718,248					
Res and Business Total	\$270,247,627	\$198,176,734	-\$25,788,586	\$131,812,454	\$181,360,179	\$442,635,775	\$313,172,634	\$129,463,142	1.41
Portfolio Total (w / IE and VO)	\$296,872,537	\$279,296,410	-\$24,896,793	\$212,739,007	\$214,893,596	\$551,272,154	\$427,632,604	\$123,639,550	1.29

* A detailed breakdown of the Overall Portfolio costs can be found in Table 2-2.

Source: Guidehouse analysis

3.1 Program Specific Data Collection

The program specific data collection for each measure in ComEd's CY2019 portfolio is described below:

- Guidehouse leveraged the program tracking data and evaluation reports to compile measure level savings, quantity and realization rate values.
- TRM v 7.0 was used to compile measure life and incremental cost data.
- The utility incentives costs, non-incentive costs and actual measure costs were requested from ComEd.
- A cost assumption review was performed on all the cost data.

3.2 Cost Review

Incremental Measure Cost

There were instances where the program tracking data and the incremental cost value from the reference sources did not align due to potential misinterpretation of the program unit definition. In retrofit-type measures, this cost is the full measure cost and not incremental installation costs (material and labor). O&M costs shall be included if there is a difference between the efficient measure and the baseline measure. In cases where the efficient measure has a significantly shorter or longer life than the relevant baseline measure (e.g., LEDs versus halogens), the avoided baseline replacement measure costs should be accounted for in the TRC analysis. The incremental cost input in the TRC analysis is not reduced by the amount of any incentives. Here are specific considerations highlighted in our analysis:

- Residential New Construction – Guidehouse used data analyzed by ComEd and Nicor Gas to calculate the incremental cost per the different qualifying tiers of efficiency.
- Business New Construction – The program implementer analyzed project costs of construction meeting code versus exceeding code to calculate a \$/kWh and a \$/therm saved cost.
- Retrocommissioning – Both the study and measure implementation costs are included.
- Custom (including Data Centers) and Industrial Systems – The costs on a project level must be analyzed to determine if the full measure cost or an incremental cost is to be used. An accurate analysis is difficult and an estimated cost per kWh saved (tied to avoided cost) is typically used in relation to the average project payback to remain cost effective. In CY2019, Guidehouse used the reported project costs provided by ComEd and adjusted, as necessary, to ensure it includes the incremental cost only to calculate a program average measure cost per kWh saved.
- Prescriptive programs (Small Business, Standard, HVAC, Multi-Family, etc.) – Guidehouse researched the incremental measure cost data from the TRM and the DNV GL workpapers to calculate the program measure costs. This data is supported by notes provided in the input assumptions workbook. For any direct install programs, ComEd provided the measure costs by measure, typically by providing the incentives, with some exceptions. For joint programs, only the ComEd portion of the costs were included.
- Early retirement (HVAC) – There were air conditioners installed that were assumed to accelerate replacement and hence savings were calculated as the full measure cost difference versus incremental costs compared to standard efficiency baseline costs. The TRM provides data for using the NPV cost differential for early retirement with guidance to use actual program data for early retirement first year costs.
- For the Elementary Energy Education Program and other similar programs, the per kit costs were used to calculate incremental measure cost versus the TRM deemed incremental costs of the measures included in the kits.
- Income Eligible direct install programs leveraged the incentive costs as the measure costs.

Data Sources and Assumptions

For the CY2019 TRC analysis, Table 3-3 provides the sources and assumptions for the measure costs by program. This table provides the baseline of identifying gaps in data and recommendations to improve cost data in future TRC analyses (acknowledging that some CY2019 programs are not implemented in CY2020).

Table 3-3. CY2019 Program Cost Data Sources and Assumptions

Program	Data Source	Note
Appliance Rebates	TRM	TRM deemed values are used for the analysis.
Elementary Education Kits	ComEd	Actual cost per kit used
Fridge and Freezer Recycling	Incentives	Net incentive ⁸ costs equal measure costs. Program level Incentive costs provided by ComEd are prorated by energy savings for each measure since the total exceeds the bottom-up measure costs. Actual costs divided by category and technology type was provided.
Heating and Cooling (HVAC) Rebates	TRM	Used 3 tons as the assumed average unit capacity of all the units installed in 2019 to align the savings and cost units (tons vs per unit).
Weatherization - Market Rate	Project Invoices	Guidehouse leverages CY 2019 project data. The CY2019 project data was the average cost of installing a sample of projects from ComEd provided implementer invoices. This average cost for each weatherization measure type is used to calculate the overall measure cost for the program.
Home Energy Assessment	Project Invoices	Since most of the measures are DI, Guidehouse calculates the average cost of installing a sample of projects from ComEd provided implementer invoices. This average cost for each measure type is used to calculate the overall measure cost for the program. However, the incentives exceed the total measure costs.
Home Energy Reports	NA	There are no incentives or measure costs and only program administration costs.
Lighting Discounts	TRM	Includes analysis of the mix of lamps and the NPV replacement costs
Multi-Family Market Rate	Project Invoices	Since most of the measures are DI, Guidehouse calculates the average cost of installing a sample of projects from ComEd provided implementer invoices. This average cost for each measure type is used to calculate the overall measure cost for the program. However, the incentives exceed the total measure costs.
Residential New Construction	ComEd	Guidehouse used analyzed project data by ComEd to calculate the incremental cost per the different qualifying tiers of efficiency, \$/tier
Custom	ComEd	Sample of project files, average \$/kWh
Industrial Systems Optimization	ComEd	Sample of project files, average \$/kWh
Instant Discounts	TRM	Includes analysis of the mix of lamps and the NPV replacement costs
Business New Construction	ComEd	The program implementer analyzed project costs of construction meeting code versus exceeding code to calculate a \$/kWh and a \$/therm saved cost. ComEd doesn't track the measure costs for this program. Guidehouse makes the assumption that the implementation contractor and marketing costs are the only costs associated with this program and there is no measure cost.
Operational Efficiency/Facility Assessments	Not Applicable	
Public Housing Energy Savings	ComEd (Multi-Family Market Rate Program) and TRM	Measure costs weren't tracked by ComEd. Guidehouse had to make the assumption that the measures costs for DI projects was similar to the DI measures installed in MF MR program. TRM deemed incremental cost values were used for Non-DI measures.
Retrocommissioning	ComEd	Sample of project files, average \$/kWh
Small Business	TRM, DNV GL workpaper, assumptions	Certain assumptions on unit definition

⁸ Net refers to incentives calculated as net incentives = NTG x paid incentives

Program	Data Source	Note
Standard	TRM, DNV GL workpaper, assumptions	Certain assumptions on unit definition
Strategic Energy Management	Incentives	Assume measure cost equals incentives
Street Lighting	Project Invoice	ComEd provides this value based on their internal calculations.
Affordable Housing New Construction	Res New Const	\$/kWh ratio from the res NC program
Food Bank LED Distribution	Implementer provided costs and Incentives	Implementer provide costs per pack. However, the incentives exceeded the measure cost. Guidehouse makes the assumption that incentives are equal to the measure cost.
Appliance and Lighting Discounts - Income Eligible	TRM	Includes analysis of the mix of lamps and the NPV replacement costs
Multi-Family IHWAP and IE	Incentive	The tracking data provided incentives per measure. Guidehouse assumes that the measure costs should equal incentives. However the tracking data at the measure level did not add up to the reconciliation workbook.
Single Family Retrofit – CBA and IHWAP	/incentive	The tracking data provided incentives per measure. Guidehouse assumes that the measure costs should equal incentives. However the tracking data at the measure level did not add up to the reconciliation workbook.
Manufactured Housing	Incentives	The tracking data provided incentives per measure. Guidehouse assumes that the measure costs should equal incentives. However the tracking data at the measure level did not add up to the reconciliation workbook.
UIC ERC Low Income Kits	Incentives	The kits are provided at no charge to the customer. Therefore, the cost of the kit is the measure cost. IE kit measure breakdown costs were provided by ComEd. However, the reported incentives exceeded the measure costs. Therefore, to align the costs, GH used the reported incentives.

Source: Guidehouse analysis

3.3 Findings and Recommendations

Guidehouse performed a bottom-up analysis for each program in ComEd's CY2019 portfolio and found some discrepancies associated with the measure costs. However, there is one finding for program and incentive costs. The appendix of this document provides a summary of the documentation Guidehouse provided for the CY2018 TRC analysis for documenting measure costs.

Finding 1. Some program costs are bundled together with other programs. Calculating a program specific cost-effectiveness requires estimation of program cost allocation. The specific programs included:

- Incentives – Custom and Incentives – Standard
- Appliance Rebates – Income Eligible (IE) (Combined with Lighting Discounts - IE) and Lighting Discounts – IE
- Multi Family Retrofits – IE and Multi Family Retrofits - IE (IHWAP)
- Single-Family Retrofits – CBA and Single-Family Retrofits – IE (IHWAP)
- Residential HVAC and Weatherization

Recommendation 1. Guidehouse recommends breaking down the program budgets and tracking by program and not in aggregate.

Finding 2. The tracking data for the Business Standard and Small Business Energy Savings programs do not contain the units of measure counts.

Recommendation 2. ComEd should provide the units information for measure count in the tracking data. This will help calculate the total measure costs inputs accurately.

Finding 3. Bottom-up measure costs provided by ComEd are lower than the incentives for direct install programs. Guidehouse, therefore, used the incentives to allocate the costs to the individual measures within the programs. Programs with this finding include:

- Manufactured Housing Retrofit
- Home Energy Assessment
- Fridge Freezer Recycling⁹
- Appliance – IE
- Lighting discounts –IE
- Single Family – CBA
- Single Family - IHWAP
- Multi-Family – Income Eligible
- Multi- Family - IHWAP
- Public Housing Energy Savings
- UIC Kits

Some of the programs listed above did have measure level breakdown either in the tracking system with incentives or other documentation ComEd provided with measure level costs. Since these values were lower than the reconciliation incentives value, we opted to use the incentives as the indicator for measure costs.

Recommendation 3: Provide documentation of exceptions to measure cost or a full breakdown of all measure costs in direct install program within the tracking system. It is possible that in some installations, costs vary and are not the same across all customers. Actual costs for each unit rebated should be documented and the program implementation documentation should describe any deviation from the invoiced (program-level) incentives and why it equals or exceeds the measure costs. The following are specific rationale and recommendations for addressing the finding (incentives exceeding measure costs) across the programs:

- Lighting Discounts – IE, Multi Family Retrofits – IE, Residential HVAC, Single-Family Retrofits - IE (IHWAP), and Weatherization: Since the incentive and non-incentive costs were not tracked separately for these programs, ComEd had to provide percent allocation values which impacts the comparison of incentives with measure costs.
- UIC-ERC Income Eligible Kits: Since ComEd incentivizes the kits completely, Guidehouse would recommend making sure the overall incentive for the program line up with the cost of each kit distributed as a part of the program. If the cost per kit multiplied by the total number of kits distributed is different, then any discrepancy between the two numbers should be explained.
- MF Market Rate, Public Small Facilities and Public Housing Authority: ComEd should provide the total cost of all the direct install measures installed as a part of the program.

⁹ For this program, it may be that the program provides in addition to covering the costs of recycling and additional incentive payment to cover any non-measure related costs.

APPENDIX A. GUIDANCE ON COST INFORMATION NEEDED FOR FUTURE TRC ANALYSES

The TRM provides guidance on when the actual costs should be used instead of the deemed costs. These situations include:

- Direct install measures, for example:
 - Aerators
 - Showerheads
- Operations and maintenance type of measures, for example:
 - Weatherization and air sealing
 - Economizer repair
- Large variability of costs, for example:
 - Food service equipment, such as combination ovens and ice makers
 - Larger sized units, such as variable speed drives above a certain size threshold
 - Various control applications, such as advanced rooftop controls
 - Early retirement
- Default values provided, but recommend using actual cost data, for example:
 - Storage water heaters
 - Ozone laundry

Most measures have deemed measure costs and are stated as the incremental (difference between efficient and standard case) or full cost in the TRM. The TRM provides guidance on when to use actual costs even if incremental costs are deemed in the TRM. Additionally, there are costs provided for measures that may be installed as early retirement and those where the baseline has a shorter measure life than the efficient case. These costs are provided also as a net present value replacement cost (to adjust those costs to year of installation instead of future replacement costs).

Guidehouse recommends using the actual cost in the following cases which is consistent with the TRM and the policy manual:

- Direct Install measures
- Operation and maintenance type of measures.
- Large variability for installed costs
- Default values provided but TRM recommends using actual costs when available
- When incremental costs provided in the TRM are not applicable to specific delivery type(s) and must be substituted with actual measure costs.

For measures where the TRM recommends using the actual costs but also provides a default value, Guidehouse recommends using the default value only if the data collection effort is a barrier and the implementer thinks it is reasonable compared to the prices they are quoted for the measures. Guidehouse will review this assumption on a case by case basis upon TRC analysis review for CY2020 and beyond.