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ComEd Virtual Commissioning Impact Evaluation Report

**Energy Efficiency/Demand Response Plan:
Program Year 2021 (CY2021)
(1/1/2021-12/31/2021)**

Prepared for:

ComEd

FINAL

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1. Introduction

This report presents the results of the impact evaluation of the CY2021 Virtual Commissioning (VCx) Program.

The report summarizes the total energy and demand impacts for the program broken out by relevant measure and program structure details. The appendices provide the impact analysis methodology and details of the total resource cost (TRC) analysis inputs. CY2021 covers January 1, 2021 through December 31, 2021.

2. Program Description

The VCx Program is an energy efficiency pathway in the RetroCommissioning Program[1] that targets small and medium-sized non-residential customers (including local businesses, franchisees of national chains, and schools and other public buildings) that the program deems to have significant potential for achieving energy savings through low- or no-cost operational changes.[2] This program provides qualified ComEd customers[3] with energy management and information system services to better manage their energy usage, identify energy savings opportunities, and achieve energy savings. The program follows a step-by-step process to:

- Identify customers with significant potential for low- or no-cost energy savings

- Work with customers to understand their energy usage and identify savings opportunities

- Enroll customers in the VCx Program

- Monitor customer progress periodically throughout their participation in the program

The program is designed and operated by Power TakeOff (PTO) and administered by Resource Innovations. All contacts between ComEd customers and VCx Program staff are remote, and all operational changes implemented through the program are performed by the participants, their employees, or contractors. Energy savings actions taken by each participant are documented as part of the program, and the resulting energy savings claimed for each action are estimated by PTO using a regression analysis of the participant's pre- and post-enrollment energy usage data.

The VCx Program had 174 participants in CY2021.

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[1] Although the VCx Program falls in the RetroCommissioning Program, it is evaluated separately due to differences in implementation and evaluation methodology.

[2] Recommended actions may include but are not limited to adjusting heating, ventilation, and air conditioning (HVAC) and lighting schedules to match occupancy, adjusting thermostat setbacks, and managing equipment startup and shutdown schedules.

[3] To qualify, a participant must be a ComEd non-residential customer with at least 1 year of 30-minute interval smart (advanced metering infrastructure, or AMI) meter data available prior to program engagement.

3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the VCx Program achieved in CY2021.

Table 3-1. Total Annual Incremental Electric Savings

Savings Category	Units	Ex Ante Gross Savings	Program Gross Realization Rate	Verified Gross Savings	Program Net-to-Gross Ratio (NTG)	CY2019 Net Carryover Savings	CY2020 Net Carryover Savings	Verified Net Savings
Electric Energy Savings - Direct	kWh	23,880,939	0.94	22,473,830	1.00	N/A	N/A	22,473,830
Electric Energy Savings - Converted from Gas	kWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Electric Energy Savings	kWh	23,880,939	0.94	22,473,830	1.00	N/A	N/A	22,473,830
Summer Peak§ Demand Savings	kW	N/A	N/A	1,455	1.00	N/A	N/A	1,455

N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).

§ The coincident summer peak period is defined as 1:00-5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August.

Note: The impact evaluation approach for this program cannot estimate water and gas savings.

The "Verified Net Savings" in row one (Electric Energy Savings – Direct) include primary kWh savings as a result of measure implementation. It does not include carryover savings from CY2019 and CY2020, secondary kWh savings from waste water treatment, and electric heating penalties since they do not apply to this program.

Source: ComEd tracking data and evaluation team analysis

4. Cumulative Persisting Annual Savings

Table 4-1 and Figure 4-1 show the measure-specific and total verified gross savings for the VCx Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2021. The electric CPAS across all measures installed in 2021 is shown in Table 4-1. The historic rows in each table are the CPAS contributions back to CY2018. The Program Total Electric CPAS is the sum of the CY2021 contribution and the historic contributions. Figure 4-1 shows the savings across the effective useful life (EUL) of the measures. There are no gas savings from this program, so the electric CPAS is same as total CPAS.

Table 4-1. Cumulative Persisting Annual Savings – Electric

Research Category	EUL	CY2021 Verified Gross Savings (kWh)	NTG*	Lifetime Net Savings (kWh)†	Verified Net kWh Savings 2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
VCx	7.3	22,473,830	1.00	164,058,958				22,473,830	22,473,830	22,473,830	22,473,830	22,473,830	22,473,830	22,473,830	6,742,149
Total Electric Contribution to CPAS		22,473,830		164,058,958				22,473,830	22,473,830	22,473,830	22,473,830	22,473,830	22,473,830	22,473,830	6,742,149
Total Electric Contribution to CPAS‡					8,148,664	22,571,439	41,120,251	41,120,251	41,120,251	32,971,587	32,971,587	32,971,587	32,971,587	19,987,419	8,653,665
Electric CPAS					8,148,664	22,571,439	41,120,251	63,594,081	63,594,081	55,445,417	55,445,417	55,445,417	55,445,417	42,461,249	15,395,814
Incremental Expiring Electric Savings§															15,731,681
Incremental Expiring Electric Savings								-	-	8,148,664	-	-	-	12,984,168	11,333,754
Incremental Expiring Electric Savings								-	-	8,148,664	-	-	-	12,984,168	27,065,435

Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
VCx	22,473,830	6,742,149	-	-	-	-	-	-	-	-	-	-
Total Electric Contribution to CPAS	22,473,830	6,742,149	-	-	-	-	-	-	-	-	-	-
Total Electric Contribution to CPAS‡	19,987,419	8,653,665										
Electric CPAS	42,461,249	15,395,814	-	-	-	-	-	-	-	-	-	-
Incremental Expiring Electric Savings§	-	15,731,681	6,742,149	-	-	-	-	-	-	-	-	-
Incremental Expiring Electric Savings	12,984,168	11,333,754	8,653,665	-	-	-	-	-	-	-	-	-
Incremental Expiring Electric Savings	12,984,168	27,065,435	15,395,814	-	-	-	-	-	-	-	-	-

Note: The green highlighted cell shows program total first-year electric savings. The gray cells are blank, indicating values irrelevant to the CY2021 contribution to CPAS.

* A deemed value. Source: Illinois Stakeholder Advisory Group (SAG) website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.

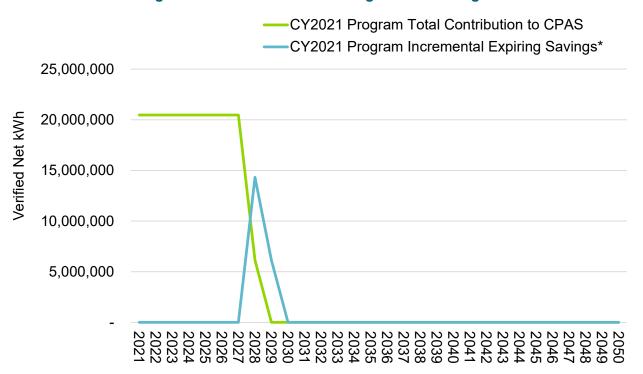† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Historic savings go back to CY2018.

§ Incremental expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.

Source: Evaluation team analysis

Figure 4-1. Cumulative Persisting Annual Savings

* Expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.
Source: Evaluation team analysis

5. Program Savings by Measure

This program has only one measure, so measure-level results are the same as the program-level results discussed in the previous section.

6. Impact Analysis Findings and Recommendations

The issue that had the largest effect on adjusting ex ante gross savings was documentation and handling of non-routine events (NREs).

The evaluation team developed several recommendations for the program team based on findings from the CY2021 evaluation.

Finding 1. Multiple projects had insufficient and/or inconsistent documentation and inclusion of NREs.

Project a1C1Q00000MLsb6UAD had a NRE listed for a water pump replacement on 2020-09-27 in the final evaluation model summary file. Guidehouse subsequently received an updated file in response to first draft verified savings with this NRE omitted. Guidehouse confirmed with the program that this NRE did indeed take place, but that the model that produced the ex ante gross savings did not include it because it coincided with the pump replacement. This resulted in inappropriate attribution of savings from the water pump replacement to the program. Guidehouse modified the regression model for this site to accommodate the NRE, align with the standard modeling approach, and produce an estimate of savings attributable to the program.

The updated model summary file also omitted NREs for the following projects that had had them in the original model summary file:

- a1C1Q00000MLsb6UAD

- a1C1Q00000LvUMzUAN

- a1C1Q00000LvUNIUAN

- a1C1Q00000LvUNpUAN

- a1C1Q00000LvUNYUA3

- a1C1Q00000MA1oaUAD

- a1C1Q00000MA1oPUAT

- a1C1Q00000MA1oQUAT

- a1C1Q00000MA1oVUAT

- a1C1Q00000N0mEVUAZ

- a1C1Q00000N0mEWUAZ

- a1C1Q00000NJO69UAH

- a1C1Q00000NJO6EUAX

- a1C1Q00000NvjlBUAR

- a1C1Q00000NvjlCUAR

Guidehouse does not generally have visibility into NREs and relies on the descriptions contained in the model summary file to be correct, transparent, and thorough. Apart from the project noted above, Guidehouse ran models informed by the updated model summary file and assumed that any NREs omitted from that file did not actually take place and were originally included in error. The evaluation team welcomes further discussion on this topic.

Additionally, Guidehouse identified the following projects that had NREs in the model summary file with no description:

- a1C1Q00000LvUNqUAN

- a1C1Q00000LvUO6UAN

- a1C1Q00000N0mEQUAZ

- a1C1Q00000NJO6CUAX

- a1C1Q00000Nvjl4UAB

- a1C1Q00000NvjlAUAR

- a1C1Q00000OFJbhUAH

- a1C1Q00000NJO6XUAX

- a1C1Q00000LvUN6UAN

Guidehouse included these NREs as we were generally able to decipher what they were based on the NRE name listed in the model summary file.

Finally, Guidehouse found that the following projects had a reporting end date in the model summary file prior to 2021-12-31 along with notes that read "Simpler to end data than make permanent NRE for a temporary problem" or "Chose to cut off data after 1 year of reporting to simplify M&V.":

- a1C1Q00000KV13DUAT

- a1C1Q00000LvUNWUA3

- a1C1Q00000Mkd05UAB

- a1C1Q00000MLsb6UAD

- a1C1Q00000N0mEhUAJ

- a1C1Q00000N0mEVUAZ

- a1C1Q00000N0mEWUAZ

- a1C1Q00000N0mEZUAZ

- a1C1Q00000Nvjl9UAB

- a1C1Q00000OFJbmUAH

Guidehouse followed the specified reporting end date for these projects, but notes that this is effectively including NREs in the model without any description of what they were.

Guidehouse verified savings for all projects using the assumption that the model summary file contained complete and accurate accounting of NREs.

> **Recommendation 1.** The program should include documentation delivered in the evaluation data that includes all confirmed NREs. The program should not omit NREs or end the reporting period early. If such updates are made, the program team should provide full descriptions for the reasons and documentation to support the change.

Finding 2. Multiple projects had regression equations that deviated from the standard modeling approach without a documented explanation. Guidehouse spot checked the two projects with the lowest realization rates and the two projects with the highest realization rates and found that three of the four had regression equations that deviated from the standard model; none of them, however, had notes in the model summary file to explain why. Table 6-1 details the modeling deviations for projects Guidehouse spot checked.

Table 6-1. Modeling Deviations

Project ID	Modeling Deviation
a1C1Q00000MA1oTUAT	Monthly binary variables omitted from model without explanation.
a1C1Q00000MLsb6UAD	Known NRE binary variables omitted from model. Verbal explanation provided. Guidehouse further refined the model to include the known NREs and maintain the standard modeling approach.
a1C1Q00000Mkd0DUAR	Monthly binary variables omitted from model without explanation.
a1C1Q00000KV132UAD	None, though responses to first draft verified savings indicated an ex ante daily model, the updated model summary file indicated an hourly model.

Source: ComEd tracking data

Guidehouse used the standard modeling approach for all projects. This included running an hourly model by default. For projects where the program and Guidehouse agreed that a daily model provided a better model fit, Guidehouse ran a daily model. No modeling deviations outside of this standard approach were sufficiently documented by the program, so Guidehouse did not include those deviations.

> **Recommendation 2.** The program should include documentation delivered in the evaluation data that documents and justifies any deviations from the standard modeling approach. This will allow Guidehouse to review the modified models and confirm that they do not introduce modeling bias or otherwise violate required assumptions for establishing causal inference.

Finding 3. Multiple sites had pre-period data deficiencies. Guidehouse requested 1 year of hourly interval data prior to enrollment in the CY2021 VCx evaluation plan. The intent of this

request was to receive 1 full calendar year of usable interval data for each site so the regression model could properly account for annual usage patterns.

Multiple sites had data flagged for removal due to COVID-19 impacts (International Performance Measurement and Verification Protocol (IPMVP) Method 1). Nine sites had fewer than 340 usable pre-period days after these removals. Table 6-2 lists the projects associated with these sites and the number of usable pre-period days.

Table 6-2. Usable Pre-Period Days

Project ID	Usable Pre-Period Days
a1C1Q00000NvjlCUAR	206
a1C1Q00000KV12xUAD	218
a1C1Q00000LvUNTUA3	235
a1C1Q00000MA1oDUAT	239
a1C1Q00000MLsb6UAD	255
a1C1Q00000MkczyUAB	274
a1C1Q00000N0mEWUAZ	283
a1C1Q00000N0mEjUAJ	322
a1C1Q00000NJO67UAH	328

Source: ComEd tracking data and evaluation team analysis

Some of these sites included pre-period data spanning multiple years with the same calendar months appearing multiple times and other calendar months omitted entirely.

Guidehouse did not exclude sites due to a short pre-period, though Guidehouse did shorten a COVID-19 removal period for project a1C1Q00000KV12xUAD. The consumption data for the site associated with that project showed what appeared to be minimal COVID-19 impacts during a two-month period within the specified removal period. Guidehouse chose to include those months to add some accounting of seasonality to the model.

Guidehouse verified savings for all projects using the assumption that missing pre-period seasonality did not impact savings.

> **Recommendation 2.** Require a full calendar year of usable pre-period data for every site. This is especially important for establishing causal inference from the regression model for sites with large seasonal differences in usage, such as schools.

Finding 4. Multiple sites had post-periods that did not cover the seasonality expected at the site. Guidehouse examined projects that were implemented at schools and found the following projects associated with sites that included no summer post-period.

- a1C1Q00000MA1oDUAT
- a1C1Q00000KV12nUAD
- a1C1Q00000Nvjl4UAB
- a1C1Q00000NvjlBUAR

- a1C1Q00000NvjlCUAR

- a1C1Q00000Nvjl1UAB

The regression model produced savings for these sites based on months outside of summer. These savings were then annualized to a full year, assuming the same savings would occur throughout the year.

Guidehouse verified savings for all projects using the assumption that missing post-period seasonality did not impact savings.

> **Recommendation 4.** Require full seasonal coverage of post-period data for sites that have known seasonal usage patterns (such as schools), and for projects that have likely seasonal impact variation (such as HVAC schedule adjustments). Guidehouse believes the assumption that savings derived from a partial year without full seasonal coverage are representative of yearly savings is too weak to continue using for such projects.

Finding 5. Baseline adjustments were applied too generically. Events that occur annually and that are accounted for using a binary variable (IPMVP Method 7) should use a single binary variable to account for the event with two different timeframes. For example, project ID a1C1Q00000LvUN0UAN has separate binary variables to account for school startup, one in the pre-period and one in the post-period. The intent of this type of variable should be to capture the effect of school startups in a typical year (i.e., averaged over both years).

> **Recommendation 5.** Adjust the regression model as needed to account for annually-repeated baseline adjustments, such as scheduled school breaks. This may require modifications to the model summary file as well.

Finding 6. Guidehouse found that the following projects had documented program changes in the model summary file that overlapped with the defined baseline period:

- a1C1Q00000LvUN8UAN

- a1C1Q00000LvUNfUAN

- a1C1Q00000LvUNHUA3

- a1C1Q00000LvUNiUAN

- a1C1Q00000LvUNJUA3

- a1C1Q00000LvUNjUAN

- a1C1Q00000LvUNnUAN

- a1C1Q00000LvUNPUA3

- a1C1Q00000LvUNqUAN

- a1C1Q00000LvUNrUAN

- a1C1Q00000LvUNxUAN

- a1C1Q00000LvUNYUA3

- a1C1Q00000LvUO0UAN

- a1C1Q00000LvUO5UAN

- a1C1Q00000MA1oaUAD

- a1C1Q00000MA1oDUAT

- a1C1Q00000MA1oKUAT

- a1C1Q00000MA1oMUAT

- a1C1Q00000MA1oTUAT

- a1C1Q00000MA1oWUAT

- a1C1Q00000MkczhUAB

- a1C1Q00000MkcziUAB

- a1C1Q00000MkczZUAR

- a1C1Q00000Mkd0EUAR

- a1C1Q00000MLsb2UAD

- a1C1Q00000MLsb3UAD

- a1C1Q00000MLsb4UAD

- a1C1Q00000N0mEhUAJ

- a1C1Q00000N0mEUUAZ

- a1C1Q00000NjAbiUAF

- a1C1Q00000NJO67UAH

- a1C1Q00000NJO6BUAX

- a1C1Q00000NJO6DUAX

- a1C1Q00000NJO6OUAX

- a1C1Q00000Nvjl0UAB

- a1C1Q00000OMvU9UAL

For example, project a1C1Q00000LvUN8UAN had a specified baseline period defined in the model summary file as 2018-11-05 to 2020-02-23. This project also had a Change 0 Start Date in the model summary file of 2020-02-05, which falls within the specified baseline period. Guidehouse used the Reporting Start and End Date to define the post period for all projects, which did not contain overlap with the baseline period for any project.

Recommendation 6. The baseline (pre) period should not include overlap with any program changes. Doing so may cause the model to produce a savings estimate that does not fully capture the program change, resulting in underestimated savings.

Appendix A. Impact Analysis Methodology

Guidehouse estimated the VCx Program's annualized energy savings by using baseline hourly energy usage models for each CY2021 program participant calibrated to their pre-enrollment hourly advanced metering infrastructure (AMI) usage data and available post-enrollment usage data (as supplied by the program implementer) using a regression model of the form shown in Equation A-1. In addition to AMI data, the evaluation team used tracking data that listed the dates of program changes and NREs as well as degree-hour data derived from local weather data, both supplied by the program implementer.[4] CY2021 gross program savings comprises the sum of the individual participants' gross annualized savings.

Equation A-1. VCx Hourly Load Model

$$E_{t,d} = \sum_{h=1}^{24} \alpha_h HOD_{h,t} + \sum_{h=1}^{24} \beta_h HOD_{h,t} * Weekend_d + \sum_{m=1}^{12} \sum_{h=1}^{24} \beta_{m,h} HOD_{h,t} * Month_{t,m} +$$

$$\gamma_L CDH_{t,d} + \gamma_Q CDH_{t,d}^2 + \delta_L HDH_{t,d} + \delta_Q HDH_{t,d}^2 +$$

$$Change_{t,d} \left(\sum_{h=1}^{24} \theta_h HOD_h + \sum_{h=1}^{24} \varphi_h HOD_h * Weekend_d \right) + \varepsilon_t$$

where:

- $t, d, m,$ and h index the hour of day, day of week, month of year, and hour, respectively.

- $E_{t,d}$ is the customer's energy consumption at hour t of day d.

- The $HOD_{h,t}$ comprise a set of 24 binary hour-of-day indicators, each of which equals 1 if t falls in the hth hour of the day, and 0 otherwise.

- $Weekend_d$ is a binary indicator that equals 1 if d is a weekend or holiday weekday, and 0 otherwise.

- The $Month_{t,m}$ comprise a set of 12 month-of-year indicators, each of which equals 1 if t falls in month m, and 0 otherwise.

- $CDH_{t,d}$ is the cooling degree hours during hour t of day d.

- $HDH_{t,d}$ is the heating degree hours during hour t of day d.

- $Change_{t,d}$ is a vector of binary indicators, each of which equals 1 if t falls within the dates of the confirmed change(s), and 0 otherwise. This includes VCx program changes and NREs as documented by the program.

- The $\alpha_h, \beta_h, \beta_{m,h}, \gamma_L, \gamma_Q, \delta_L, \delta_Q, \theta$ and φ coefficients are unknown parameters to be estimated.

- $\varepsilon_{t,d}$ is an hourly mean-zero disturbance term.

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[4] ZIP code-level weather data from The Weather Company was provided by the program implementer.

Fitting this model to the available data in the baseline and reporting periods for a given participant using regression analysis yields a customer-specific set of coefficients that represent the effects of the program-induced operational changes net of hour of day, day type, month of year, and weather effects, as well as any NREs.

In cases where the program and Guidehouse both agreed that a participant's model produced better fitness metrics at the daily level, Guidehouse instead used a daily version of Equation A-1. This model was fitted to daily rollups of the customer's hourly usage and weather data, as Equation A-2 shows.

Equation A-2. VCx Daily Load Model

$$E_d = \alpha Weekend_d + \sum_{m=1}^{12} \beta_{d,m} Month_m + \gamma_L CDD_d + \gamma_Q CDD_d^2 + \delta_L HDD_d + \delta_Q HDD_d^2 +$$

$$\theta Change_d + \varepsilon_d$$

where:

- E_d is the customer's energy consumption during day d

- CDD_d are the cooling degree days during day d

- HDD_d are the heating degree days during day d

- ε_d is a daily mean-zero disturbance term

All other definitions are the same as in Equation A-1.

Appendix B. Impact Findings Detailed Results

Table B-1 shows the realization rate by project.

Table B-1 Realization Rate by Project

Project ID	Ex Ante Gross Savings (kWh)	Verified Gross Savings (kWh)	Model Resolution	Realization Rate
a1C1Q00000Mkd0DUAR	90,650	111,445	Hourly	1.23
a1C1Q00000KV132UAD	17,493	19,618	Hourly	1.12
a1C1Q00000NjAbhUAF	345,437	381,794	Hourly	1.11
a1C1Q00000MA1oaUAD	33,813	37,086	Hourly	1.10
a1C1Q00000MLsb1UAD	62,142	67,908	Daily	1.09
a1C1Q00000LvUNrUAN	282,336	302,735	Daily	1.07
a1C1Q00000LvUNiUAN	66,754	71,300	Hourly	1.07
a1C1Q00000LvUN0UAN	28,165	29,927	Daily	1.06
a1C1Q00000LvUNqUAN	255,855	270,073	Daily	1.06
a1C1Q00000NJO6CUAX	209,216	218,688	Hourly	1.05
a1C1Q00000Nvjl4UAB	47,280	49,362	Hourly	1.04
a1C1Q00000KV134UAD	157,158	163,229	Hourly	1.04
a1C1Q00000LvUO3UAN	89,058	91,803	Hourly	1.03
a1C1Q00000LvUNbUAN	274,198	282,165	Daily	1.03
a1C1Q00000NJO6QUAX	255,202	262,591	Hourly	1.03
a1C1Q00000KV12qUAD	6,147	6,322	Hourly	1.03
a1C1Q00000N0mEfUAJ	223,756	230,056	Hourly	1.03
a1C1Q00000Mkd05UAB	27,682	28,455	Hourly	1.03
a1C1Q00000LvUNBUA3	33,598	34,487	Hourly	1.03
a1C1Q00000LvUNeUAN	26,224	26,826	Hourly	1.02
a1C1Q00000Mkd0AUAR	181,856	185,791	Hourly	1.02
a1C1Q00000N0mEXUAZ	15,609	15,946	Hourly	1.02
a1C1Q00000NJO6LUAX	32,658	33,282	Hourly	1.02
a1C1Q00000NJO6DUAX	109,763	111,805	Daily	1.02
a1C1Q00000MA1oLUAT	416,915	424,475	Hourly	1.02
a1C1Q00000NJO67UAH	61,036	62,097	Hourly	1.02
a1C1Q00000NJO6NUAX	48,991	49,808	Hourly	1.02
a1C1Q00000NvjlCUAR	103,422	105,131	Hourly	1.02
a1C1Q00000MA1oOUAT	104,994	106,688	Hourly	1.02
a1C1Q00000MLsbBUAT	18,845	19,121	Hourly	1.01
a1C1Q00000MA1oCUAT	103,722	105,129	Hourly	1.01
a1C1Q00000MLsb3UAD	111,056	112,538	Hourly	1.01
a1C1Q00000NjAbeUAF	12,640	12,796	Hourly	1.01
a1C1Q00000N0mEQUAZ	174,145	176,112	Hourly	1.01
a1C1Q00000KV131UAD	116,140	117,265	Hourly	1.01
a1C1Q00000MA1oHUAT	74,926	75,639	Hourly	1.01
a1C1Q00000LvUNnUAN	229,177	231,056	Hourly	1.01
a1C1Q00000LvUNmUAN	35,162	35,415	Hourly	1.01
a1C1Q00000OMvU9UAL	63,312	63,768	Hourly	1.01

Project ID	Ex Ante Gross Savings (kWh)	Verified Gross Savings (kWh)	Model Resolution	Realization Rate
a1C1Q00000MA1olUAT	81,155	81,717	Hourly	1.01
a1C1Q00000MA1oQUAT	64,050	64,493	Hourly	1.01
a1C1Q00000LvUMzUAN	237,932	239,538	Hourly	1.01
a1C1Q00000MA1oWUAT	100,726	101,309	Hourly	1.01
a1C1Q00000LvUO6UAN	99,652	100,204	Hourly	1.01
a1C1Q00000NJO6UUAX	15,262	15,346	Hourly	1.01
a1C1Q00000LvUNGUA3	31,010	31,166	Hourly	1.01
a1C1Q00000KV138UAD	36,206	36,368	Hourly	1.00
a1C1Q00000MLsb9UAD	502,406	504,651	Hourly	1.00
a1C1Q00000OMvU2UAL	281,608	282,762	Hourly	1.00
a1C1Q00000NJO6JUAX	206,879	207,646	Hourly	1.00
a1C1Q00000N0mEVUAZ	461,499	463,056	Hourly	1.00
a1C1Q00000LvUNxUAN	141,388	141,854	Hourly	1.00
a1C1Q00000KV12nUAD	79,400	79,660	Hourly	1.00
a1C1Q00000NvjI1UAB	512,236	513,863	Daily	1.00
a1C1Q00000Mkd0EUAR	429,307	430,618	Hourly	1.00
a1C1Q00000KV139UAD	6,011	6,029	Hourly	1.00
a1C1Q00000LvUNgUAN	42,819	42,946	Hourly	1.00
a1C1Q00000LvUNOUA3	17,944	17,992	Hourly	1.00
a1C1Q00000MkczZUAR	146,977	147,372	Hourly	1.00
a1C1Q00000N0mEiUAJ	26,117	26,185	Hourly	1.00
a1C1Q00000LvUNTUA3	14,272	14,310	Hourly	1.00
a1C1Q00000LvUNdUAN	111,050	111,292	Hourly	1.00
a1C1Q00000N0mEWUAZ	512,005	513,043	Daily	1.00
a1C1Q00000MA1obUAD	6,961	6,975	Hourly	1.00
a1C1Q00000MLsb0UAD	79,303	79,449	Hourly	1.00
a1C1Q00000LvUNcUAN	217,760	218,144	Hourly	1.00
a1C1Q00000N0mESUAZ	145,538	145,779	Hourly	1.00
a1C1Q00000KV13FUAT	22,919	22,954	Hourly	1.00
a1C1Q00000MLsb7UAD	51,784	51,855	Hourly	1.00
a1C1Q00000Mkd00UAB	10,743	10,757	Hourly	1.00
a1C1Q00000NJO6AUAX	236,994	237,277	Hourly	1.00
a1C1Q00000KV12uUAD	181,766	181,969	Hourly	1.00
a1C1Q00000N0mEhUAJ	158,840	159,007	Hourly	1.00
a1C1Q00000MLsbCUAT	20,521	20,541	Hourly	1.00
a1C1Q00000OFJbhUAH	952,224	953,072	Hourly	1.00
a1C1Q00000LvUNHUA3	55,156	55,200	Hourly	1.00
a1C1Q00000LvUNLUA3	51,277	51,317	Hourly	1.00
a1C1Q00000KV12pUAD	143,520	143,610	Hourly	1.00

Project ID	Ex Ante Gross Savings (kWh)	Verified Gross Savings (kWh)	Model Resolution	Realization Rate
a1C1Q00000Nvjl2UAB	119,220	119,292	Hourly	1.00
a1C1Q00000OFJbmUAH	58,903	58,928	Hourly	1.00
a1C1Q00000LvJNAUA3	11,520	11,523	Hourly	1.00
a1C1Q00000Nvjl3UAB	82,173	82,186	Hourly	1.00
a1C1Q00000LvJNYUA3	490,334	490,318	Hourly	1.00
a1C1Q00000LvJNUUA3	97,436	97,423	Hourly	1.00
a1C1Q00000MLsbEUAT	49,028	49,013	Hourly	1.00
a1C1Q00000LvJNIUAN	150,763	150,716	Hourly	1.00
a1C1Q00000Nvjl0UAB	126,796	126,735	Hourly	1.00
a1C1Q00000LvJNDUA3	20,818	20,804	Hourly	1.00
a1C1Q00000NJO6WUAX	32,590	32,559	Hourly	1.00
a1C1Q00000LvJNNUA3	79,743	79,664	Hourly	1.00
a1C1Q00000LvJN4UAN	38,225	38,186	Hourly	1.00
a1C1Q00000MkczhUAB	23,027	23,003	Hourly	1.00
a1C1Q00000Nvjl9UAB	87,505	87,408	Hourly	1.00
a1C1Q00000LvJNFUA3	61,381	61,300	Hourly	1.00
a1C1Q00000MkczsUAB	14,261	14,240	Hourly	1.00
a1C1Q00000KV12zUAD	35,131	35,079	Hourly	1.00
a1C1Q00000MA1oPUAT	60,011	59,915	Hourly	1.00
a1C1Q00000Mkd08UAB	314,004	313,468	Hourly	1.00
a1C1Q00000LvJNPUA3	16,874	16,842	Hourly	1.00
a1C1Q00000NjAbkUAF	166,671	166,328	Hourly	1.00
a1C1Q00000MA1oEUAT	57,715	57,588	Hourly	1.00
a1C1Q00000N0mEdUAJ	13,340	13,306	Hourly	1.00
a1C1Q00000LvJNCUA3	20,850	20,785	Hourly	1.00
a1C1Q00000MLsbDUAT	61,380	61,176	Hourly	1.00
a1C1Q00000N0mEZUAZ	208,079	207,346	Hourly	1.00
a1C1Q00000KV137UAD	7,071	7,046	Hourly	1.00
a1C1Q00000Nvjl8UAB	16,549	16,489	Hourly	1.00
a1C1Q00000LvJNWUA3	100,570	100,199	Hourly	1.00
a1C1Q00000NJO69UAH	193,427	192,678	Daily	1.00
a1C1Q00000NjAbnUAF	42,610	42,404	Hourly	1.00
a1C1Q00000MA1oUUAT	120,788	120,195	Hourly	1.00
a1C1Q00000LvJNJUA3	37,501	37,315	Hourly	1.00
a1C1Q00000KV136UAD	650,837	647,510	Daily	0.99
a1C1Q00000NJO6lUAX	15,016	14,936	Hourly	0.99
a1C1Q00000MkcziUAB	1,187,123	1,180,652	Hourly	0.99
a1C1Q00000MkczyUAB	86,740	86,236	Hourly	0.99
a1C1Q00000MA1oSUAT	180,523	179,465	Hourly	0.99

Project ID	Ex Ante Gross Savings (kWh)	Verified Gross Savings (kWh)	Model Resolution	Realization Rate
a1C1Q00000NJO6SUAX	79,204	78,706	Hourly	0.99
a1C1Q00000MA1oVUAT	181,536	180,181	Hourly	0.99
a1C1Q00000NvjkvUAB	53,858	53,450	Hourly	0.99
a1C1Q00000LvUNhUAN	8,261	8,197	Hourly	0.99
a1C1Q00000N0mEUUAZ	118,551	117,594	Hourly	0.99
a1C1Q00000LvUNkUAN	23,113	22,925	Hourly	0.99
a1C1Q00000NvjlBUAR	433,999	430,451	Hourly	0.99
a1C1Q00000LvUNIUA3	56,095	55,609	Hourly	0.99
a1C1Q00000N0mEjUAJ	331,619	328,590	Hourly	0.99
a1C1Q00000MA1oMUAT	29,591	29,317	Hourly	0.99
a1C1Q00000LvUN8UAN	69,860	69,182	Hourly	0.99
a1C1Q00000LvUNEUA3	20,989	20,757	Hourly	0.99
a1C1Q00000MkczjUAB	23,173	22,875	Hourly	0.99
a1C1Q00000NJO6OUAX	66,545	65,650	Hourly	0.99
a1C1Q00000NJO6XUAX	12,786	12,608	Hourly	0.99
a1C1Q00000NJO6MUAX	29,524	29,096	Hourly	0.99
a1C1Q00000LvUO5UAN	23,440	23,093	Hourly	0.99
a1C1Q00000LvUNSUA3	7,501	7,378	Daily	0.98
a1C1Q00000MLsb8UAD	189,954	186,797	Hourly	0.98
a1C1Q00000LvUNZUA3	52,653	51,625	Daily	0.98
a1C1Q00000N0mEbUAJ	100,453	98,320	Daily	0.98
a1C1Q00000KV12yUAD	241,447	236,274	Hourly	0.98
a1C1Q00000LvUN9UAN	7,825	7,648	Hourly	0.98
a1C1Q00000LvUNQUA3	44,494	43,448	Daily	0.98
a1C1Q00000NvjlAUAR	7,588	7,406	Hourly	0.98
a1C1Q00000Mkd0FUAR	6,647	6,483	Hourly	0.98
a1C1Q00000LvUNpUAN	14,849	14,420	Daily	0.97
a1C1Q00000LvUN3UAN	45,978	44,470	Daily	0.97
a1C1Q00000NJO6BUAX	41,905	40,474	Hourly	0.97
a1C1Q00000LvUN6UAN	97,979	94,188	Hourly	0.96
a1C1Q00000OFJbnUAH	44,259	42,496	Hourly	0.96
a1C1Q00000NvjkwUAB	45,791	43,921	Hourly	0.96
a1C1Q00000NjAbiUAF	584,674	560,683	Daily	0.96
a1C1Q00000Mkd07UAB	16,414	15,621	Hourly	0.95
a1C1Q00000NjAbmUAF	479,940	455,843	Hourly	0.95
a1C1Q00000KV13DUAT	67,841	63,760	Hourly	0.94
a1C1Q00000MLsb2UAD	110,216	101,962	Hourly	0.93
a1C1Q00000LvUN5UAN	12,244	11,326	Hourly	0.93
a1C1Q00000NjAboUAF	13,146	11,970	Daily	0.91

Project ID	Ex Ante Gross Savings (kWh)	Verified Gross Savings (kWh)	Model Resolution	Realization Rate
a1C1Q00000LvUN7UAN	6,495	5,897	Daily	0.91
a1C1Q00000LvUNjUAN	225,682	199,677	Hourly	0.88
a1C1Q00000MA1oKUAT	308,217	272,039	Daily	0.88
a1C1Q00000MLsb4UAD	103,855	91,139	Hourly	0.88
a1C1Q00000NJO6EUAX	36,025	31,606	Hourly	0.88
a1C1Q00000MLsb5UAD	58,501	50,560	Hourly	0.86
a1C1Q00000LvUNfUAN	8,142	6,955	Hourly	0.85
a1C1Q00000OFJbiUAH	128,234	109,105	Hourly	0.85
a1C1Q00000MA1oNUAT	50,275	41,776	Hourly	0.83
a1C1Q00000MA1oJUAT	58,826	48,532	Hourly	0.83
a1C1Q00000NJO6GUAX	7,532	5,672	Daily	0.75
a1C1Q00000N0mEeUAJ	69,115	49,123	Hourly	0.71
a1C1Q00000MA1oDUAT	213,071	148,649	Hourly	0.70
a1C1Q00000LvUO0UAN	152,790	97,974	Hourly	0.64
a1C1Q00000KV12xUAD	286,720	178,902	Hourly	0.62
a1C1Q00000MA1oYUAT	76,984	44,141	Hourly	0.57
a1C1Q00000MLsb6UAD	2,053,782	1,022,880	Hourly	0.50
a1C1Q00000MA1oTUAT	64,477	13,091	Daily	0.20

Source: ComEd tracking data and evaluation team analysis

Appendix C. Total Resource Cost Detail

Table C-1 shows the TRC cost-effectiveness analysis inputs available at the time of finalizing this impact evaluation report. This table does not include additional required cost data (e.g., measure costs, program-level incentives, and non-incentive costs). ComEd will provide this data to the evaluation team later.

Table C-1. Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity	EUL (years)*	ER Flag†	Gross Electric Energy Savings (kWh)	Gross Peak Demand Reduction (kW)	Gross Gas Savings (Therms)	Gross Secondary Savings due to Water Reduction (kWh)	Gross Heating Penalty (kWh)	Gross Heating Penalty (Therms)	NTG (kWh)	NTG (kW)	NTG (Therms)	Net Electric Energy Savings (kWh)	Net Peak Demand Reduction (kW)	Net Gas Savings (Therms)	Net Secondary Savings due to Water Reduction (kWh)	Net Heating Penalty (kWh)	Net Heating Penalty (Therms)
Other	VCx	Projects		7.3	No	22,473,830	1,455.23	N/A	N/A	N/A	N/A	1.00	1.00	N/A	22,473,830	1,455.23	N/A	N/A	N/A	N/A
	Total					**22,473,830**	**1,455**	**0**	**0**	**0**	**0**				**22,473,830**	**1,455**	**0**	**0**	**0**	**0**

* The total of the EUL column is the weighted average measure life (WAML) and is calculated as the sum product of EUL and measure savings divided by total program savings.
† Early replacement (ER) measures are flagged as YES, otherwise a NO is indicated in the column.

Source: ComEd tracking data and evaluation team analysis