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Custom Rebates Program Impact Evaluation Report

Energy Efficiency Plan: Program Year 2022 (1/1/2022-12/31/2022)

Prepared for:

Nicor Gas

FINAL

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1. Introduction

This report presents the results of the impact evaluation of the Nicor Gas 2022 Custom Rebates Program (Custom Program) and a summary of the energy impacts for the total program and broken out by relevant measure and program structure details. The appendix presents the impact analysis methodology and cost-effectiveness input summary. Program year 2022 covers January 1, 2022 through December 31, 2022.

2. Program Description

The Custom Program is targeted to the commercial and industrial (C&I) and public sector customers of Nicor Gas and 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 C&I and public sector customers with more complex facilities that will benefit most from a custom offering during new equipment purchases, facility modernization and industrial process improvements.

The program staff work with both trade allies and decision-makers at facilities with natural gas annual 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 a project's initial application be pre-approved prior to the start of the project. Prior to issuing an approval notice, the implementer performs pre-installation inspections on almost all projects, especially for complex and high impact measures.

The Custom Program offer the Nicor Gas only, non-joint Retro-Commissioning (NG-RCx), 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 NG-RCx offering reported one project in 2022. After reviewing the project, the evaluation team determined it was not an RCx project but a Custom project. The evaluation team includes this project in the custom-private path for 2022.

The Custom Program also offers feasibility studies and installation incentives for Combined Heat and Power (CHP) projects. No savings were realized from the CHP program path.

The Custom Program had 72 completed projects in 2022, as shown in

Table 2-1.

Table 2-1. 2022 Volumetric Summary

Participation	Private	Public	Total
Custom - Participants *	29	41	**70**
Custom - Projects †	30	42	**72**

* 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 2022.

Table 3-1. 2022 Annual Energy Savings Summary

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
Custom - Private	1,206,301	89%	1,077,848	0.84	905,393
Custom - Public	462,838	106%	490,187	0.84	411,757
Total or Weighted Average	**1,669,139**	**94%**	**1,568,035**	**0.84**	**1,317,150**

Note: Totals may not sum due to rounding.
* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross (NTG). A deemed value available on the Illinois Energy Efficiency Stakeholder Advisory Group (SAG) website: https://www.ilsag.info/evaluator-ntg-recommendations-for-2022/
Source: Guidehouse evaluation team analysis.

4. Program Savings by Measure

The Custom Program identifies measures as less than or greater than 7,500 therms, as shown in Table 4-1.

Table 4-1. 2022 Annual Energy Savings by Size

Program Sector	Savings Category	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
Private	Custom > 7,500 therms	1,183,091	89%	1,051,579	0.84	883,327
Private	Custom 2,500-7,500 therms	23,210	113%	26,269	0.84	22,066
Private Subtotal		***1,206,301***	***89%***	***1,077,848***	***0.84***	***905,393***
Public	Custom > 7,500 therms	349,870	105%	366,058	0.84	307,489
Public	Custom 2,500-7,500 therms	112,968	110%	124,128	0.84	104,268
Public Subtotal		***462,838***	***106%***	***490,187***	***0.84***	***411,757***
Total or Weighted Average		**1,669,139**	**94%**	**1,568,035**	**0.84**	**1,317,150**

Note: Totals may not sum due to rounding.

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross (NTG). A deemed value available on the Illinois Energy Efficiency Stakeholder Advisory Group (SAG) website: https://www.ilsag.info/evaluator-ntg-recommendations-for-2022/
Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.

2022 program savings by measure are as shown in Table 4-2. Large energy saving projects for Building Automation System (BAS) Upgrade, Gas Pipe Replacement, Furnace Rebuild, Condensing Boiler with CO2 Capture, Burner Replacement and Boiler Replacement provided most program savings.

Table 4-2. 2022 Annual Energy Savings by Measure

Savings Category	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
AHU CV to VAV	29,107	121%	35,269	0.84	29,626
BAS & Energy Wheel Recovery	9,129	121%	11,062	0.84	9,292
BAS Controls	36,636	115%	42,247	0.84	35,487
BAS Upgrade	238,440	104%	248,664	0.84	208,878
Boiler Replacement	122,160	105%	128,279	0.84	107,754
Boiler Replacement and BAS	6,078	121%	7,365	0.84	6,186
Burner Replacement	152,042	102%	155,118	0.84	130,299
Case Replacement	5,800	121%	7,028	0.84	5,903
Commercial Dryer	56,024	92%	51,289	0.84	43,083
Condensing Boiler w CO2 capture	177,749	68%	121,419	0.84	101,992
DCV	4,551	94%	4,275	0.84	3,591
DDC Controls	7,736	94%	7,267	0.84	6,105
Direct Fired MAU w VFD and Pressure Control	11,211	121%	13,584	0.84	11,411
Display Cases	13,558	121%	16,428	0.84	13,800
Economizer	11,419	121%	13,836	0.84	11,623
Furnace Rebuild	179,235	68%	122,434	0.84	102,844
Gas Pipe Replacement	215,463	100%	215,222	0.84	180,786
Geothermal and HVAC Reno	45,539	92%	41,690	0.84	35,020
Insulation	29,165	117%	34,190	0.84	28,720
MAU Upgrade	44,851	92%	41,060	0.84	34,491
Pavings Under Aggregate Storage Area	19,273	121%	23,353	0.84	19,617
Re-Tube	19,050	121%	23,083	0.84	19,390
RO	16,216	121%	19,649	0.84	16,505
RTU Replacement	23,466	120%	28,262	0.84	23,740
Stack Economizer and Water Heater	61,274	68%	41,856	0.84	35,159
Steam Absorption Chiller Upgrade	3,535	94%	3,321	0.84	2,790
Steam Generator	67,980	68%	46,437	0.84	39,007

Savings Category	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
Steam to Hot Water	34,067	92%	31,188	0.84	26,198
Tank Insulation	1,942	94%	1,824	0.84	1,532
Tankless High Efficiency Units	9,821	121%	11,900	0.84	9,996
Thermal Heat Curtains	14,031	121%	17,001	0.84	14,281
Water System	2,591	94%	2,434	0.84	2,045
Total or Weighted Average	**1,669,139**	**94%**	**1,568,035**	**0.84**	**1,317,150**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross (NTG). A deemed value available on the Illinois Energy Efficiency Stakeholder Advisory Group (SAG) website: https://www.ilsag.info/evaluator-ntg-recommendations-for-2022/
Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.

5. Impact Analysis Findings and Recommendations

5.1 Impact Parameter Estimates

Evaluation was completed for all selected sample custom projects. Reviewed project files and data included the program tracking data, project files, monthly billing data, and information collected through telephone interviews and email communications with the customer contacts. The overall realization rate (RR) is 94%, which is the ratio of the verified gross savings to the ex ante savings.

In the following section, findings and recommendations from the evaluation are presented, including discussion of sampled 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.

5.2 Findings and Recommendations

The evaluation team found the largest deviation from ex ante savings in Condensing Boiler, Boiler Burner Upgrade, Geothermal and HVAC Renovation, RTU Replacement, and HVAC systems. The evaluation team sampled and reviewed projects in waves as these were completed during the program year and provided findings to Nicor Gas in monthly calls and summary results spreadsheets. Key findings and recommendations are summarized below.

Finding 1. For Condensing Boiler with CO2 Capture project NG-21-28, the submitted documents showed the existing boilers were in extremely poor condition and needed to be replaced. The baseline for an end-of-useful-life boiler replacement should be the code defined minimum efficiency boiler. The baseline efficiency for this project was updated from the existing boiler efficiency to 75.3% based on Illinois Statewide Technical Reference Manual (IL-TRM) Section 4.4.10 and adjustment made to account for baseline shell losses, excess air and turndown differences.

Recommendation 1. For end of use equipment replacement, use code defined minimum efficiency equipment instead of existing equipment as baseline.

Finding 2. For Stack Economizer and Water Heater project NG-21-12, the ex ante high turndown burner savings factor was based on one previous project with logged data to support its high turndown burner savings. Instead of using one previous project savings factor for various projects, the evaluation team updated the high turndown burner savings factor to match the algorithm from IL-TRM Section 4.4.20. The economizer and linkageless controls ex ante savings remained the same in verified savings calculations.

Recommendation 2. For High Turndown Burner projects, if no site-specific data were collected, use the algorithm from IL-TRM Section 4.4.20 to calculate the savings factor.

Finding 3. Geothermal and HVAC Reno project NGPS-21-09 was a fuel switching project. The calculated Heat Pump Site Heat Consumed should not be claimed as part of the project savings. Based on IL-TRM Section 4.4.9, Heat Pump Site Heat Consumed should be valued as extra energy consumption from the project installation.

Recommendation 3. For Geothermal Heat Pump projects, claim the Heat Pump Site Heat Consumed as extra energy consumption instead of energy savings.

Finding 4. For Burner Replacement project NG-22-01, the calculated average post implementation boiler efficiency was based on high, mid, and low firing rate efficiencies. Considering the boiler was lightly loaded, the evaluation team updated the average efficiency to be based on only mid and low firing rate efficiencies.

Recommendation 4. For the Burner Replacement project, determine the boiler efficiency based on the actual firing rate of the boiler when the data is available.

Finding 5. For Display Cases project NG-21-01, the ex ante regression was a linear model between daily therm usage and outdoor air temperature. The evaluation team added a break point above which the gas usage was level and below which the gas usage varies linearly based on the outdoor air temperature to improve the regression model accuracy. This approach better represents the weather independent baseload gas usage.

Recommendation 5. Use a break point in the regression models for gas usage versus outdoor air temperature when the analyzed data shows a weather independent baseload gas usage across all temperatures.

Finding 6. For BAS & Energy Wheel Recovery project NGPS-20-10, the building operating hours was confirmed by the customer to be 24/7. Optimal start controls only result in energy savings if the HVAC system turns off during unoccupied hours and turns on during occupied hours. The verified savings excluded the savings from optimal start control.

Recommendation 6. Claim no savings for optimal start sequence for buildings operating 24/7.

Finding 7. For Boiler Replacement project NGPS-21-22, the baseline boiler efficiency was updated from the ex ante value of 80% to 82% according to IL-TRM Section 4.4.10 since the boilers were above 2.5 MMBtu/hr. In addition, the ex ante efficiency increase savings factor was calculated as (Post Installation Efficiency - Baseline Efficiency)/Post Installation Efficiency, and was updated to (Post Installation Efficiency - Baseline Efficiency)/Baseline Efficiency based on the algorithm in IL-TRM Section 4.4.10.

Recommendation 7. For boiler replacement projects, use the baseline efficiency and savings algorithm defined in IL-TRM Section 4.4.10 based on site specific boiler information.

Finding 8. For VAV project NGPS-20-29, there were billing data from periods when the heat recovery system was not in operation, but those datapoints were included in the analysis for therm savings. Such datapoints were excluded in the verified savings calculations to produce more accurate modeling results.

Recommendation 8. When preparing models to reflect relationship between two parameters, filter to include only the valid datapoints from the raw data for analysis.

Finding 9. For variable air volume (VAV) project NGPS-20-29, a 3% deration factor was included in the ex ante calculations to account for transmission losses. The evaluation team agreed there were system losses associated with the piping between the buildings and within the buildings, but recommended gas savings from reduced boiler loads should be calculated using the boiler efficiency rather than system efficiency. The issue was the change in boiler load for the VAV conversion did not impact the system transmission loss, as in both the baseline and the post implementation cases, the piping was maintained at the same temperature and resulted in the same losses. The 3% deration factor was removed in the verified savings.

Recommendation 9. When the system transmission losses were not impacted by a project before and after the implementation, the program should not derate the boiler efficiency used to quantify savings for such losses.

Finding 10. Burner Replacement Projects NG-20-45 and NG-20-46 were Phase 1 and Phase 2 for a project at the same customer facility. A custom lite tool and a custom whole building utility data analysis tool were used to quantify savings. The boiler in project NG-20-45 and the boiler in project NG-20-46 were of the same capacity and had very similar firing rates, with only about 1% difference. As a result, the verified savings from utility data analysis was calculated to be the same for these two projects. Different RRs were calculated for these two projects since the ex ante savings of these projects were different.

Recommendation 10. Provide an advanced notification to the evaluation team for multi-phase projects, to allow these to be tracked by the evaluation team separately from regular custom projects.

Finding 11. Project NG-RCx-22-02 was a pipeline replacement project submitted as a RCx project at no cost to the customer. However, the project nature is a capital project which does not fit the RCx project definition. No project cost or incentives documentation was provided to the evaluation team. Also, the project was considered as an early replacement with the effective useful life (EUL) of the measure determined to be 5 years. The American Society for Testing and Materials (ASTM) standard pipeline life of 50 year. This EUL was determined to be 10% of the industrial standard lifetime, based on the received description that the pipeline was in poor condition, but with no existing safety concerns.

Recommendation 11. For large, complex, and unique projects, the implementer should continue to work with the evaluation team to adequately utilize the parallel path review process and improve frequent communications for timely turnaround of evaluation feedback on project scope and eligibility.

Finding 12. The tracking data description of measure names were “Custom > 7,500 therms” and “Custom 2,500-7,500 therms”. Projects NGPS-22-06, NGPS-20-06, NGPS-21-28, NGPS-21-06 and NGPS-21-25 have savings below 2,500 therms which does not match the assigned measure name of “Custom 2,500-7,500 therms”.

Recommendation 12. Review the program tracker and ensure the measure names are consistent with the measure savings.

Appendix A. Impact Analysis Methodology

The 2022 evaluation involved retrospective adjustments to ex ante gross savings on custom measure variables of all projects installed in 2022. Nicor Gas provided documentation of project applications and savings. The evaluation team verified project eligibility and savings based on engineering review, billing data review, and site-specific verification of a sample of program measures. The evaluation team designed the sample sizes to provide a 90/10 confidence and relative precision level for program-level gross savings verification.

Evaluation designed the sampling such that the biggest project was treated as a certainty stratum. Other C&I and public sector custom projects were randomly selected through a stratified sample design at the project level using the population gross therm savings determined from program tracking data.

Three strata were defined by project savings to make up 33%, 65%, and 96% of the total C&I and public sector Custom Program savings. The bottom 4% of savings were placed in stratum four and not included in the final sample draw. The realization rate of the C&I and public sector sample custom projects was applied to stratum four. 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 Sector	Sampling Strata	Number of Projects (N)	Ex Ante Gross Savings (Therms)	n	Ex Ante Gross Savings (Therms)	Sampled % of Population (% Therms)
Custom - C&I and Public Sector	Certainty	1	215,463	1	215,463	100%
	1	4	486,238	3	418,258	86%
	2	11	462,390	4	179,318	39%
	3	38	451,391	13	186,592	41%
	4	18	53,657	0	-	0%
Total		**72**	**1,669,139**	**21**	**999,631**	**60%**

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 RRs and Relative Precision at 90% Confidence Level

Program Sector	Sampling Strata	Relative Precision + or - %	Mean RR	Standard Error
Custom - C&I and Public Sector	Certainty	0%	100%	0.00
	1	46%	68%	0.11
	2	24%	92%	0.09
	3	16%	121%	0.11
	4	-	-	-
Custom Total RR (90/10)		**10%**	**94%**	**0.05**

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 verified (ex post) gross savings based on the 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. The evaluation team used IL-TRM v10.0 as a source of inputs for some non-site-specific data.

A.2 Onsite Data Collection

Guidehouse conducted telephone interviews with a sample of project's customer site representatives to confirm equipment operating details and other relevant information. No onsite evaluations were completed during 2022.

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 selected samples.

Table B-1. Profile of 2022 Custom Program Gross Impact Sample

Project ID	Program Sector	Ex Ante Gross Savings (Therms)	Strata	Verification Approach	Measure
NGRCx-22-02	Private	215,463	Certainty	File Review	Pipe Replacement
NG-22-32	Private	179,235	1	File Review	Furnace Rebuild
NG-21-28	Private	177,749	1	File Review	Condensing Boiler w CO2 capture
NG-21-12	Private	61,274	1	File Review	Stack Economizer and Water Heater
NG-20-45	Private	53,109	2	File Review	Burner Replacement
NGPS-21-09	Public	45,539	2	File Review	Geothermal and HVAC Reno
NGPS-21-42	Public	45,175	2	File Review	HVAC System
NGPS-21-41	Public	35,495	2	File Review	HVAC System
NG-22-01	Private	27,952	3	File Review	Burner Replacement
NGPS-21-15	Public	23,198	3	File Review	AHU CV to VAV
NGPS-21-49	Public	19,819	3	File Review	Building Controls
NGPS-21-54	Public	16,701	3	File Review	BAS
NGPS-21-26	Public	15,247	3	File Review	RTU Replacement
NG-20-46	Private	15,044	3	File Review	Boiler Burner Upgrade
NG-21-14	Private	13,769	3	File Review	BAS for MAUs
NG-21-01	Private	13,558	3	File Review	Display Cases
NG-21-19	Private	10,599	3	File Review	Boiler Replacement
NGPS-20-10	Public	9,129	3	File Review	BAS & Energy Wheel Recovery
NGPS-21-22	Public	8,894	3	File Review	Boiler Replacement
NGPS-20-47	Public	6,773	3	File Review	Boiler Replacement
NGPS-20-29	Public	5,909	3	File Review	VAV

Source: Nicor Gas tracking data and Guidehouse team analysis.

Table B-2. 2022 Summary of Custom Program Sample Verification Results

Project ID	Program Sector	Measure Description	Gross Realization Rate	Summary of Adjustment
NGRCx-22-02	Private	Pipe Replacement	100%	Included additional utility usage dada from November 2022 to March 2023 and updated the verified savings calculations accordingly.
NG-22-32	Private	Furnace Rebuild	100%	No adjustments
NG-21-28	Private	Condensing Boiler with CO2 capture	30%	Adjusted the baseline boiler efficiency to 75.3% to account for the existing boilers being at the end of the useful life, shell losses, excess air and turndown differences. Adjusted the post boiler efficiency to 95.2% to account for CO2 recapture and differences in summer and winter efficiencies.
NG-21-12	Private	Stack Economizer and Water Heater	88%	The high turndown burner savings factor was updated to match the algorithm from IL-TRM Section 4.4.20. The economizer and linkageless controls savings factors remained the same as ex ante calculations.
NG-20-45	Private	Burner Replacement	75%	Revised custom lite tool and building level analysis received. Verified savings updated to be the average savings of these two methodologies. Since the projects NG-20-45 and NG-20-46 boilers are of similar firing rates, the savings was split evenly between these two projects.
NGPS-21-09	Public	Geothermal and HVAC Reno	65%	The calculated Heat Pump Site Heat Consumed was updated to be extra consumption instead of savings according to IL-TRM Section 4.4.9. 50% of the DCV and ERV related savings included in the verified savings.
NGPS-21-42	Public	HVAC System	119%	Included additional utility usage data from March to October 2022 and updated the verified savings calculations accordingly.
NGPS-21-41	Public	HVAC System	116%	Included additional utility usage dada from March to October 2022 and updated the verified savings calculations accordingly.

Project ID	Program Sector	Measure Description	Gross Realization Rate	Summary of Adjustment
NG-22-01	Private	Burner Replacement	118%	Updated the average post implementation boiler efficiency to reflect mid/low firing efficiencies since the boiler was lightly loaded. Updated cycling losses based on load profile from billed usages.
NGPS-21-15	Public	AHU CV to VAV	125%	Included additional utility usage dada from April to October 2022 in the savings analysis.
NGPS-21-49	Public	Building Controls	105%	Included additional utility usage dada from May to October 2022 in the savings analysis.
NGPS-21-54	Public	BAS	109%	Included additional utility usage dada from May to October 2022 and updated the verified savings calculations accordingly.
NGPS-21-26	Public	RTU Replacement	160%	Included additional utility usage dada from April to December 2022 in the savings analysis.
NG-20-46	Private	Boiler Burner Upgrade	264%	Revised custom lite tool and building level analysis received. Verified savings updated to be the average savings of these two methodologies. Since the projects NG-20-45 and NG-20-46 boilers are of similar firing rates, the savings was split evenly between these two projects.
NG-21-14	Private	BAS for MAUs	100%	No adjustments
NG-21-01	Private	Display Cases	72%	Added a break point to the regression analysis to improve the model for energy usage. Included additional utility usage dada in the verified savings calculations.
NG-21-19	Private	Boiler Replacement	100%	No adjustments
NGPS-20-10	Public	BAS & Energy Wheel Recovery	67%	Excluded the optimal start savings since the building operate 24/7.
NGPS-21-22	Public	Boiler Replacement	80%	Updated the baseline boiler efficiency to 82% since the boilers are above 2.5 mmBtu/hr. Updated the savings factor to be (Post Installation Efficiency - Baseline Efficiency)/Baseline Efficiency based on Illinois Statewide Technical Reference Manual (IL-TRM) Section 4.4.10.
NGPS-20-47	Public	Boiler Replacement	100%	No adjustments

Project ID	Program Sector	Measure Description	Gross Realization Rate	Summary of Adjustment
NGPS-20-29	Public	VAV	114%	Excluded the 3% deration factor which accounts for the transmission losses. In the analysis of equipment Therm savings versus outdoor air temperatures, excluded the trend data from the periods when the heat recovery system was not in operation.

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. Currently, 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. The evaluation team 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

Savings Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
AHU CV to VAV	Project	2	15.0	29,107	35,269	29,626
BAS & Energy Wheel Recovery	Project	1	22.8	9,129	11,062	9,292
BAS Controls	Project	5	15.0	36,636	42,247	35,487
BAS Upgrade	Project	18	15.0	238,440	248,664	208,878
Boiler Replacement	Project	10	25.0	122,160	128,279	107,754
Boiler Replacement and BAS	Project	1	25.0	6,078	7,365	6,186
Burner Replacement	Project	5	21.0	152,042	155,118	130,299
Case Replacement	Project	1	12.0	5,800	7,028	5,903
Commercial Dryer	Project	1	14.0	56,024	51,289	43,083
Condensing Boiler w CO2 capture	Project	1	25.0	177,749	121,419	101,992
DCV	Project	1	10.0	4,551	4,275	3,591
DDC Controls	Project	2	15.0	7,736	7,267	6,105
Direct Fired MAU w VFD and Pressure Control	Project	1	15.0	11,211	13,584	11,411
Display Cases	Project	1	12.0	13,558	16,428	13,800
Economizer	Project	1	5.0	11,419	13,836	11,623
Furnace Rebuild	Project	1	16.5	179,235	122,434	102,844
Gas Pipe Replacement	Project	1	5.0	215,463	215,222	180,786
Geothermal and HVAC Reno	Project	1	25.0	45,539	41,690	35,020
Insulation	Project	3	15.0	29,165	34,190	28,720
MAU Upgrade	Project	1	15.0	44,851	41,060	34,491
Pavings Under Aggregate Storage Area	Project	1	15.0	19,273	23,353	19,617

Savings Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Re-Tube	Project	1	25.0	19,050	23,083	19,390
RO	Project	1	20.0	16,216	19,649	16,505
RTU Replacement	Project	3	15.0	23,466	28,262	23,740
Stack Economizer and Water Heater	Project	1	18.1	61,274	41,856	35,159
Steam Absorption Chiller Upgrade	Project	1	23.0	3,535	3,321	2,790
Steam Generator	Project	1	25.0	67,980	46,437	39,007
Steam to Hot Water	Project	1	25.0	34,067	31,188	26,198
Tank Insulation	Project	1	15.0	1,942	1,824	1,532
Tankless High Efficiency Units	Project	1	20.0	9,821	11,900	9,996
Thermal Heat Curtains	Project	1	5.0	14,031	17,001	14,281
Water System	Project	1	15.0	2,591	2,434	2,045
Total or Weighted Average		**72**	**16.9**	**1,669,139**	**1,568,035**	**1,317,150**

* Verified gross therms shown by measure type are based on sample realization rates for the population times ex ante gross therms, and do not reflect individual projects.

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