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|  | RetroCommissioning Program Impact Evaluation Report  Energy Efficiency Plan: Program Year 2023  (1/1/2023-12/31/2023) | | | |
|  | Prepared for:  Peoples Gas and North Shore Gas  DRAFT  **March 15, 2023** | | | |
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# Introduction

This report presents the results of the impact evaluation of the Peoples Gas (PGL) and North Shore Gas (NSG) 2023 RetroCommissioning program and presents a summary of the energy impacts for the total program as well as relevant measure and program structure details. The appendices present the impact analysis methodology, detailed engineering desk review results, and Illinois total resource cost (TRC) inputs. Program year 2023 covers January 1, 2023, through December 31, 2023.

The 2023 RetroCommissioning program is offered jointly to customers served by ComEd, Nicor Gas, PGL, and NSG. This report presents results of the impact evaluation for PGL and NSG.

# Program Description

The RetroCommissioning program has been part of ComEd’s Energy Efficiency program portfolio since 2007. In 2010, ComEd began coordinating the program with the gas utilities that also serve ComEd customers. ComEd manages and funds the program, and the gas utilities have the option to share the program costs and savings with ComEd on a project-by-project basis. The overlapping gas territories include Nicor Gas, PGL, and NSG.

The RetroCommissioning program helps commercial and industrial customers improve the energy performance of their facilities through systematic analysis of existing building systems. Program-qualified energy efficiency service providers (EESPs) recruit participants, conduct energy studies, and recommend energy‑saving measures to implement. EESPs are required to verify implemented projects and measures before the project is considered complete. As the implementation contractor, Resource Innovations verifies, tracks, and reports savings for the coordinating utilities.

Generally, the program pays 100% for a detailed study, contingent on a participant’s commitment to spend a defined amount of its own funds implementing study recommendations with a simple payback of 18 months or less. In CY2023, this component consisted of two tracks: Monitoring-Based Commissioning (MBCx), and RetroCommissioning Flex (RCx).

* **MBCx** projects are supported by a multiyear agreement between the building owner and the EESP. This approach identifies, analyses, implements, and verifies multiple bundles of measures on a rolling basis with the EESP monitoring building automation system (BAS) data periodically using integrated, program-installed software to document ongoing savings. Measure savings are counted toward program goals in the calendar year these are submitted based on EESP monitoring since the prior submitted savings.
* **RCx** projects generally last 6-15 months and include a fully funded RCx Flex study covering the costs of engineering services and additional performance-based incentives. To receive the study, participants must agree to implement mutually agreed upon energy conservation measures (ECMs) with a simple payback of 1.5 years or less.

The PGL program had 12 participants in 2023 and completed 17 projects[[1]](#footnote-2) as Table 2‑1 shows.

Table 2‑1. 2023 RCx Program Volumetric Summary for PGL

|  |  |
| --- | --- |
| Participation | Total |
| Participants \* | 12 |
| Installed Projects † | 17 |

\* Participants are defined as unique Account Name.

† Installed projects are defined as unique Work Order ID.

Source: Peoples Gas tracking data and Guidehouse evaluation team analysis

The NSG program had one participant in 2023 and completed one project as Table 2‑2 shows.

Table 2‑2. 2023 RCx Program Volumetric Summary for NSG

|  |  |
| --- | --- |
| Participation | Total |
| Participants \* | 1 |
| Installed Projects † | 1 |

\* Participants are defined as unique Account Name.

† Installed projects are defined as unique Work Order ID.

Source: North Shore Gas tracking data and Guidehouse evaluation team analysis

# Program Savings Detail

Table 3‑1 summarizes the energy savings the PGL RetroCommissioning program achieved by path in 2023. Guidehouse implemented the addition to the Illinois Energy Efficiency Policy Manual related to the Net-to-Gross (NTG) ratio to be used for “economically disadvantaged areas” (hereafter “DAC”) for eligible business customers.

Table 3‑1. 2023 RCx Program Annual Energy Savings Summary for PGL

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Program Path |  | Ex Ante Gross Savings (therms) | Verified Gross RR\* | Verified Gross Savings (therms) | NTG† | Verified  Net  Savings (therms) |
| All Tracks |  | 349,572 | 89% | 312,749 | 0.98 | 306,494 |
| All Tracks - DAC |  | 11,613 | 82% | 9,552 | 1.00 | 9,552 |
| **Total or Weighted Average** |  | **361,185** | **89%** | **322,300** | **0.98** | **316,045** |

Note: Totals may not sum due to rounding.

Note: Guidehouse excluded two projects from the PGL CY2023 tracking data (WO-4297215 and WO-4297880) from both the ex ante and verified savings as savings for both projects were already claimed and verified in CY2022 (See Table B-2, projects 17-119 and 20-0066 in CY2022 report).[[2]](#footnote-3)

\* 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 Stakeholders Advisory Group (SAG) website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2023/>. The NTG ratio for eligible business customers in disadvantaged neighborhoods is set to 1.00 as per the “NTG Ratio for Disadvantaged Areas” policy.[[3]](#footnote-4)

Source: Peoples Gas tracking data and Guidehouse evaluation team analysis

Table 3‑2 summarizes the energy savings the NSG RetroCommissioning program achieved by path in 2023.

Table 3‑2. 2023 RCx Program Annual Energy Savings Summary for NSG

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Program Path | Ex Ante Gross Savings (therms) | Verified Gross  RR\* | Verified Gross Savings (therms) | NTG† | Verified  Net  Savings (therms) |
| All Tracks | 4,558 | 113% | 5,156 | 0.98 | 5,053 |
| **Total or Weighted Average** | **4,558** | **113%** | **5,156** | **0.98** | **5,053** |

\* 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 website: [**https://www.ilsag.info/evaluator-ntg-recommendations-for-2023/**](https://www.ilsag.info/evaluator-ntg-recommendations-for-2023/)**.** The NTG ratio for eligible business customers in disadvantaged neighborhoods is set to 1.00 as per the “NTG Ratio for Disadvantaged Areas” policy.

Source: North Shore Gas tracking data and Guidehouse evaluation team analysis

# Program Savings by Measure

The RetroCommissioning program does not claim savings by measure, so this report does not present measure-level savings. Evaluation-verified savings for the program are based on a random sample of projects and reported at the project level. Appendix B provides more information about sampled project-level (bundle-level for MBCx) savings.

# Impact Analysis Findings and Recommendations

## Findings and Recommendations

**Finding 1.** The evaluation team noted that input parameters in some ex ante custom calculators (e.g., 19-0151, 20-0036) were based on setpoint values even when those parameters were monitored and trended and actual values were available. The team also identified one project (22-0027) where hard-coded input parameters in the calculators did not match the trend data and investigation phase data was not updated with additional pre- and post-implementation data collected during the verification phase.

**Recommendation 1**. Emphasize the priority of measured data for measure verification when available. Hard-coded values, if used, should indicate the source and include the corresponding source document as part of the project files. If additional/more recent trend data is collected, it should be used to update the estimated savings.

**Finding 2.** The evaluation team noticed multiple input errors in the project calculators (e.g., 20-0061, 21-0054, 22-0010, 20-0037, 20-0049, 19-0151, 22-0045). Some examples of the errors include incorrect motor horsepower, incorrect air handler schedule, incorrect fan power calculations, and incorrect/inconsistent boiler efficiency.

**Recommendation 2**. Enhance quality control procedures to reduce these errors.

**Finding 3.** For project 20-0036, the implemented mixed air temperature (MAT) setpoint and discharge air temperature (DAT) setpoint sequencing measures save cooling energy but also result in increased natural gas usage for certain air handling units. Through this project, the optimization sequence was implemented as a permanent change rather than a reset measure. As a result, although the implemented change reduced cooling load in the summer, it also resulted in increased heating loads in the winter as the change was not reset back to winter setpoints.

**Recommendation 3.** Provide training to highlight the difference between a reset and a change to ensure the appropriate optimization sequence is applied through the program.

**Finding 4.** For multiple projects (e.g., 19-0151, 22-0006, 22-0010), the evaluation team through verification activities found that the equipment that was modified for program measures is no longer in service. Program requirements under the RetroCommissioning program offerings stipulate that equipment must be installed and operational. The evaluation team did not verify any savings associated with the equipment that is no longer in service.

**Recommendation 4.** If the program is aware than equipment within the scope of the project is scheduled for near-term replacement, any savings resulting from operational modifications on that equipment should not be claimed as they will not persist following replacement. No-cost changes/measures are still encouraged because they provide immediate benefit to the participant, even though they may not qualify as eligible savings through the program.

**Finding 5.** For project ID 21-0054, the calculator did not use the most appropriate weather station based on proximity. The evaluation team updated the reference weather station selected in the calculator.

**Recommendation 5.** Increase training on the availability of weather stations in the standard calculator template and ensure uniform use of proximal datasets. In CY2024, additional weather stations will be included in the calculator, which will increase the alternatives available as “best reference” and the possibility of erroneous selections, making the increased training more valuable.

**Finding 6.** Through onsite inspections and phone interviews with building operators, the evaluation team noticed that some retrocommissioning measures (e.g., 20-0037, 20-0036) were deemed too aggressive by the operating engineers and undone to meet occupant comfort or other system setpoints. Examples of these measures include rooftop unit scheduling, and MAT and DAT setpoint resets and optimization.

**Recommendation 6.** Time should be allowed post implementation for facility operators to adjust to the measures for continued feasibility before the program finalizes the estimated project savings. If the recommended changes are identified to be too aggressive and compromise system operation or occupant comfort, the EESPs should readjust the measures before finalizing project savings. The additional time post implementation will allow the EESPs to find compromised solutions for implemented measures rather than the facility operators undoing the measure entirely.

##### Impact Analysis Methodology

###### Ex Ante Estimates

EESPs estimated ex ante energy savings with custom algorithms, frequently using hourly weather data and time-series trend data applied in engineering relationships of energy, temperature, and mass transfer. Alternatively, when data supported the method, EESPs determined savings by regressions of utility-metered energy use versus outdoor temperature and other independent variables. When energy efficiency measures had a climate-related component, service providers used standard weather datasets (typical meteorological year 3, or TMY3)[[4]](#footnote-5) for proximal locations to estimate weather-normalized savings.

###### Evaluation Methods

The evaluation team used a stratified random sampling approach to select the gross impact sample. In CY2023, the evaluation team reviewed 28 projects[[5]](#footnote-6) (38% of the total) and 499,866 therms (77% of the total claimed). The team sorted projects based on the level of ex ante kWh electric energy savings and presence or absence of natural gas savings, and then placed the projects into six strata. Within each stratum, the team selected a random sample of projects for analysis.

The evaluation team reviewed each sampled project and its measures individually to validate the savings, usually using the same methods as the ex ante estimate. Savings calculation reviews ensured the savings estimates were accurately modelled, used consistent inputs, and included reasonable assumptions, as required. In some cases, the team acquired additional trend data or interval meter data to verify savings with more data and data concurrent with expected savings (e.g., winter data for winter measures). In most cases, the impact evaluation involved analysis of time-series trend and measured data both pre- and post-implementation. In all cases, the evaluation team normalized savings estimates to TMY weather data to minimize the effects of atypical weather variation.

For a nested sample of projects (selected from projects sampled for engineering review), Guidehouse performed on-site inspections to determine whether implemented measures were still operating as described in project documentation (set points, affected equipment, hours of operation, etc.). For projects not selected for an on-site inspection, evaluators supplemented desk reviews with phone interviews with building operators and reviewed some BAS via remote connection or teleconferencing.

In cases where the evaluation team’s verified inputs were inconsistent with EESP reported data, such as setpoints or operational hours, the team re-estimated savings with available data, additional data requested from the participant or EESP, or program guideline inputs.

Table A‑1 provides a profile of the gross impact measurement and verification sample for the RetroCommissioning program compared to the population.

Table A‑1. 2023 RCx Program 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) |
| RetroCommissioning | Large | 7 | 0 | 6 | 0 | N/A |
| Large – Gas | 2 | 228,167 | 2 | 228,167 | 100% |
| Medium | 14 | 0 | 6 | 0 | N/A |
| Medium – Gas | 8 | 146,814 | 6 | 130,911 | 89% |
| Small | 38 | 0 | 6 | 0 | N/A |
| Small – Gas | 30 | 277,280 | 8 | 140,788 | 51% |
| Total or Weighted Average |  | 99 | 652,261 | 34 | 499,866 | 77% |

Note: The population and the sample summary represent all projects completed in CY2023 as per the ComEd tracking data, collaborated with the PG and NSG data. The table shows the gas sample disposition.

Source: Guidehouse evaluation team analysis

Savings Rollup

There are two basic statistical methods for combining individual gross RRs from the sample projects into an estimate of verified gross therms savings for the population when using stratified random sampling: separate and combined ratio estimation.[[6]](#footnote-7) In the case of a separate ratio estimator, a separate gross therms savings RR is calculated for each stratum and then combined. In the case of a combined ratio estimator, the evaluation completes a single gross therms savings RR calculation without first calculating separate gross RRs by stratum.

The evaluation team used the separate ratio estimation technique to estimate verified gross impacts for the program. The separate ratio estimation technique follows the steps outlined in the California Evaluation Framework,[[7]](#footnote-8) which identifies best practices in program evaluation. The team matched these steps to the stratified random sampling method it used to create the sample for the component.

##### Impact Analysis Supplemental Information

Table B‑1 provides the ex ante and verified gas saving for each stratum.

Table B‑1. 2023 RCx Program Gas Savings by Strata (All Projects)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Strata | Sample Size | Ex Ante Gross Savings (therms) | Verified Gross RR\* | Verified Gross Savings (therms) | NTG† | Verified Net Savings (therms) |
| Large | 6 | 0 | N/A | 0 | 0.98 | 0 |
| Large – Gas | 2 | 228,167 | 98% | 224,160 | 0.98 | 219,677 |
| Medium | 6 | 0 | N/A | 0 | 0.98 |  |
| Medium – Gas | 6 | 130,911 | 80% | 104,461 | 0.99 | 103,104 |
| Small | 6 | 0 | N/A | 1,156 | 0.98 | 1,133 |
| Small – Gas | 8 | 140,788 | 82% | 115,796 | 0.98 | 113,480 |
| **Total** **or Weighted Average** | **34** | **499,866** | **89%** | **445,573** | **0.98** | **437,394** |

\* 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 website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2023/>. The NTG ratio for eligible business customers in disadvantaged neighborhoods is set to 1.00 as per the “NTG Ratio for Disadvantaged Areas” policy.

Source: Guidehouse evaluation team analysis

Table B‑2 and Table B‑3 show the strata classification and ex ante and verified gas savings for all projects claimed by PGL and NSG in CY2023, respectively.

Table B‑2. 2023 RCx Program Gas Savings by Project (PGL Projects Only)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Project ID | Bundle # | Strata | Ex Ante Gross Savings (therms) | Verified Gross RR\* | Verified Gross Savings (therms) | NTG† | Verified Net Savings (therms) |
| 22-0010 | Bundle #12 | Large – Gas | 169,694 | 98% | 166,714 | 0.98 | 163,379 |
| 22-0010 | Bundle #10 | Medium – Gas | 34,422 | 80% | 27,467 | 0.98 | 26,918 |
| 22-0010 | Bundle #11 | Medium – Gas | 27,641 | 80% | 22,056 | 0.98 | 21,615 |
| 22-0010 | Bundle #8 | Small – Gas | 25,124 | 82% | 20,664 | 0.98 | 20,251 |
| 22-0021 | Bundle #2 | Small – Gas | 23,505 | 82% | 19,333 | 0.98 | 18,946 |
| 21-0047 | Bundle #1 | Small – Gas | 20,124 | 82% | 16,552 | 0.98 | 16,221 |
| 22-0005 | Bundle #2 | Medium – Gas | 15,900 | 80% | 12,687 | 0.98 | 12,434 |
| 22-0027 | Bundle #1 | Small – Gas | 14,730 | 82% | 12,115 | 0.98 | 11,873 |
| 20-0029 | Bundle #1 | Small – Gas | 11,613 | 82% | 9,552 | 1.00 | 9,552 |
| 21-0007 | Bundle #1 | Small – Gas | 6,361 | 82% | 5,232 | 0.98 | 5,127 |
| 21-0033 | Bundle #1 | Small – Gas | 4,421 | 82% | 3,636 | 0.98 | 3,563 |
| 22-0034 | Bundle #2 | Small – Gas | 2,499 | 82% | 2,055 | 0.98 | 2,014 |
| 17-119 | Bundle #5 | Small – Gas | 2,410 | 82% | 1,982 | 0.98 | 1,943 |
| 22-0027 | Bundle #2 | Small – Gas | 1,998 | 82% | 1,643 | 0.98 | 1,610 |
| 22-0028 | Bundle #1 | Small – Gas | 573 | 82% | 471 | 0.98 | 462 |
| 21-0037 | Bundle #1 | Small – Gas | 167 | 82% | 137 | 0.98 | 135 |
| 22-0034 | Bundle #1 | Medium – Gas | 3 | 80% | 2 | 0.98 | 2 |
| **Total or Weighted Average** | | | **361,185** | **89%** | **322,300** | **0.98** | **316,045** |

Note: Totals may not sum due to rounding.

\* 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 website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2023/>. The NTG ratio for eligible business customers in disadvantaged neighborhoods is set to 1.00 as per the “NTG Ratio for Disadvantaged Areas” policy.

Source: Guidehouse evaluation team analysis

Table B‑3. 2023 RCx Program Gas Savings by Project (Only NSG Projects)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Project ID | Bundle # | Strata | Ex Ante Gross Savings (therms) | Verified Gross RR\* | Verified Gross Savings (therms) | NTG† | Verified Net Savings (therms) |
| 21-0054 | Bundle #1 | Small – Gas | 4,558 | 113% | 5,156 | 0.98 | 5,053 |
| **Total or Weighted Average** | | | **4,558** | **113%** | **5,156** | **0.98** | **5,053** |

\* 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 website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2023/>.

Source: Guidehouse evaluation team analysis

Table B‑4 details the verified gas savings and RR of all sampled gas projects.

Table B‑4. 2023 RCx Program Gas Savings by Project (All Sampled Projects)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Project ID | Bundle # | Strata | Ex Ante Gross Savings (therms) | Verified Gross RR\* | Verified Gross Savings (therms) | NTG† | Verified Net Savings (therms) |
| 22-0010 | Bundle #12 | Large - Gas | 169,694 | 100% | 169,694 | 0.98 | 166,300 |
| 20-0061 | Bundle #2 | Large - Gas | 58,473 | 93% | 54,466 | 0.98 | 53,377 |
| 19-0151 | Bundle #1 | Small - Gas | 54,283 | 86% | 46,414 | 0.98 | 45,486 |
| 22-0010 | Bundle #10 | Medium - Gas | 34,422 | 0% | 0 | 0.98 | 0 |
| 22-0010 | Bundle #11 | Medium - Gas | 27,641 | 100% | 27,681 | 0.98 | 27,128 |
| 22-0010 | Bundle #8 | Small - Gas | 25,124 | 80% | 20,099 | 0.98 | 19,697 |
| 22-0025 | Bundle #1 | Medium - Gas | 22,425 | 100% | 22,425 | 0.98 | 21,977 |
| 21-0052 | Bundle #1 | Medium - Gas | 20,339 | 100% | 20,339 | 1.00 | 20,339 |
| 21-0047 | Bundle #1 | Small - Gas | 20,124 | 100% | 20,124 | 0.98 | 19,722 |
| 20-0036 | Bundle #8 | Small - Gas | 18,831 | 42% | 7,963 | 0.98 | 7,804 |
| 22-0014 | Bundle #1 | Medium - Gas | 17,746 | 100% | 17,746 | 0.98 | 17,391 |
| 22-0027 | Bundle #1 | Small - Gas | 14,730 | 88% | 12,902 | 0.98 | 12,644 |
| 22-0045 | Bundle #1 | Medium - Gas | 8,338 | 195% | 16,270 | 1.00 | 16,270 |
| 21-0054 | Bundle #1 | Small - Gas | 4,558 | 113% | 5,156 | 0.98 | 5,053 |
| 17-119 | Bundle #5 | Small - Gas | 2,410 | 100% | 2,410 | 0.98 | 2,362 |
| 22-0013 | Bundle #2 | Small - Gas | 728 | 100% | 728 | 0.98 | 713 |
| 22-0001 | Bundle #2 | Small | 0 | N/A | 1,156 | 0.98 | 1,133 |

Note: Participants can submit multiple bundles at different times during the year. Each project bundle submitted in CY2023 was counted as one project for impact evaluation sampling purposes.

\* 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 website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2023/>. The NTG ratio for eligible business customers in disadvantaged neighborhoods is set to 1.00 as per the “NTG Ratio for Disadvantaged Areas” policy.

Source: Guidehouse evaluation team analysis.

##### Program-Specific Inputs for the Illinois TRC

Table C‑1 and Table C‑2 show the 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 these tables 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. 2023 RCx Program Verified Cost-Effectiveness Inputs – PGL

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Program Path | Savings Category | Units | Quantity | Effective Useful Life | Ex Ante Gross Savings (therms) | Verified Gross Savings (therms) | Verified Net Savings (therms) |
| All Tracks | All Tracks | Projects | 16 | 8.6 | 349,572 | 312,749 | 306,494 |
| All Tracks | All Tracks – DAC | Projects | 1 | 8.6 | 11,613 | 9,552 | 9,552 |
| **Total or Weighted Average** | |  | **17** | **8.6** | **361,185** | **322,300** | **316,045** |

Note: Totals may not sum due to rounding.

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

Table C‑2. 2023 RCx Program Verified Cost-Effectiveness Inputs – NSG

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Program Path | Savings Category | Units | Quantity | Effective Useful Life | Ex Ante Gross Savings (therms) | Verified Gross Savings (therms) | Verified Net Savings (therms) |
| All Tracks | All Tracks | Projects | 1 | 8.6 | 4,558 | 5,156 | 5,053 |
| **Total or Weighted Average** | |  | **1** | **8.6** | **4,558** | **5,156** | **5,053** |

Source: North Shore Gas tracking data and Guidehouse evaluation team analysis.

1. Program participants can submit multiple bundles at different times during the year. Each project bundle submitted in CY2023 is counted as one project for impact evaluation sampling purposes. [↑](#footnote-ref-2)
2. https://www.ilsag.info/wp-content/uploads/PGL\_NSG-RetroCommissioning-2022-Impact-Evaluation-Report-2023-05-04-Final.pdf [↑](#footnote-ref-3)
3. Illinois Energy Efficiency Policy Manual Version 3.0, Section 7.4, available at <https://www.ilsag.info/policy/> [↑](#footnote-ref-4)
4. TMY3 were produced by the National Renewable Energy Laboratory’s Electric and Systems Center under the Solar Resource Characterization Project, which is funded and monitored by the U.S. Department of Energy’s Energy Efficiency and Renewable Energy Office. Source data for all 239 TMY3 locations draw on data from 1991 through 2005. [↑](#footnote-ref-5)
5. The evaluation team reviewed 34 individual sample points because the team randomly selected multiple bundles for four projects in CY2023. [↑](#footnote-ref-6)
6. A full discussion and comparison of separate vs. combined ratio estimation can be found in *Sampling Techniques* (Cochran, 1977), pp. 164-169. [↑](#footnote-ref-7)
7. Tec Market Works, *The California Evaluation Framework*, prepared for the California Energy Commission, June 2004, available at <http://www.calmac.org>. [↑](#footnote-ref-8)