Guidehouse

Business Custom Incentive Program Impact Evaluation Report

Energy Efficiency Plan Year 2020 (1/1/2020-12/31/2020)

Prepared for:

Nicor Gas

Final

July 14, 2021

Prepared by:

Rick Berry
Charles Ampong
Guidehouse

Roger Hill
InCA Energy Efficiency

Business Custom Incentive Program Impact Evaluation Report

Submitted to:

Nicor Gas Company
1844 Ferry Road
Naperville, IL 60563

Submitted by:

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

Contact:

Ed Balbis	Stu Slote	Kevin Grabner
Partner	Director	Associate Director
561.644.9407	802.526.5113	608.616.5805
ebalbis@guidehouse.com	stu.slote@guidehouse.com	kevin.grabner@guidehouse.com

Table of Contents

List of Tables and Figures

1. Introduction

This report presents the results of the impact evaluation of the Nicor Gas 2020 Custom Program. It presents a summary of the energy impacts for the total program and broken out by relevant measure and program structure details, including Nicor Gas Retro-Commissioning and Combined Heat and Power projects. The appendix presents the impact analysis methodology. Program year 2020 covers January 1, 2020 through December 31, 2020.

2. Program Description

The Custom Program is targeted to the public sector and private sector commercial and industrial (C&I) customers of Nicor Gas. It provides customers with rebate incentives for the installation of cost-effective natural gas-related energy efficiency improvements that are not eligible for a prescriptive rebate under the Nicor Gas Business Energy Efficiency Rebate Program. The Custom Program provides audits and engineering studies to assist customers in understanding their efficiency opportunities by quantifying the estimated project costs, energy savings, and forecasted incentives. The program targets large public sector and C&I customers with more complex facilities that will benefit most from a custom offering during new equipment purchases, facility modernization and industrial process improvements. The Custom Program was implemented in 2020 by CLEAResult.

The program staff work with both trade allies and decision-makers at facilities with natural gas use over 60,000 therms to identify and quantify efficiency opportunities at their facilities. Interested customers must first submit a letter of interest and a pre-approval application to the program. The initial application includes usage history and detailed calculations and specifications for the project. Program staff review the customer's initial reported savings and screen projects using an internal cost-benefit test. The Custom Program requires that a project's initial application be pre-approved prior to the start of the project. Prior to issuing an approval notice, pre-installation inspections are performed on almost all projects, especially for complex and high impact measures.

Additionally, Nicor Gas continued the Nicor Gas non-joint Retro-Commissioning (NG-RCx) offering in 2020, assisting participants with low-cost and no cost tune-ups and adjustments to the operating systems, building controls, energy management systems and HVAC systems of existing buildings. The Custom program also offers feasibility studies and installation incentives for Combined Heat and Power (CHP) projects. In 2020, NG-RCx and CHP projects were implemented by CLEAResult and included with Custom Program tracking data.

The Custom Program had 32 participants in 2020 and completed 49 projects, as shown in Table 2-1. The Combined Heat and Power (CHP) Program completed one private sector project in 2020. The NG-RCx Program completed one project in 2020.

Table 2-1. 2020 Volumetric Summary

Participation	Private	Public	Total
Custom – Participants	17	11	28
Custom – Completed Projects	33	16	49
Projects, 2,500 - 7,500 therms	19	7	26
Projects, > 7,500 therms	14	9	23
Combined Heat and Power	1	0	1
Nicor Gas Retro-Commissioning	1	0	1

* Participants are defined as unique account names
† Installed Projects are defined as unique Project IDs
Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.

3. Savings Summary

Table 3-1 summarizes the energy savings the Custom Program achieved by path in 2020.

Table 3-1. 2020 Annual Energy Savings Summary – Custom

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms	NTG†	Verified Net Savings (Therms)
Private	2,927,728	101%	2,947,462	0.79	2,328,495
Public	232,650	101%	234,218	0.79	185,032
Total or Weighted Average	**3,160,378**	**101%**	**3,181,680**	**0.79**	**2,513,527**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
Source: Guidehouse evaluation team analysis.

Table 3-2 summarizes the energy savings the CHP Program achieved by path in 2020.

Table 3-2. 2020 Annual Energy Savings Summary – CHP

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms	NTG†	Verified Net Savings (Therms)
Private	9,129	100%	9,129	0.80	7,303
Public	0	NA	0	0.80	0
Total or Weighted Average	**9,129**	**100%**	**9,129**	**0.80**	**7,303**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
Source: Guidehouse evaluation team analysis.

Table 3-3 summarizes the energy savings the NG-RCx Program achieved by path in 2020.

Table 3-3. 2020 Annual Energy Savings Summary – NG-RCx

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms	NTG†	Verified Net Savings (Therms)
Private	7,716	117%	9,022	0.94	8,481
Public	0	NA	0	0.94	0
Total or Weighted Average	**7,716**	**117%**	**9,022**	**0.94**	**8,481**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
Source: Guidehouse evaluation team analysis.

4. Program Savings by Measure

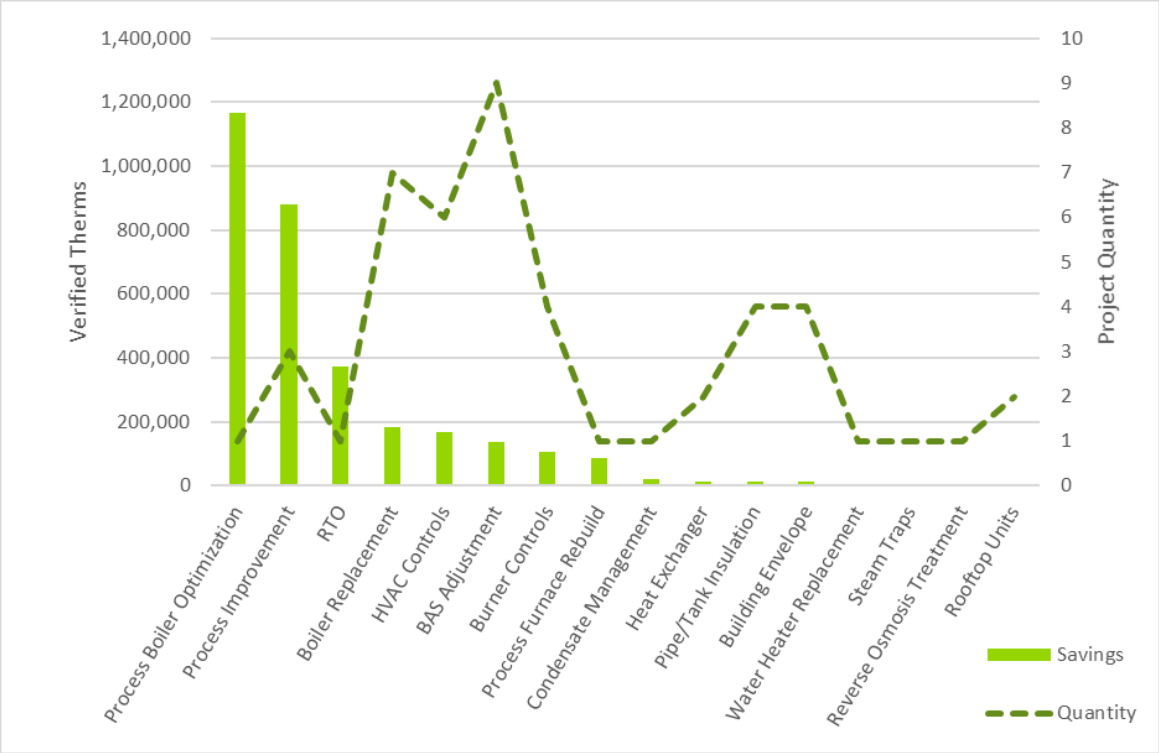
The Custom Program identifies measures as less than or equal to or greater than 7,500 therms, as shown in Table 4-1. The Custom Program projects, excluding CHP and NG-RCx, are further broken down by project type (i.e., technology) in Figure 4-1. Large energy saving projects for process boiler optimization and process improvements provided the majority of program savings, while projects involving controls adjustments were the most common.

Table 4-1. 2020 Annual Energy Savings by Measure

Program Management	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
Private	Custom > 7,500 therms	2,880,510	101%	2,899,926	0.79	2,290,941
Private	Custom 2,500-7,500 therms	47,218	101%	47,536	0.79	37,554
Private Subtotal		*2,927,728*	*101%*	*2,947,462*	*0.79*	*2,328,495*
Public	Custom > 7,500 therms	198,048	101%	199,383	0.79	157,512
Public	Custom 2,500-7,500 therms	34,602	101%	34,835	0.79	27,520
Public Subtotal		*232,650*	*101%*	*234,218*	*0.79*	*185,032*
Total or Weighted Average		**3,160,378**	**101%**	**3,181,680**	**0.79**	**2,513,527**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.

Figure 4-1. Verified Savings by Custom Project Type



Source: Nicor Gas tracking data and Guidehouse team analysis.

5. Impact Analysis Findings and Recommendations

5.1 Impact Parameter Estimates

Table 5-1 shows the unit therm savings and realization rate findings by measure from Guidehouse's review. The realization rate is the ratio of the verified savings to the ex ante savings. Following the table, we provide findings and recommendations, including discussion of all measures with realization rates above or below 100%. Appendix A provides a description of the impact analysis methodology, and Appendix B provides brief findings for all sampled projects. Appendix C shows the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of producing this impact evaluation report.

Table 5-1. Verified Gross Savings Parameters

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
Custom Measures	Vary	Vary	Vary	101%	Project File Review, Monthly Billing Data, Verification*
CHP Measures	Vary	Vary	Vary	100%	Project File Review, Monthly Billing Data, Verification*
NG RCx Measures	Vary	Vary	Vary	117%	Project File Review, Monthly Billing Data, Verification*

* Program Tracking Data (PTD) provided by Nicor Gas, extract dated January 28, 2021. Project files and monthly billing data provided by Nicor Gas. Verification, including telephone interviews with customer contacts, performed by Guidehouse.
Source: Nicor Gas tracking data and Guidehouse team analysis.

5.2 Findings and Recommendations

Two projects (NG-19-24 and NG-19-41) used more than 24 months of production and gas consumption data when establishing baseline operation. This exceeds the range that was previously agreed upon between the implementation and evaluation teams. In response to ambiguity over the appropriate amount of data to use in developing baselines, CLEAResult and Guidehouse agreed to the following approach:[1]

> *When using utility history to estimate the baseline conditions, 12 – 24 months is considered acceptable by evaluation. This means that evaluation will not make adjustments to the amount (range of time) of utility history used to estimate the baseline condition. There may be exceptions based on the judgement of the evaluation, but any deviation will be accompanied by a discussion (email or phone conversation) with implementation to gain additional context.*

[1] In 2018, Guidehouse (then Navigant) and CLEAResult agreed that using between 12 – 24 months of baseline usage in a project would avoid evaluation adjustment. This agreement was recorded in an email dated August 29, 2018 and titled "Nicor Custom: Usage History Protocol Summary."

Guidehouse adjusted the savings calculation to use 24 months of data to establish the baseline conditions.

Recommendation 1. Use between 12 and 24 months of data when establishing baseline operation in calculations.

Two projects (NGPS-16-16 and NGPS-20-11) had their savings values swapped in the tracking data file. Guidehouse used the ex ante the savings found in the calculation files for evaluation purposes.

Table 5-2. Projects with Swapped Ex Ante Savings

Project ID	Ex Ante Savings (Tracking Data; therms)	Ex Ante Savings (Calculation)
NGPS-19-16	26,634	8,554
NGPS-20-11	8,554	26,634

Source: Nicor Gas tracking data and Guidehouse team analysis.

An additional project (NG-20-05) had what appears to be a data transposition error. The ex ante savings in the calculation is 43,330 therms, while the tracking data shows 44,330 therms.

Recommendation 2. Incorporate a quality control step that confirms that the correct savings is entered in the tracking data.

Project NG19-028 involved controls on steam tracing lines and the calculation relied on pre- and post-installation usage data. The ex ante savings calculation went through the parallel path review process, but only four months of post-installation data was available at the end of the program year. The verified savings is based on an updated calculation that uses eight months of post-installation data available at the time of evaluation. This update reduced the realization rate to 89%.

Recommendation 3. For projects that have limited post-installation data available by the close of a program year, Guidehouse recommends that the implementer consider holding projects over to the next program year. This would allow more post-installation data to accumulate and would reduce the risk of evaluation adjustment. Guidehouse recognizes that this decision would have many factors to consider and that, in some cases, claiming the savings in a given year may be worth the risk of evaluation adjustment.

Two projects (NGPS-18-001 and NGPS-19-15) calculated savings using weekly regression analyses. Both projects involved HVAC upgrades at education facilities that would have limited weekend activity. The evaluation team updated the regressions to use separate weekday and weekend regressions, which offered improved correlation coefficients (R^2).

Recommendation 4. For projects that rely on regression analyses, consider applying separate regressions for times periods that have unique operation (e.g., weekday/weekend, weekday/Saturday/Sunday, etc.).

Project NG-18-024 involved a boiler replacement and the ex ante calculation relied on an engineering calculation that assumed boiler load factors and profiles. Guidehouse determined there was no support for the load profile assumptions in the engineering calculation. Additionally, there was a transposition error in the slope of the boiler efficiency curve.[2]

Recommendation 5. Ensure ex ante calculations include explanations or justifications for assumptions and values used to calculate the savings.

Project NGRCx-20-01 involves a large suburban hospital in the midst of a multi-year project to improve energy performance and maintain comfort through the HVAC retro-commissioning process. In 2020, the hospital implemented one measure affecting six air handling units (AHU) at the facility, with Nicor Gas claiming savings from five of those air handlers, for a total of 7,716 claimed therms savings. The implemented measure increases the deadband between the heating and cooling temperature setpoints at the zone-level and reduces the potential for cycling between heating and cooling.

The ex ante savings estimates are based trended pre- and post-implementation data with more than 12 months between the periods. Increased airflow in affected air handers over the course of the study were dismissed in the ex ante estimates as not related to the measure. The long span of time between pre- and post-data makes it hard verify this assumption. The evaluation team would prefer to include the effects of air volume changes as complete estimates of energy differences, but concedes there is not a suitable method to disentangle confounding effects of the measure, occupant behavior, changes implemented due to Covid-19 and other operational changes over the long study period. If properly implemented, evaluation agrees the measure can save energy.

In the case of project NGRCx-20-01, pre implementation data was collected from February 2019 through June 2019, and post implementation data was collected August 2020 and September 2020, in the midst of the COVID-19 pandemic which is known to affect hospital operations. A pre- and post-implementation calculation, as recommended by evaluation, cannot be used to calculate a COVID-19 normalized savings estimate for 2020. A discussion between the implementation team and evaluators concluded a calculation using pre-COVID-19 airflows should be used to estimate COVID-19 normalized savings.

Recommendation 6. The implementation contractor should work with the evaluation team to develop a preferred calculation methodology, data collection protocol, and savings verification procedure for a deadband adjustment measure.

The Nicor Gas tracking data reports average measure lives for custom measures. Guidehouse assigns a project-specific measure life at the end of year to sampled projects based on review of detailed project documents. For measures that are not sampled, Guidehouse assigns a

[2] The slope entered as “0.00411”, should have been entered as “0.0411”.

measure life after referring to the basic measure description (consisting of two or three words or a short phrase) in the tracking data at the end of year. In the current process, Nicor Gas sees the evaluation measure life assignments with the release of the first draft report. To provide an opportunity for discussion on measure lives prior to the first draft, the evaluators could report a measure life along with interim impact results for sampled projects. For non-sampled measures, the evaluator could assign a measure life in early February, when the end of year data arrives, and share those with the implementer for feedback. This would allow resolution of measure life assignments prior to the first draft report.

Recommendation 7. Work with the evaluator to implement an early review process of evaluator measure life assignments.

Appendix A. Impact Analysis Methodology

The 2020 evaluation involved retrospective adjustments to ex ante gross savings on custom measure variables of all projects installed in 2020. CLEAResult provided documentation of project applications and savings. Guidehouse verified project eligibility and savings based on engineering review, billing data review, and site-specific verification of a sample of program measures. Guidehouse designed the sample sizes to provide a 90/10 confidence and relative precision level for program-level gross savings verification.

The evaluation team conducted site-specific research to verify project savings that were not based on measures specified in the TRM. Projects were randomly selected through a stratified sample design at the tracking record level using the population gross therm savings determined from program tracking data. Strata were defined by project size, with 82% of the projects (40 of 49) providing 15% of program gross savings. Table A-1 shows a profile of the sample selection.

Table A-1. Profile of Gross Impact Sample for Custom Projects

	Population Summary			Sample Summary		
Program	Sampling Strata	Number of Projects (N)	Ex Ante Gross Savings (Therms)	n	Ex Ante Gross Savings (Therms)	Sampled % of Population (% Therms)
C&I Custom	Certainty (C)	1	1,158,453	1	1,158,453	100%
	1	3	1,215,654	3	1,215,654	100%
	2	5	322,593	5	322,593	100%
	3	40	463,678	13	285,449	62%
TOTAL		**49**	**3,160,378**	**22**	**2,982,149**	**94%**

Source: Guidehouse evaluation team analysis.

Table A-2 gives the strata-level verified gross realization rates and statistical precision values at 90% confidence for the Custom Program.

Table A-2. Gross Therm Realization Rates and Relative Precision at 90% Confidence Level

Program	Strata	Relative Precision +or-%	Mean RR	Standard Error
C&I Custom	C	NA	100%	0.00
	1	0.0%	97%	0.00
	2	0.0%	95%	0.00
	3	21.6%	117%	0.14
Custom Total RR (90/10)		**6.3%**	**101%**	**0.04**

Source: Guidehouse analysis

A.1 Engineering Review of Project Files

For each selected project, an in-depth application review is performed to assess the engineering methods, parameters and assumptions used to generate all ex ante impact estimates. For each measure in the sampled project, engineers estimated ex post gross savings based on their review of documentation and engineering analysis.

To support this review, the implementation contractor provided project documentation in electronic format for each sampled project. Documentation included some or all scanned files of hardcopy application forms and supporting documentation from the applicant (invoices, measure specification sheets, and vendor proposals), pre-inspection reports and photos, post inspection reports and photos, and calculation spreadsheets.

A.2 On-Site Data Collection

No on-site surveys were completed during 2020 due to the COVID-19 pandemic.

Appendix B. Impact Analysis Supplemental Information

Table B-1 provides a summary of the Custom Program sample selection and verification approach. Table B-2 provides a summary of verification results for the Custom Program sample.

Table B-1. Profile of 2020 Custom Gross Impact Sample

Project ID	Program Path	Ex Ante Gross Savings (therms)	Strata	Verification Approach	Measure
NG06-054	Private	1,158,453	C	File Review	Process Boiler Optimization
NG-20-27	Private	473,391	1	File Review	Process Improvement
NG-19-028	Private	372,330	1	File Review	Process Improvement
NG06-037	Private	369,933	1	File Review	RTO
NG-19-17	Private	84,822	2	File Review	Process Furnace Rebuild
NG-18-024	Private	74,938	2	File Review	Boiler Replacement
NG-19-05	Private	57,985	2	File Review	HVAC Controls
NG-19-24	Private	52,658	2	File Review	Burner Controls
NGPS-18-001	Public	52,190	2	File Review	Boiler Replacement
NG-19-41	Private	45,646	3	File Review	Burner Controls
NG-20-05	Private	44,330	3	File Review	BAS Adjustment
NGPS-19-23	Public	36,579	3	File Review	HVAC Controls
NGPS-19-10	Public	35,026	3	File Review	Boiler Replacement
NGPS-19-15	Public	30,025	3	File Review	HVAC Controls
NGPS-19-16	Public	26,634	3	File Review	HVAC Controls
NG-20-08	Private	22,316	3	File Review	BAS Adjustment
NGPS-19-25	Public	11,817	3	File Review	HVAC Controls
NG-20-09	Private	10,554	3	File Review	BAS Adjustment
NGPS-20-11	Public	8,554	3	File Review	Pipe/Tank Insulation
NG-20-11	Private	6,173	3	File Review	BAS Adjustment
NG-19-31	Private	3,935	3	File Review	Boiler Replacement
NGPS-20-05	Public	3,860	3	File Review	Building Envelope

Source: Nicor Gas tracking data and Guidehouse team analysis.

Table B-2. 2020 Summary of Custom Program Sample Verification Results

Project ID	Program Path	Measure Description	Gross Realization Rate	Summary of Adjustment
NG06-054	Private	Process Boiler Optimization	100%	Ok
NG-20-27	Private	Process Improvement	100%	Ok
NG-19-028	Private	Process Improvement	89%	Included additional post-installation data.
NG06-037	Private	RTO	100%	Ok
NG-19-17	Private	Process Furnace Rebuild	86%	Corrected a formula error, updated annual production, and removed outliers.
NG-18-024	Private	Boiler Replacement	68%	Updated the approach to reflect post-installation usage data, corrected an input error, and updated boiler load assumptions.
NG-19-05	Private	HVAC Controls	156%	Corrected a cell reference error
NG-19-24	Private	Burner Controls	68%	Updated the baseline regression to be based on 24 months, rather than 35.
NGPS-18-001	Public	Boiler Replacement	105%	Updated the regression to use weekday and weekend profiles.
NG-19-41	Private	Burner Controls	211%	Updated the baseline regression to be based on 24 months, rather than 36. Also, updated slope and intercept calculations to remove downtime data points.
NG-20-05	Private	BAS Adjustment	98%	The verified savings corrects what appears to be a data entry error (tracking data: 44,330; ex ante calculator: 43,330)
NGPS-19-23	Public	HVAC Controls	100%	Ok
NGPS-19-10	Public	Boiler Replacement	100%	Ok
NGPS-19-15	Public	HVAC Controls	99%	Updated the regression to use weekday and weekend profiles.
NGPS-19-16	Public	HVAC Controls	32%	The ex ante savings was swapped with NGPS-20-11.
NG-20-08	Private	BAS Adjustment	100%	Ok
NGPS-19-25	Public	HVAC Controls	151%	Updated the occupancy schedule in the calculation.
NG-20-09	Private	BAS Adjustment	100%	Ok
NGPS-20-11	Public	Pipe/Tank Insulation	275%	The ex ante savings was swapped with NGPS-19-16. Also, corrected a unit error and updated the thermal regain factor.
NG-20-11	Private	BAS Adjustment	100%	Ok
NG-19-31	Private	Boiler Replacement	104%	Updated regression analysis with additional data.
NGPS-20-05	Public	Building Envelope	74%	Corrected the R-value of the installed insulation.

Source: Nicor Gas tracking data and Guidehouse team analysis.

Table B-3. 2020 Summary of CHP Program Sample Verification Results

Project ID	Program Path	Measure Description	Gross Realization Rate	Summary of Adjustment
NG06-084	Private	CHP	100%	Ok

Source: Nicor Gas tracking data and Guidehouse team analysis.

Table B-4. 2020 Summary of NG RCx Program Sample Verification Results

Project ID	Program Path	Measure Description	Gross Realization Rate	Summary of Adjustment
NGRCx-20-01	Private	Increase Dead Band on Hospital Air Handling Unit (AHU) Controls	117%	Pre-COVID-19 airflows used to estimate COVID-19 normalized savings

Source: Nicor Gas tracking data and Guidehouse team analysis.

Appendix C. Program-Specific Inputs for the Illinois TRC

Table C-1 shows the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of producing this impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to the evaluation team later. Guidehouse will include annual and lifetime water savings and greenhouse gas reductions in the end of year summary report.

Table C-1. Verified Cost Effectiveness Inputs - Custom

Research Category	Units	Quantity	Effective Useful Life (years)	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Process Boiler Optimization	Project	1	17.4	1,158,453	1,166,261	921,347
Process Improvement	Project	3	17.4	874,191	880,083	695,266
RTO	Project	1	20.0	369,933	372,427	294,217
Boiler Replacement	Project	7	25.0	182,932	184,165	145,490
HVAC Controls	Project	6	15.0	167,670	168,800	133,352
BAS Adjustment	Project	9	8.8	136,634	137,555	108,668
Burner Controls	Project	4	18.3	104,098	104,800	82,792
Process Furnace Rebuild	Project	1	17.4	84,822	85,394	67,461
Condensate Management	Project	1	20.0	21,117	21,259	16,795
Heat Exchanger	Project	2	24.0	14,448	14,545	11,491
Pipe/Tank Insulation	Project	4	15.0	13,200	13,289	10,498
Building Envelope	Project	4	20.0	11,922	12,002	9,482
Water Heater Replacement	Project	1	15.0	6,555	6,599	5,213
Steam Traps	Project	1	20.0	5,836	5,875	4,642
Reverse Osmosis Treatment	Project	1	15.0	4,846	4,879	3,854
Rooftop Units	Project	2	15.0	2,318	2,334	1,844
Destratification Fans	Project	1	10.0	1,403	1,412	1,116
Total or Weighted Average - Custom Program	**Project**	**49**	**17.7**	**3,160,378**	**3,181,680**	**2,513,527**
Total or Weighted Average - CHP	**Project**	**1**	**20.0**	**9,129**	**9,129**	**7,303**
Total or Weighted Average - NG RCx	**Project**	**1**	**8.8**	**7,716**	**9,022**	**8,481**

Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.