

ComEd Business Telecomm Impact Evaluation Report

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

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Prepared by:

Michael Frischmann
EcoMetric

Pranav Wale
EcoMetric

Himanshu Haridas
EcoMetric

Submitted to:

ComEd
2011 Swift Drive
Oak Brook, IL 60523

Submitted by:

Guidehouse Inc.
150 N. Riverside Plaza, Suite 2100
Chicago, IL 60606

Contact:

Charles Maglione, Partner
703.431.1983
cmaglione@guidehouse.com

Jeff Erickson, Director
608.616.4962
jeff.erickson@guidehouse.com

Nishant Mehta, Associate Director
608.616.5823
nishant.mehta@guidehouse.com

Sagar Phalke, Managing
Consultant
303.493.0350
sagar.phalke@guidehouse.com

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1. Introduction

This report presents the results of the impact evaluation of the CY2021 Business Telecomm Program.

It 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 Business Telecomm Program aims to cost-effectively generate and capture savings from energy efficiency projects undertaken by telecommunications, cable, and internet service provider customers. It provides specialized energy assessments and energy management planning to help customers increase reliability, improve efficiency, and reduce energy consumption without adversely affecting facility operations. Franklin Energy was the program implementer in CY2021.

This program is called Telecommunication Optimization in the deemed NTG Spreadsheet, which shows a 0.90 net-to-gross (NTG) ratio for thermostat measures and a 0.80 NTG ratio for non-thermostat measures.¹

In CY2021, the program had 63 unique participating facilities that completed 70 individual projects (see Table 2-1).

Table 2-1. Number of Participants and Projects

Participation	Total
Total Participants	63
Total Projects	70

Source: ComEd tracking data and evaluation team analysis

The Business Telecomm Program included prescriptive and custom measures during CY2021. Network combing and programmable thermostats were new prescriptive measures added for CY2021. Custom measures include large network combing, heating, ventilation, and air conditioning (HVAC) controls, airflow management, equipment optimization, and economizers. The program included the measures shown in Table 2-2 and Figure 2-1.

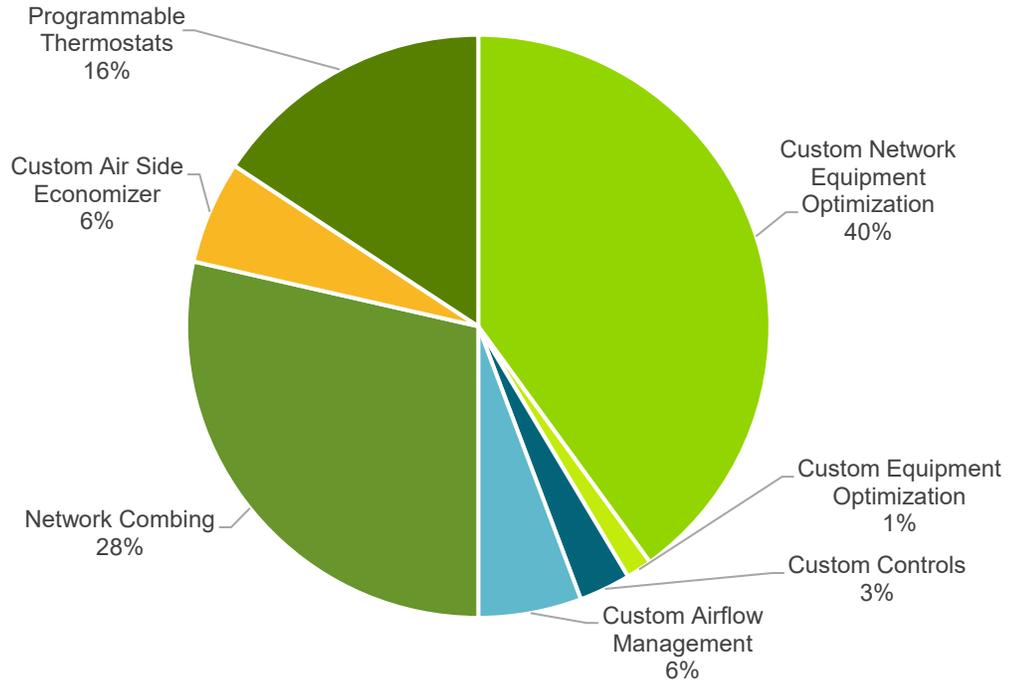
Table 2-2. Number of Measures by Type

End Use Type	Research Category	Quantity Unit
Telecomm	Custom Network Equipment Optimization	28 Project
Telecomm	Custom Equipment Optimization	1 Project
Telecomm	Custom Controls	2 Project
Telecomm	Custom Airflow Management	4 Project
Telecomm	Network Combing	20 Project
Telecomm	Custom Air Side Economizer	4 Project
Telecomm	Programmable Thermostats	11 Project
	Total	70

Source: ComEd tracking data and evaluation team analysis

¹ ComEd CY2021 NTG values can be found on the Illinois Stakeholder Advisory Group (SAG) website: https://www.ilsag.info/ntg_2021.

Figure 2-1. Share of Measures Installed



Source: ComEd tracking data and evaluation team analysis

3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the Business Telecomm Program achieved in CY2021. The gas savings are only those that ComEd may be able to claim, which excludes savings the gas utilities claim, either via joint or non-joint programs.²

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	12,498,595	0.99	12,350,428	Varies	N/A	N/A	9,883,056
Electric Energy Savings - Converted from Gas [‡]	kWh	34,807	1.00	34,807	Varies	N/A	N/A	27,845
Total Electric Energy Savings	kWh	12,533,402	0.99	12,385,235	Varies	N/A	N/A	9,910,901
Summer Peak [§] Demand Savings	kW	1,435	1.00	1,438	Varies	N/A	N/A	1,150

N/A = not applicable. Carryover is not applicable to this program.

[‡] Gas savings are converted to kilowatt-hours (kWh) by multiplying therms by 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh). The evaluation will determine which gas savings will be converted to kWh and counted toward ComEd’s electric savings goal while producing the portfolio-wide Summary Report. According to Section 8-103B(b-25) of the Illinois Public Utilities Act, “In no event shall more than 10% of each year’s applicable annual incremental goal as defined in paragraph (7) of subsection (g) of this Section be met through savings of fuels other than electricity.”

The “Verified Net Savings” in row one (Electric Energy Savings – Direct) includes primary kWh savings as a result of measure implementation. It does not include carryover savings, secondary kWh savings from wastewater treatment or electric heating penalties as they don’t apply to this program.

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

Source: ComEd tracking data and evaluation team analysis

² The evaluation will determine which gas savings will be counted toward goal while producing the portfolio-wide Summary Report.

4. Cumulative Persisting Annual Savings

Table 4-1 to Table 4-3 and Figure 4-1 show the measure-specific and total verified gross savings for the Business Telecomm 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 CY2021 gas contribution to CPAS (converted to equivalent electricity) is shown in Table 4-2. The combined savings are shown in Table 4-3. The historic rows in each table are the CPAS contribution back to CY2018. The Program Total Electric CPAS and the Program Total Gas CPAS are the sum of the CY2021 contribution and the historic contribution. Figure 4-1 shows the savings across the effective useful life (EUL) of the measures.

Table 4-1. Cumulative Persisting Annual Savings – Electric

End Use Type	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	
Telecomm	Custom Network Equipment Optimization	10.0	6,143,410	0.80	49,147,282				4,914,728	4,914,728	4,914,728	4,914,728	4,914,728	4,914,728	4,914,728
Telecomm	Custom Equipment Optimization	15.0	2,461,648	0.80	29,539,772				1,969,318	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318
Telecomm	Custom Controls	8.8	1,934,076	0.80	13,615,893				1,547,261	1,547,261	1,547,261	1,547,261	1,547,261	1,547,261	1,547,261
Telecomm	Custom Airflow Management	8.8	899,219	0.80	6,330,504				719,376	719,376	719,376	719,376	719,376	719,376	719,376
Telecomm	Network Combing	10.0	767,667	0.80	6,141,338				614,134	614,134	614,134	614,134	614,134	614,134	614,134
Telecomm	Custom Air Side Economizer	15.0	117,273	0.80	1,407,277				93,818	93,818	93,818	93,818	93,818	93,818	93,818
Telecomm	Programmable Thermostats	11.0	27,135	0.90	268,633				24,421	24,421	24,421	24,421	24,421	24,421	24,421
CY2021 Program Total Electric Contribution to CPAS			12,350,428		106,450,699				9,883,056						
Historic Program Total Electric Contribution to CPAS‡						-	3,627,993	10,391,091	10,391,091	10,391,091	10,391,091	10,294,736	10,294,736	10,179,591	
Program Total Electric CPAS						-	3,627,993	10,391,091	20,274,147	20,274,147	20,274,147	20,177,792	20,177,792	20,062,647	
CY2021 Program Incremental Expiring Electric Savings§															
Historic Program Incremental Expiring Electric Savings													96,355	-	115,145
Program Total Incremental Expiring Electric Savings													96,355	-	115,145

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Telecomm	Custom Network Equipment Optimization	4,914,728	4,914,728	4,914,728	4,914,728								
Telecomm	Custom Equipment Optimization	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318			
Telecomm	Custom Controls	1,547,261	1,547,261	1,237,808									
Telecomm	Custom Airflow Management	719,376	719,376	575,500									
Telecomm	Network Combing	614,134	614,134	614,134	614,134								
Telecomm	Custom Air Side Economizer	93,818	93,818	93,818	93,818	93,818	93,818	93,818	93,818	93,818			
Telecomm	Programmable Thermostats	24,421	24,421	24,421	24,421	24,421							
CY2021 Program Total Electric Contribution to CPAS		9,883,056	9,883,056	9,429,729	7,616,420	2,087,558	2,063,137	2,063,137	2,063,137	2,063,137			
Historic Program Total Electric Contribution to CPAS‡		10,064,446	9,721,937	5,229,208	178,658	178,658	178,658	178,658					
Program Total Electric CPAS		19,947,502	19,604,993	14,658,937	7,795,078	2,266,216	2,241,795	2,241,795	2,063,137	2,063,137			
CY2021 Program Incremental Expiring Electric Savings§				453,327	1,813,309	5,528,862	24,421				2,063,137		
Historic Program Incremental Expiring Electric Savings		115,145	342,510	4,492,729	5,050,550				178,658				
Program Total Incremental Expiring Electric Savings		115,145	342,510	4,946,056	6,863,859	5,528,862	24,421		178,658		2,063,137		

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 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 CY2019, the Business Telecomm Program had no savings in CY2018.

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

Source: Evaluation team analysis

Table 4-2. Cumulative Persisting Annual Savings – Gas

End Use Type	Research Category	EUL	CY2021 Verified		Lifetime Net Savings (Therms)†	Verified Net Therms Savings									
			Gross Savings (Therms)	NTG*		2018	2019	2020	2021	2022	2023	2024	2025	2026	
Telecomm	Custom Network Equipment Optimization	10.0	-	0.80	-										
Telecomm	Custom Equipment Optimization	15.0	-	0.80	-										
Telecomm	Custom Controls	8.8	-	0.80	-										
Telecomm	Custom Airflow Management	8.8	-	0.80	-										
Telecomm	Network Combing	10.0	-	0.80	-										
Telecomm	Custom Air Side Economizer	15.0	-	0.80	-										
Telecomm	Programmable Thermostats	11.0	1,188	0.90	10,450				950	950	950	950	950	950	950
CY2021 Program Total Gas Contribution to CPAS (Therms)			1,188		10,450				950						
CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)‡									27,845						
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§										8,646	8,646	8,646	8,646	8,646	4,323
Program Total Gas CPAS (kWh Equivalent)										8,646	8,646	36,491	36,491	36,491	32,168
CY2021 Program Incremental Expiring Gas Savings (Therms)															
CY2021 Program Incremental Expiring Gas Savings (kWh Equivalent) 															
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)															4,323
Program Total Incremental Expiring Gas Savings (kWh Equivalent)															4,323

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Telecomm	Custom Network Equipment Optimization	-	-	-	-	-	-	-	-	-	-	-	-
Telecomm	Custom Equipment Optimization	-	-	-	-	-	-	-	-	-	-	-	-
Telecomm	Custom Controls	-	-	-	-	-	-	-	-	-	-	-	-
Telecomm	Custom Airflow Management	-	-	-	-	-	-	-	-	-	-	-	-
Telecomm	Network Combing	-	-	-	-	-	-	-	-	-	-	-	-
Telecomm	Custom Air Side Economizer	-	-	-	-	-	-	-	-	-	-	-	-
Telecomm	Programmable Thermostats	950	950	950	950	950	-	-	-	-	-	-	-
CY2021 Program Total Gas Contribution to CPAS (Therms)		950	950	950	950	950							
CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)‡		27,845	27,845	27,845	27,845	27,845							
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§													
Program Total Gas CPAS (kWh Equivalent)		27,845	27,845	27,845	27,845	27,845							
CY2021 Program Incremental Expiring Gas Savings (Therms)							950						
CY2021 Program Incremental Expiring Gas Savings (kWh Equivalent) 							27,845						
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)		4,323											
Program Total Incremental Expiring Gas Savings (kWh Equivalent)		4,323					27,845						

Note: The green highlighted cell shows program total first-year gas savings in kWh equivalents. The gray cells are blank, indicating no values or do not contribute to calculating CPAS in CY2021.

* A deemed value. Source: Illinois SAG website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2021>.

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

‡ kWh equivalent savings are calculated by multiplying therm savings by 29.31.

§ Historic savings go back to CY2019, the Business Telecomm Program had no savings in CY2018.

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

Source: Evaluation team analysis

Table 4-3. Cumulative Persisting Annual Savings – Total

End Use Type	Research Category	EUL	CY2021 Verified		Verified Net kWh Savings (Including Those Converted from Gas Savings)										
			Gross Savings (kWh)	Lifetime Net Savings (kWh)†	2018	2019	2020	2021	2022	2023	2024	2025	2026		
Telecomm	Custom Network Equipment Optimization	10.0	6,143,410	0.80	49,147,282				4,914,728	4,914,728	4,914,728	4,914,728	4,914,728	4,914,728	4,914,728
Telecomm	Custom Equipment Optimization	15.0	2,461,648	0.80	29,539,772				1,969,318	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318
Telecomm	Custom Controls	8.8	1,934,076	0.80	13,615,893				1,547,261	1,547,261	1,547,261	1,547,261	1,547,261	1,547,261	1,547,261
Telecomm	Custom Airflow Management	8.8	899,219	0.80	6,330,504				719,376	719,376	719,376	719,376	719,376	719,376	719,376
Telecomm	Network Combing	10.0	767,667	0.80	6,141,338				614,134	614,134	614,134	614,134	614,134	614,134	614,134
Telecomm	Custom Air Side Economizer	15.0	117,273	0.80	1,407,277				93,818	93,818	93,818	93,818	93,818	93,818	93,818
Telecomm	Programmable Thermostats	11.0	61,941	0.90	574,931				52,266	52,266	52,266	52,266	52,266	52,266	52,266
CY2021 Program Total Contribution to CPAS			12,385,235	106,756,997				9,910,901	9,910,901	9,910,901	9,910,901	9,910,901	9,910,901	9,910,901	9,910,901
Historic Program Total Contribution to CPAS‡									3,636,639	10,399,737	10,399,737	10,399,737	10,303,382	10,303,382	10,183,914
Program Total CPAS									3,636,639	10,399,737	20,310,638	20,310,638	20,310,638	20,214,283	20,214,283
CY2021 Program Incremental Expiring Savings§															
Historic Program Incremental Expiring Savings													96,355		119,468
Program Total Incremental Expiring Savings													96,355		119,468

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Telecomm	Custom Network Equipment Optimization	4,914,728	4,914,728	4,914,728	4,914,728								
Telecomm	Custom Equipment Optimization	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318	1,969,318			
Telecomm	Custom Controls	1,547,261	1,547,261	1,237,808									
Telecomm	Custom Airflow Management	719,376	719,376	575,500									
Telecomm	Network Combing	614,134	614,134	614,134	614,134								
Telecomm	Custom Air Side Economizer	93,818	93,818	93,818	93,818	93,818	93,818	93,818	93,818	93,818			
Telecomm	Programmable Thermostats	52,266	52,266	52,266	52,266	52,266							
CY2021 Program Total Contribution to CPAS		9,910,901	9,910,901	9,457,574	7,644,265	2,115,403	2,063,137	2,063,137	2,063,137	2,063,137			
Historic Program Total Contribution to CPAS‡		10,064,446	9,721,937	5,229,208	178,658	178,658	178,658						
Program Total CPAS		19,975,347	19,632,838	14,686,782	7,822,923	2,294,061	2,241,795	2,241,795	2,063,137	2,063,137			
CY2021 Program Incremental Expiring Savings§				453,327	1,813,309	5,528,862	52,266				2,063,137		
Historic Program Incremental Expiring Savings		119,468	342,510	4,492,729	5,050,550				178,658				
Program Total Incremental Expiring Savings		119,468	342,510	4,946,056	6,863,859	5,528,862	52,266		178,658		2,063,137		

Note: The green highlighted cell shows program total first-year electric savings (including direct electric savings and those converted from gas). The gray cells are blank, indicating no values or do not contribute to calculating CPAS in CY2021.

* A deemed value. Source: Illinois SAG website: <https://www.ilsag.info/evaluator-ntq-recommendations-for-2021>.

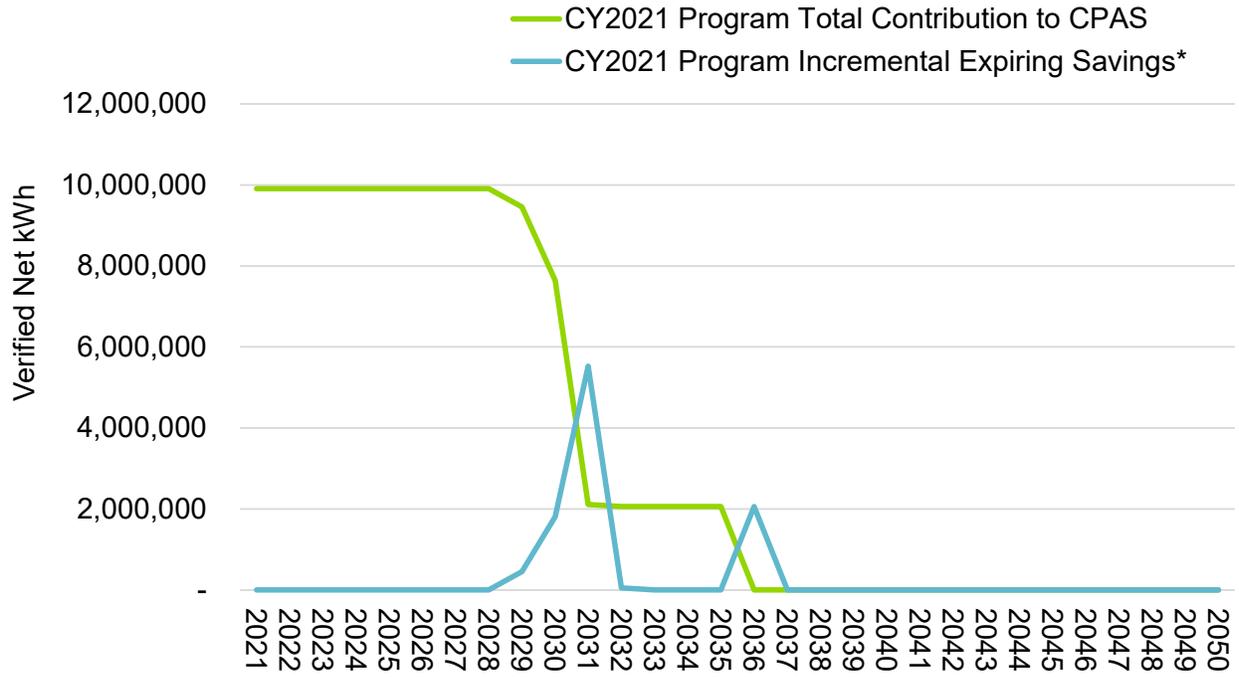
† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Historic savings go back to CY2019, the Business Telecomm Program had no savings in 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

The program included the measures shown in Table 5-1 and Figure 5-1.

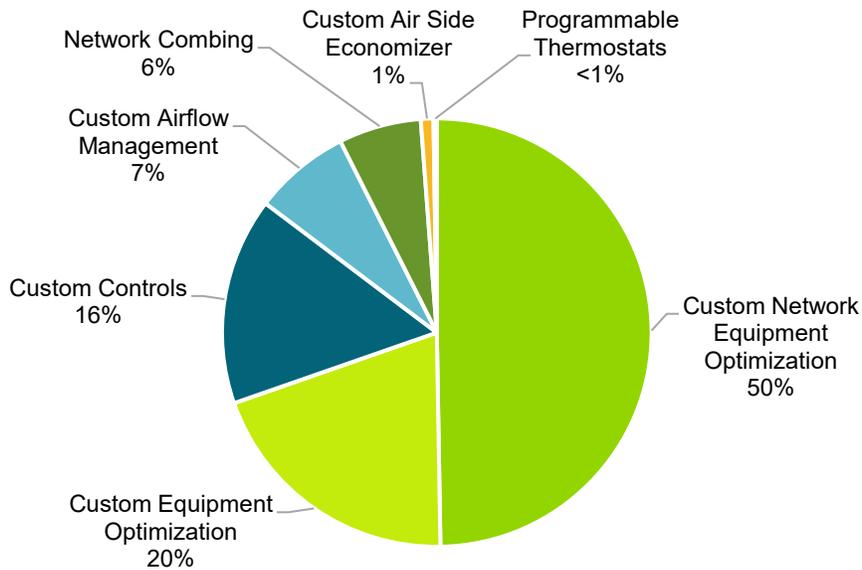
Table 5-1. Number of Measures by Type

End Use Type	Research Category	Quantity Unit
Telecomm	Custom Network Equipment Optimization	28 Project
Telecomm	Custom Equipment Optimization	1 Project
Telecomm	Custom Controls	2 Project
Telecomm	Custom Airflow Management	4 Project
Telecomm	Network Combing	20 Project
Telecomm	Custom Air Side Economizer	4 Project
Telecomm	Programmable Thermostats	11 Project
Total		70

Note: This is the same table as Table 2-2.

Source: ComEd tracking data and evaluation team analysis

Figure 5-1. Verified Net Savings by Measure – Electric



Source: ComEd tracking data and evaluation team analysis

Measure-level energy and demand savings are provided in the following tables.

Table 5-2. Energy Savings by Measure – Electric

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)	EUL (years)
Telecomm	Custom Network Equipment Optimization	6,217,112	0.99	6,143,410	0.80	4,914,728	10.0
Telecomm	Custom Equipment Optimization	2,491,180	0.99	2,461,648	0.80	1,969,318	15.0
Telecomm	Custom Controls	1,957,279	0.99	1,934,076	0.80	1,547,261	8.8
Telecomm	Custom Airflow Management	910,007	0.99	899,219	0.80	719,376	8.8
Telecomm	Network Combing	776,877	0.99	767,667	0.80	614,134	10.0
Telecomm	Custom Air Side Economizer	118,680	0.99	117,273	0.80	93,818	15.0
Telecomm	Programmable Thermostats	27,460	0.99	27,135	0.90	24,421	11.0
Total		12,498,595	0.99	12,350,428		9,883,056	

* A deemed value. Source: Illinois SAG website: <https://www.ilsaq.info/evaluator-ntg-recommendations-for-2021>.
Source: ComEd tracking data and evaluation team analysis

Table 5-3. Summer Peak Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Peak Demand Reduction (kW)	NTG*	Verified Net Peak Demand Reduction (kW)
Telecomm	Custom Network Equipment Optimization	889.86	1.00	891.79	0.80	713.43
Telecomm	Custom Equipment Optimization	211.62	1.00	212.08	0.80	169.66
Telecomm	Custom Controls	209.84	1.00	210.29	0.80	168.24
Telecomm	Custom Airflow Management	35.88	1.00	35.96	0.80	28.77
Telecomm	Network Combing	83.65	1.00	83.83	0.80	67.07
Telecomm	Custom Air Side Economizer	0.00	N/A	0.00	0.80	0.00
Telecomm	Programmable Thermostats	4.10	1.00	4.11	0.90	3.29
Total		1,434.95	1.00	1,438.06		1,150.45

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

* A deemed value. Source: Illinois SAG website: <https://www.ilsaq.info/evaluator-ntg-recommendations-for-2021>.
Source: ComEd tracking data and evaluation team analysis

Table 5-4. Energy Savings by Measure – Gas

End Use Type	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross Realization Rate	Verified Gross Savings (Therms)	NTG*	Verified Net Savings (Therms)	EUL (years)
Telecomm	Custom Network Equipment Optimization	0	N/A	0	0.80	0	10.0
Telecomm	Custom Equipment Optimization	0	N/A	0	0.80	0	15.0
Telecomm	Custom Controls	0	N/A	0	0.80	0	8.8
Telecomm	Custom Airflow Management	0	N/A	0	0.80	0	8.8
Telecomm	Network Combing	0	N/A	0	0.80	0	10.0
Telecomm	Custom Air Side Economizer	0	N/A	0	0.80	0	15.0
Telecomm	Programmable Thermostats	1,188	1.00	1,188	0.90	950	11.0
Total Therms		1,188	1.00	1,188		950	
Total kWh Converted From Therms†		34,807	1.00	34,807		27,845	

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

* A deemed value. Source: Illinois SAG website: <https://www.ilsaq.info/evaluator-ntg-recommendations-for-2021>.

† Gas savings converted to kWh by multiplying therms by 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh).

Source: ComEd tracking data and evaluation team analysis

Table 5-5 is combined savings from Table 5-2 and Table 5-4.

Table 5-5. Energy Savings by Measure – Total

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)
Telecomm	Custom Network Equipment Optimization	6,217,112	0.99	6,143,410	0.80	4,914,728
Telecomm	Custom Equipment Optimization	2,491,180	0.99	2,461,648	0.80	1,969,318
Telecomm	Custom Controls	1,957,279	0.99	1,934,076	0.80	1,547,261
Telecomm	Custom Airflow Management	910,007	0.99	899,219	0.80	719,376
Telecomm	Network Combing	776,877	0.99	767,667	0.80	614,134
Telecomm	Custom Air Side Economizer	118,680	0.99	117,273	0.80	93,818
Telecomm	Programmable Thermostats	62,267	0.99	61,941	0.90	52,266
Total†		12,533,402	0.99	12,385,235		9,910,901

* A deemed value. Source: Illinois SAG website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2021>.

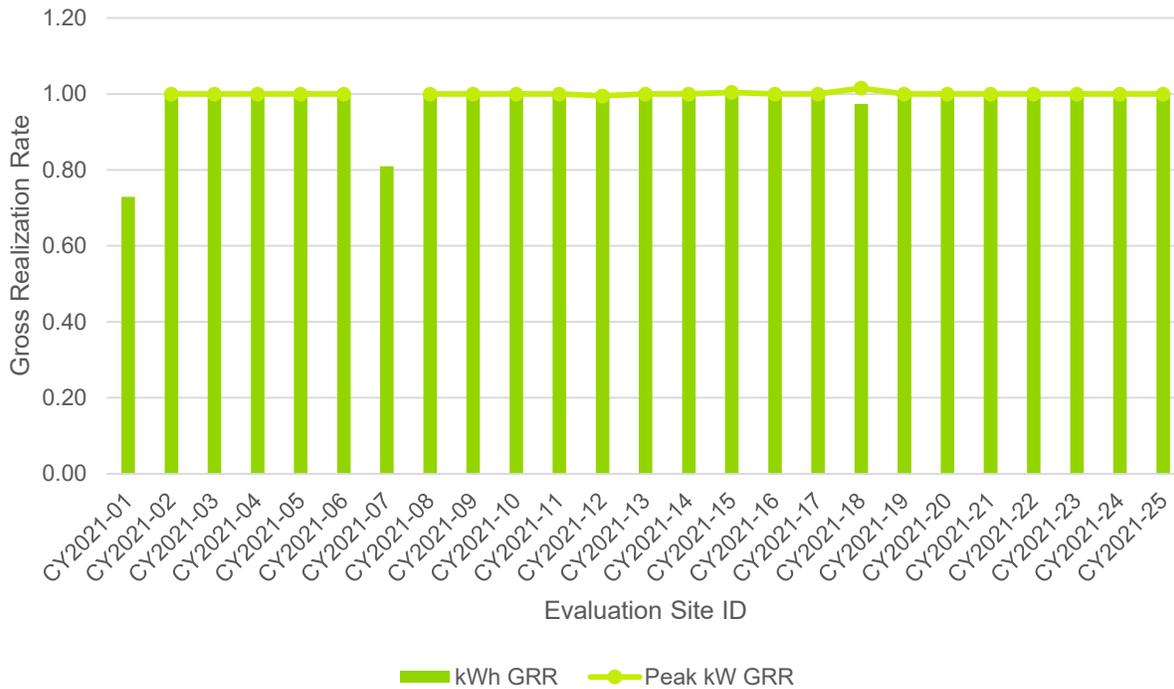
† The total includes the electric equivalent of the total therms.

Source: ComEd tracking data and evaluation team analysis

6. Impact Analysis Findings and Recommendations

The evaluation team developed several recommendations based on findings from the CY2021 evaluation. Figure 6-1 compares the energy and demand realization rates for every evaluated site. The CY2021 energy savings realization rates ranged from 0.73 to 1.00, which resulted in a program-level weighted realization rate of 0.99. The gross energy realization rate was at or above 1.0 for 22 of the 25 projects examined. The gross peak demand savings realization rates for the 25 projects in the sample ranged from 0.99 to 1.02, resulting in a program-level realization rate of 1.00.

Figure 6-1. Energy and Demand Realization Rates



Note: Projects CY2021-01 and CY2021-07 did not have peak demand savings, so the realization rate is N/A and they do not appear in this chart.

Source: ComEd tracking data and evaluation team analysis

6.1 Project-Specific Findings

Finding 1. The ex ante calculations for project CY2021-18 did not account for potential downtime or scheduled routine maintenance. The time period selected to calculate the efficient case power from the metered data ignored routine maintenance and weather-related issues, which had occurred during the monitoring period. Guidehouse included the effects of maintenance and weather for 4 weeks per year in the verified savings. This project had an electric realization rate of 0.97.

Recommendation 1. Include the effects of routine maintenance, likely weather events (i.e., rain, snow, low temperatures), and other typical shutdown periods in the extrapolations from metered data.

Finding 2. For two sampled projects, CY2021-01 and CY2021-07, the ex ante calculations compared the baseline power of the total system to the efficient case power of only one air handling unit. Therefore, the ex ante calculation neglected the efficient case power of the other operating units. Guidehouse compared the total system power of all three units before and after the measure installation to determine the verified savings. The electric realization rates for these projects were 0.73 and 0.81.

Recommendation 2. Use a consistent basis of comparison when calculating savings. Using a consistent basis, either total system power or average per-unit power will ensure savings calculations are representative of the site-specific savings.

Finding 3. For one project, CY2021-07, the average demand reduction was used to calculate the ex ante demand savings. Guidehouse used the baseline and post case hourly profiles from the metered data to determine the peak demand savings during the PJM window. The peak demand realization rate for this project was 1.02.

Recommendation 3. Calculate peak demand savings as the reduction during the PJM peak summer period of 1:00 p.m.-5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August.

6.2 Cross-Cutting Findings

Finding 4. Equipment controls adjustment measures closely resemble retrocommissioning measures. The projects reviewed for the impact evaluation assumed a 5-, 9-, 10-, or 15-year measure life. The Illinois Technical Reference manual v9.0 (IL-TRM)³ prescribes an 8.8-year measure life for retrocommissioning projects. The IL-TRM v10.0 deems an 8.6-year measure life for retrocommissioning projects.

Recommendation 4. Use an 8.6-year measure life for retrocommissioning measures in 2022, consistent with IL-TRM v10.0. The EUL should be updated to be consistent with the EUL for retrocommissioning measures documented in the applicable version of the IL-TRM in the future.

Finding 5. One of the participants in the Business Telecomm Program was also a regular participant in the Retrocommissioning Program. The evaluation did not find cases where projects overlapped during CY2021, but overlap could occur in the future.

Recommendation 5. Document and photograph the unit ID during Business Telecomm Program HVAC upgrades to easily identify the units that are part of program projects and provide information to avoid double counting measures through various programs.

³ In this report, unless stated otherwise, IL-TRM refers to version 9.0 (v9.0).

Appendix A. Impact Analysis Methodology

Evaluators review gross impacts with a project-by-project and measure-by-measure approach. Savings calculation reviews ensure the savings estimates are accurately modeled, use consistent inputs, and include reasonable assumptions, as required. The evaluation team also reviewed the documentation to confirm project installation and verify the measure life. In some cases, the team verified assumptions using additional resources, such as applicable building codes, the IL-TRM, and IL-TRM Errata.

Where the evaluation team found differences, the verified savings were adjusted to reflect those adjustments. Results from the impact evaluation were rolled up by sampling strata and extrapolated to the participant population to determine gross researched impacts. Deemed NTG ratios were applied to verified gross results to arrive at net researched impacts.

A.1 Sampling Methodology

The evaluation team used a stratified random sampling approach to select the gross impact sample of 25 projects. The team stratified the CY2021 sample by project type (custom or prescriptive) and size. The certainty stratum included the two largest projects completed during CY2021, which accounted for 34% of the ex ante savings.

Table A-1 profiles the gross impact sample for the Business Telecomm Program in comparison with the program population. The 25 sampled sites make up approximately 62% of the population ex ante energy savings. Also shown are the ex ante-based kWh sample weights for each of the strata.

The sample design targeted a 90/10 level of confidence and relative precision.

Table A-1. Gross Impact Sample by Strata

Population summary				Sample		
Sample Strata	Numer of Sites (N)	Ex ante kWh	kWh Weights	Number of Sites	Ex ante kWh	Sampled % of Population kWh
Certainty	2	4,265,259	0.34	2	4,265,259	100%
Custom Medium	14	4,452,472	0.36	7	2,241,396	50%
Custom Small	24	2,673,957	0.21	8	1,064,285	40%
Prescriptive	30	1,106,907	0.09	8	221,622	20%
CY2021 Total	70	12,498,595		25	7,792,562	62%

Source: ComEd tracking data and evaluation team analysis

Appendix B. Impact Findings Detailed Results

B.1 Savings by Stratum

The Business Telecomm Program sample consisted of 25 sites across three strata. Table B-1 through Table B-3 provide the ex ante and verified energy, peak demand, and gas savings for each strata. The evaluation achieved a relative precision of 2.5% for electric savings.

Table B-1. Energy Savings by Strata

Sample Strata	Sample Size	Ex ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)
Certainty	2	4,265,259	0.99	4,218,975	0.80	3,375,180
Custom Medium	7	2,241,396	1.00	2,241,397	0.80	1,793,117
Custom Small	8	898,833	0.95	858,280	0.80	686,624
Prescriptive	8	387,073	1.00	387,074	0.80	310,548
CY2021 Total	25	7,792,562	0.99	7,705,726	0.80	6,165,470

* The thermostat NTG value of 0.9 is included in the prescriptive strata NTG value for thermostat projects. However, the effect is small, resulting in the rounded number of 0.80 displayed in the table.

Source: ComEd tracking data and evaluation team analysis

Table B-2. Peak Demand Savings by Strata

Sample Strata	Sample Size	Ex ante Gross Savings (kW)	Verified Gross Realization Rate	Verified Gross Savings (kW)	NTG*	Verified Net Savings (kW)
Certainty	2	414	1.01	417	0.80	334
Custom Medium	7	273	1.00	273	0.80	218
Custom Small	8	89	1.00	89	0.80	71
Prescriptive	8	43	1.00	43	0.80	35
CY2021 Total	25	819	1.00	823	0.80	658

* The thermostat NTG value of 0.9 is included in the prescriptive strata NTG value for thermostat projects. However, the effect is small, resulting in the rounded number of 0.80 displayed in the table.

Source: ComEd tracking data and evaluation team analysis

Table B-3. Gas Savings by Strata

Sample Strata	Sample Size	Ex ante Gross Savings (kW)	Verified Gross Realization Rate	Verified Gross Savings (kW)	NTG*	Verified Net Savings (kW)
Certainty	2	0	N/A	0	0.80	0
Custom Medium	7	0	N/A	0	0.80	0
Custom Small	8	0	N/A	0	0.80	0
Prescriptive	8	527	1.00	527	0.80	423
CY2021 Total	25	527	1.00	527	0.80	423

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

* The thermostat NTG value of 0.9 is included in the prescriptive strata NTG value for thermostat projects. However, the effect is small, resulting in the rounded number of 0.80 displayed in the table.

Source: ComEd tracking data and evaluation team analysis

B.2 Savings by Project

Table B-4 through Table B-6 show the verified energy, peak demand, and gas savings for each project.

Table B-4. CY2021 Energy Savings by Project

Evaluation Site ID	Sample Strata	Ex ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)
CY2021-01	Custom Small	106,465	0.73	77,600	0.80	62,080
CY2021-02	Custom Medium	287,300	1.00	287,300	0.80	229,840
CY2021-03	Custom Medium	367,927	1.00	367,927	0.80	294,342
CY2021-04	Custom Medium	406,957	1.00	406,957	0.80	325,566
CY2021-05	Prescriptive	18,229	1.00	18,229	0.80	14,583
CY2021-06	Custom Small	168,278	1.00	168,278	0.80	134,622
CY2021-07	Custom Small	61,293	0.81	49,606	0.80	39,685
CY2021-08	Custom Medium	224,760	1.00	224,761	0.80	179,808
CY2021-09	Custom Small	148,638	1.00	148,637	0.80	118,910
CY2021-10	Custom Small	183,199	1.00	183,199	0.80	146,559
CY2021-11	Prescriptive	1,904	1.00	1,904	0.90	1,713
CY2021-12	Prescriptive	3,841	1.00	3,841	0.90	3,457
CY2021-13	Prescriptive	4,392	1.00	4,392	0.90	3,953
CY2021-14	Prescriptive	879	1.00	879	0.90	791
CY2021-15	Prescriptive	6,018	1.00	6,018	0.80	4,815
CY2021-16	Custom Small	156,518	1.00	156,518	0.80	125,214
CY2021-17	Certainty	2,491,180	1.00	2,491,180	0.80	1,992,944
CY2021-18	Certainty	1,774,080	0.97	1,727,795	0.80	1,382,236
CY2021-19	Custom Medium	380,854	1.00	380,854	0.80	304,684
CY2021-20	Custom Medium	379,979	1.00	379,979	0.80	303,983
CY2021-21	Custom Medium	193,619	1.00	193,619	0.80	154,895
CY2021-22	Prescriptive	165,452	1.00	165,452	0.80	132,361
CY2021-23	Prescriptive	96,003	1.00	96,003	0.80	76,803
CY2021-24	Prescriptive	90,356	1.00	90,356	0.80	72,285
CY2021-25	Custom Small	74,442	1.00	74,442	0.80	59,554

* A deemed value. Source: Illinois SAG website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2021>.

Source: ComEd tracking data and evaluation team analysis

Table B-5. CY2021 Peak Demand Savings by Project

Evaluation Site ID	Sample Strata	Ex ante Gross Savings (kW)	Verified Gross Realization Rate	Verified Gross Savings (kW)	NTG*	Verified Net Savings (kW)
CY2021-01	Custom Small	0	N/A	0	0.80	0
CY2021-02	Custom Medium	40	1.00	40	0.80	32
CY2021-03	Custom Medium	51	1.00	51	0.80	41
CY2021-04	Custom Medium	3	1.00	3	0.80	3
CY2021-05	Prescriptive	2	1.00	2	0.80	2
CY2021-06	Custom Small	25	1.00	25	0.80	20
CY2021-07	Custom Small	0	N/A	0	0.80	0
CY2021-08	Custom Medium	34	1.00	34	0.80	27
CY2021-09	Custom Small	22	1.00	22	0.80	17
CY2021-10	Custom Small	7	1.00	7	0.80	6
CY2021-11	Prescriptive	0	1.00	0	0.90	0
CY2021-12	Prescriptive	1	1.00	1	0.90	0
CY2021-13	Prescriptive	1	1.00	1	0.90	1
CY2021-14	Prescriptive	0	1.00	0	0.90	0
CY2021-15	Prescriptive	1	1.00	1	0.80	1
CY2021-16	Custom Small	24	1.00	24	0.80	20
CY2021-17	Certainty	212	1.00	212	0.80	169
CY2021-18	Certainty	203	1.02	206	0.80	165
CY2021-19	Custom Medium	57	1.00	57	0.80	46
CY2021-20	Custom Medium	59	1.00	59	0.80	47
CY2021-21	Custom Medium	28	1.00	28	0.80	23
CY2021-22	Prescriptive	19	1.00	19	0.80	15
CY2021-23	Prescriptive	10	1.00	10	0.80	8
CY2021-24	Prescriptive	10	1.00	10	0.80	8
CY2021-25	Custom Small	11	1.00	11	0.80	9

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

* A deemed value. Source: Illinois SAG website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2021>.

Source: ComEd tracking data and evaluation team analysis

Table B-6. CY2021 Gas Savings by Project

Evaluation Site ID	Sample Strata	Ex ante Gross Savings (therms)	Verified Gross Realization Rate	Verified Gross Savings (therms)	NTG*	Verified Net Savings (therms)
CY2021-01	Custom Small	0	N/A	0	0.80	0
CY2021-02	Custom Medium	0	N/A	0	0.80	0
CY2021-03	Custom Medium	0	N/A	0	0.80	0
CY2021-04	Custom Medium	0	N/A	0	0.80	0
CY2021-05	Prescriptive	0	N/A	0	0.80	0
CY2021-06	Custom Small	0	N/A	0	0.80	0
CY2021-07	Custom Small	0	N/A	0	0.80	0
CY2021-08	Custom Medium	0	N/A	0	0.80	0
CY2021-09	Custom Small	0	N/A	0	0.80	0
CY2021-10	Custom Small	0	N/A	0	0.80	0
CY2021-11	Prescriptive	3	1.00	3	0.90	3
CY2021-12	Prescriptive	517	1.00	517	0.90	466
CY2021-13	Prescriptive	5	1.00	5	0.90	4
CY2021-14	Prescriptive	2	1.00	2	0.90	2
CY2021-15	Prescriptive	0	N/A	0	0.80	0
CY2021-16	Custom Small	0	N/A	0	0.80	0
CY2021-17	Certainty	0	N/A	0	0.80	0
CY2021-18	Certainty	0	N/A	0	0.80	0
CY2021-19	Custom Medium	0	N/A	0	0.80	0
CY2021-20	Custom Medium	0	N/A	0	0.80	0
CY2021-21	Custom Medium	0	N/A	0	0.80	0
CY2021-22	Prescriptive	0	N/A	0	0.80	0
CY2021-23	Prescriptive	0	N/A	0	0.80	0
CY2021-24	Prescriptive	0	N/A	0	0.80	0
CY2021-25	Custom Small	0	N/A	0	0.80	0

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

* A deemed value. Source: Illinois SAG website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2021>.

Source: ComEd tracking data and evaluation team analysis

Guidehouse evaluated each measure and project for the sampled sites. The team adjusted three of the 26 sites evaluated. The details for each adjustment follow:

- CY2021-01 and CY2021-07:** The evaluation team sampled two air side economizer projects completed at the same customer facility. The two projects were phase two and phase three of an ongoing upgrade at a facility, where phase two added air economizing capability and phase three refined the operation.

The team made two revisions to the electricity savings analysis compared to the ex ante savings. The first was to use the power of the entire system during economizing mode. The ex ante calculation for CY2021-01 and CY2021-07 compared the total power of the three rooftop units to the average fan power of only one rooftop unit. This overstated the

savings by not accounting for the other two units that may also be operating in economizing mode. The evaluation team compared total system power above and below the economizing setpoint (38°F) to determine the verified savings.

The team also adjusted the maximum economizer temperature of project CY2021-07 from 55°F to 75°F per the final settings from the customer. The ex ante calculations used 55°F to offer a conservative estimate of the project savings. Raising the maximum economizer temperature increased the savings, but the project still had an overall realization rate of 0.81.

- **CY2021-18:** The ex ante calculations used metered data from the customer's control system to determine the total system power before, during, and after installing new controls optimization software. During the post-installation period, there were 2 weeks of maintenance and severe weather (the maintenance period). The ex ante calculations ignored the maintenance period in the calculation of post-installation system power. However, severe weather and routine maintenance are likely to occur each year for short periods of time. The evaluation team adjusted the post-installation system power to include 4 weeks of routine maintenance or severe weather, with the remaining 48 weeks at normal operation. This slightly increased the post-installation system power, resulting in an overall realization rate of 0.97.

The ex ante calculations also assumed the peak demand savings were equivalent to the average reduction in system power from the metered data. The metered data included date and timestamps. The team leveraged the timestamps to determine the average demand reduction between 1:00 p.m. and 5:00 p.m. on weekdays, consistent with the PJM peak definition. This increased the verified demand savings, resulting in a peak demand realization rate of 1.02.

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)
Telecomm	Custom Network Equipment Optimization	Project	28	10.0	NO	6,143,410	891.79	0	0	0	0	0.80	0.80	0.80	4,914,728	713.43	0	0	0	0
Telecomm	Custom Equipment Optimization	Project	1	15.0	NO	2,461,648	212.08	0	0	0	0	0.80	0.80	0.80	1,969,318	169.66	0	0	0	0
Telecomm	Custom Controls	Project	2	8.8	NO	1,934,076	210.29	0	0	0	0	0.80	0.80	0.80	1,547,261	168.24	0	0	0	0
Telecomm	Custom Airflow Management	Project	4	8.8	NO	899,219	35.96	0	0	0	0	0.80	0.80	0.80	719,376	28.77	0	0	0	0
Telecomm	Network Combing	Project	20	10.0	NO	767,667	83.83	0	0	0	0	0.80	0.80	0.80	614,134	67.07	0	0	0	0
Telecomm	Custom Air Side Economizer	Project	4	15.0	NO	117,273	0.00	0	0	0	0	0.80	0.80	0.80	93,818	0.00	0	0	0	0
Telecomm	Programmable Thermostats	Project	11	11.0	NO	27,135	4.11	1,188	0	0	0	0.90	0.90	0.90	24,421	3.29	950	0	0	0
Total				10.8		12,350,428	1,438	1,188	0	0	0				9,883,056	1,150	950	0	0	0

Note: To avoid double counting, the verified gross kWh and net kWh used in the TRC analysis exclude secondary energy savings from water reduction measures.

* 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