resource innovations

Reimagining tomorrow with Nexant today

Income-Eligible Bill Impacts Analysis

Draft Report

Submitted to:

CLEAResult, in support of ComEd

Nicor Gas

Peoples Gas and North Shore Gas

Date: 6/16/2023

Submitted by Resource Innovations

Greg Sidorov, Senior Consultant

Danielle Kolp, Managing Consultant

Resource Innovations

719 Main Street

Half Moon Bay, CA, 94019, USA

resource-innovations.com

Contents

1. Executive Summary 1
   1.1. Research Objectives 1
   1.2. Key Findings 2
2. Methodology 4
   2.1. Data Collection 4
   2.2. Program Research and Interviews 4
      2.2.1. Income Eligible Program Research 4
      2.2.2. Direct Outreach 4
   2.3. Achieved Savings 5
      2.3.1. Electric Bill Savings 8
   2.4. Future Potential Savings 9
3. Bill Impacts Research Findings 11
   3.1. Bill Tracking and Communication 11
      3.1.1. Self-Guided Savings Analysis 12
      3.1.2. Bill Tracking and Communication Considerations 13
   3.2. Conclusions 14
4. Achieved Savings Results 15
   4.1. Utility Program Savings Results 15
      4.1.2. Nicor Gas 22
      4.1.3. Peoples Gas - North Shore Gas 27
   4.2. Aggregate Utility Savings Results 41
      4.2.1. Aggregate Gas Savings Analysis 41
5. TRM Savings Review and Comparison 48
   5.1. ComEd 48
   5.2. Nicor 50
   5.3. Peoples Gas - North Shore Gas 51

5.4. Program Benchmarking 52
6. Future Potential Savings Results 56
6.1. Single Family IHWAP 56
6.2. Chicago Bungalow Association 58
6.3. Additional Measures for Consideration 60
7. Conclusions and Recommendations 61
7.1. Key Findings 61
Appendix A Measures Enrolled by Program A-1

1. Executive Summary

Resource Innovations contracted with Commonwealth Edison (through CLEAResult and Illume), Nicor Gas, and Peoples' Gas / North Shore Gas to analyze the income-eligible single-family and multi-family weatherization programs offered in their service territories for program participation periods from 2018 through 2020.

Commonwealth Edison partners with Nicor Gas and Peoples/North Shore Gas utilities to provide electric and gas efficiency offerings to income-eligible customers through weatherization assistance programs. The programs are available to single- and multi-family households that meet certain eligibility requirements. Through these programs, customers receive free weatherization improvement and efficiency measures designed to lower their household energy bills. Resource Innovations examined the performance of these programs by measuring the energy and bill savings produced by the programs, as well as estimated future savings potential of the programs based on trends in participation and yearly savings achieved during the study period. The programs included in the study are listed below.

- Single Family Illinois Home Weatherization Assistance Program (IHWAP)
- Multi-Family Illinois Home Weatherization Assistance Program (IHWAP)
- Public Housing Energy Savings Program (PHES)
- Income-Eligible Multi-Family Savings Program (IEMS)
- Chicago Bungalow Association Retrofits Program (CBA)

A summary of measures offered by each utility program is shown in Appendix A.

1.1. Research Objectives

The study included a comprehensive assessment of bill impacts (electricity and natural gas) achieved by the existing income-eligible program offerings for single- and multi-family households, as well as an assessment of potential future bill impacts. In addition, the study performed research around best practices for tracking and communicating customers' energy consumption and bill savings. The primary research objectives included:

1. Determine achieved energy and bill savings attributable to program participation and estimate future bill savings potential of the programs.
2. Identify opportunities, challenges, and best practices for communicating bill savings to customers.

The objectives were pursued through billing consumption analysis and a combination of primary and secondary research.

1.2. Key Findings

Per customer energy and bill savings for each program are presented in Table 1-1.

Table 1-1: Summary of Program Savings, per Customer

Utility	Program	Energy Savings (kWh or Therm)			Bill Savings (USD)		
		Annual Savings	Error Bound*	Percent Savings	Annual Savings	Error Bound*	Percent Savings
ComEd	SF IHWAP	787 kWh	±111 kWh	9.5%	$107	±$15	9.6%
	MF IHWAP	822 kWh	±147 kWh	14.6%	$111	±$20	14.5%
	CBA	272 kWh	±76 kWh	3.1%	$37	±$10	3.1%
Nicor Gas	SF IHWAP	129 Therm	±12 Therm	11.5%	$117	±$13	17.5%
Peoples Gas / Northshore Gas	SF IHWAP	169 Therm	±24 Therm	16.7%	$84	±$24	8.3%
	IEMS	605 Therm	±362 Therm	6.4%	$481	±$278	7.4%
	CBA	112 Therm	±10 Therm	8.6%	$86	±$12	6.5%

*Error bound showing 90% confidence interval.

The key findings of the study include:

- Certain programs offered under each utility were not able to produce statistically significant savings results through billing analysis due to low participation and are thus excluded from this report.
- Programs with sufficient participation for analysis showed significant annual energy (kWh or Therms) savings among program participants.
- Programs with adequate participation also showed bill savings ($) for their participants; however, unlike energy savings, these results are subject to market forces (i.e., changes in electricity and gas rates) and, therefore, showed more variation year-to-year.
- In general, savings for these programs followed expected seasonal trends, where achieved savings were greatest during months of higher consumption.
- Estimated savings derived from billing analysis are 25% to 39% of the TRM-calculated savings values.
- Programs of this type, which predominantly offer bundles of low-cost, “as needed” weatherization measures, are difficult to increase savings without significant participation growth, greater customer recruitment, and/or expanded suite of high-impact measure offerings.
- Importantly, research and interviews conducted on outside jurisdictions overwhelmingly revealed that utilities do not communicate expected bill savings to customers as an enticement to enroll in efficiency programs, nor do they provide post-treatment bill impact reports due to a myriad of risk exposure reasons.

- One possible method to provide post-treatment bill savings information directly to customers, without the risk of individualized reports, is through online software designed to share energy usage information that can be provided with online accounts.

2. Methodology

The study methodology is described in the following sections.

2.1. Data Collection

Resource Innovations submitted a detailed data request to each of the utilities, including participation tracking records for each program, customer/household characteristics, monthly billed consumption histories, and any materials available related to program operations, eligibility, and past performance. All datasets were carefully reviewed and underwent a series of rigorous assessment and validation checks. Any anomalies, questionable, missing, or otherwise concerning data were reported to the providing utility and addressed as necessary.

One considerable challenge was the inconsistencies in datasets received from the three utilities. In order to examine bill savings holistically across utilities, as well as to allow for meaningful comparisons, it is important to apply consistent approaches to analyzing the data and estimating impacts. To do this requires that each dataset is structured similarly, includes the same key variables, and that comparable regression model specifications are applied to estimate savings. To that end, Resource Innovations employed identical data management techniques that resulted in uniform analysis datasets and allowed for consistent regression modeling across each utility and program.

2.2. Program Research and Interviews

Resource Innovations identified comparable jurisdictions with similar weatherization programs to assess best practices and identify lessons learned for tracking bill impacts and communicating them to customers. Research activities included a comprehensive review of program materials from several jurisdictions, as well as in-depth interviews with program administrators and staff.

2.2.1. Income Eligible Program Research

The Resource Innovations Team started by researching the existing income eligible programs implemented by ComEd, Nicor Gas, People's and Northshore Gas, Mass Save, NYSERDA, and DTE Energy. Through this research, the team was able to obtain an understanding of the major income eligible weatherization programs across those jurisdictions, and gained insights around the types of participants reached, number of projects completed, and total number of measures installed, among other topics. This research covered both single family and multi-family retrofits, as well as public housing retrofit programs.

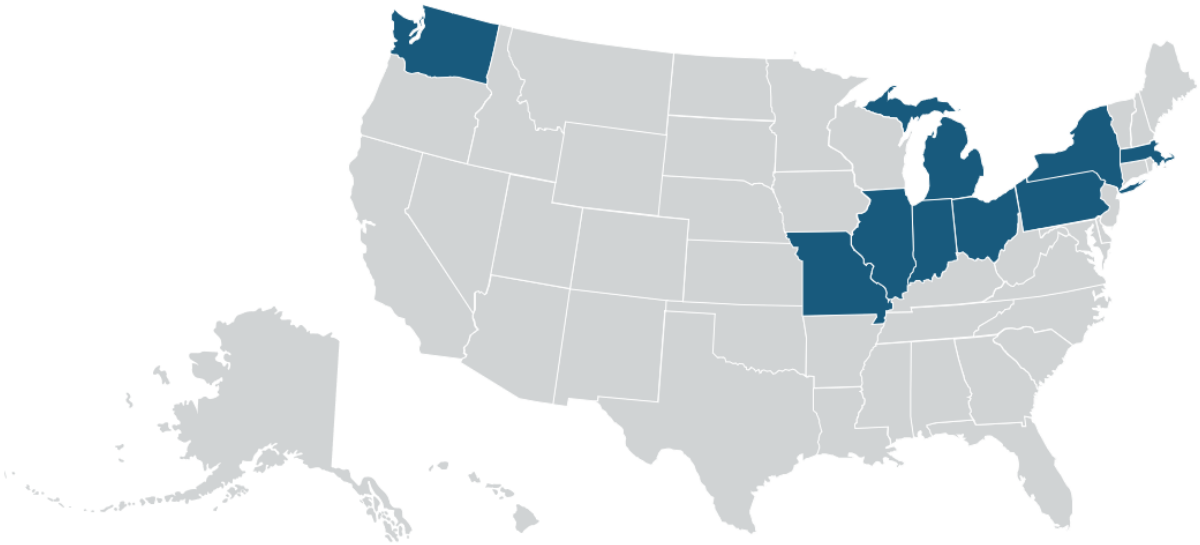
2.2.2. Direct Outreach

The next phase of research involved performing in-depth interviews with program staff. The Resource Innovations team conducted interviews and email correspondence with various utility companies. In

total, seven phone interviews were conducted with program staff covering ComEd, Nicor Gas, People's and Northshore Gas, CenterPoint, PECO Energy Company, and Puget Sound Energy (PSE), as well as emails with Ameren. The purpose of these interviews was to gather knowledge about program implementation and operations, measures offered, sectors served, and partnerships between the gas and electric utilities, and to collect detailed insights related to tracking impacts, customer communication, and successes and challenges with program administration. Specifically, the interviews targeted information about the customer experience with the programs, methods for communications related to expected and/or achieved bill impacts, and the overall effects of such communications.

The map below shows a visual of all the states we were able to reach through the various research components. States colored in blue are represented in this research.

Figure 2-1: Map of States Researched



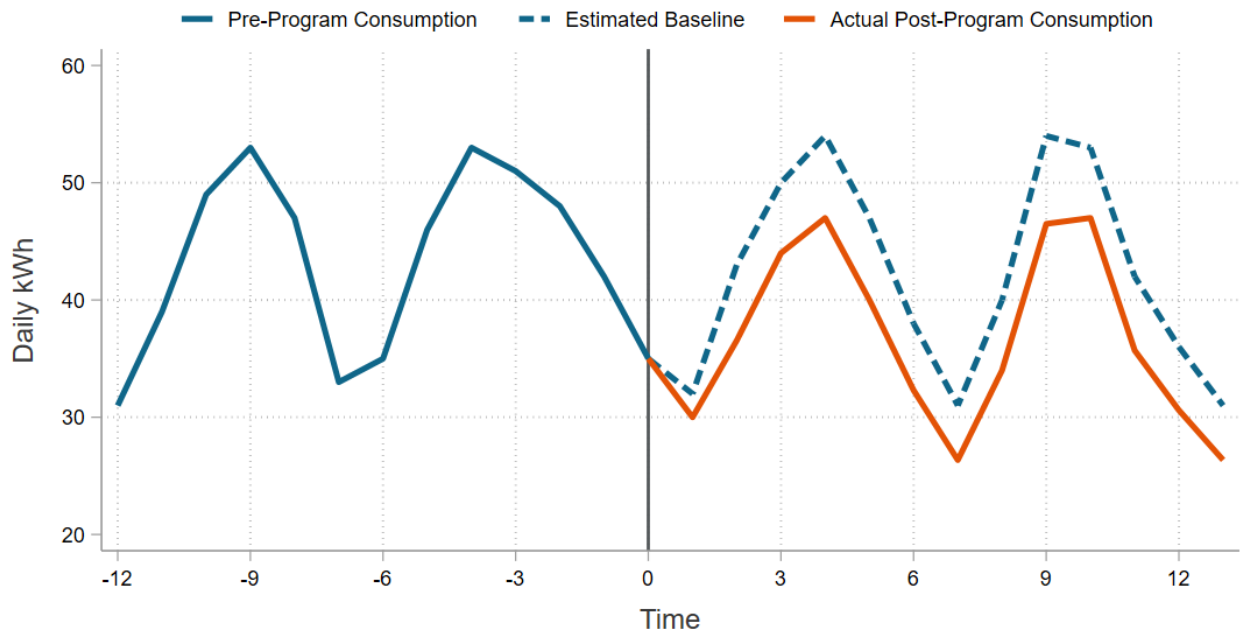
2.3. Achieved Savings

One of the primary outcomes of the study is the estimated achieved energy savings (kWh or Therms) and bill savings ($) resulting from participation in income-eligible program(s). The analysis methodology, commonly referred to as billing analysis, was identical for both energy and bill savings analyses, and utilizes the monthly energy consumption and billed dollar amounts for all program participants during the period 2018-2021. The approach compares household usage and bill amount trends before and after enactment of the program measures. The primary data inputs used in billing analysis are monthly energy (electricity or natural gas) usage and billed dollar amounts for each participant. Savings are estimated by comparing the monthly weather-normalized bills prior to participation in the program (i.e., the "pre" period) to the monthly bills after joining the program (i.e.,

the “post” period). In order to accurately measure the baseline, or what bills would have been absent the program, Resource Innovations requested billing data going back at least one full year prior to the earliest possible participation date and extending through at least one complete year after enrollment. It is important that customer billing data span at least one complete year before and after implementation of the measure(s) in order to capture any seasonal patterns in household consumption and/or savings.

Figure 2-2 depicts the general design of the analysis approach. The approach involves using customers’ monthly billing histories during the pre-intervention period (shown by the solid blue line in Figure 2-2), combined with observed weather data during the period, to model the baseline bills during the post-intervention period (represented by the dashed blue line). Observed weather data from NOAA were obtained and merged with the customer usage data. To do this, monthly billed usage data were calendarized such that weather variables could be matched by calendar month. The estimated baseline, or what would have happened absent the program, is used to compare against the actual post period data (shown by the solid orange line). Savings are calculated simply as the difference between the estimated baseline and the actuals during the post-intervention period.

Figure 2-2: Pre-Post Billing Analysis Example



Importantly, home improvement and weatherization programs often involve a wide array of measures and combinations of measures designed to save energy and reduce customers’ utility bills. Given the range of interventions offered, and the frequency with which they are combined, it can be difficult to determine the energy savings attributable to any one single measure via billing analysis. To do so requires adequate numbers of participants who implement a single measure, without implementing

any others. Resource Innovations determined it was not possible to reliably estimate savings at the measure-level for any offerings within each program.

Instead, savings are estimated at the meter, or household, level and represent the aggregate savings achieved across the full suite of individual measures installed. One benefit of this is that savings are holistic, based on empirical data, and provide a more accurate representation of program performance compared to engineering or TRM-calculated savings estimates, which are often at the measure level. The drawback is that it is difficult to perform a meaningful comparison of RI's estimated savings to TRM-calculated savings. Savings estimates resulting from billing analysis may be very different than those calculated via TRM algorithms for multiple reasons, including:

- TRM-calculated savings necessarily rely on assumptions that uniformly define key attributes about the customers/premises, efficiency measure being implemented, baseline scenario, etc. that may not accurately characterize the entire population being studied.
- Consumption patterns reflected in billing data are subject to outside forces, such as weather, commodity unit prices, market conditions, lifestyle changes, etc. that cannot be captured by TRM-based methods.
- TRMs provide a foundational basis for measure-level savings; however, in scenarios where multiple measures are implemented together, certain measures may trigger reciprocal or counteractive effects on one another, which may empirically diminish the savings attributable to any one particular measure, compared to its TRM-calculated savings. For example, installing efficient lighting measures reduces heat emissions and may lead to increased heating requirements and/or decreased cooling requirements.

When estimating savings using billing analysis, there are a few potential challenges that may come into play. First, program participation histories must be complete, substantial, and steady over the study period in order to have adequate sample. With fewer customers available for analysis, the degree of uncertainty surrounding the results grows larger. Second, the program(s) and/or offerings being analyzed must produce large enough savings, relative to baseline consumption, in order for the analysis to reliably detect them. If the expected savings are small, it can be difficult for the analysis to differentiate program-related changes in consumption from the inherent "noise" in the data. Third, depending on characteristics of the program population and/or the accessibility of non-program data, a valid control group is often difficult to identify and may not be available. Absent a control group, the analysis is inherently subject to biases stemming from exogenous factors that can influence consumption patterns among the program's participant population. This is particularly relevant when considering changes to market commodity prices. Consumers' energy usage trends - and associated savings - are heavily influenced by commodity prices, which varied significantly from year to year during the study period. Fourth, it is possible that participants of these programs may have multiple measure installations that are separated by significant periods of time, effectively resulting in multiple "post period" start dates. For purposes of evaluating savings at the program-level, this compromises the ability to define the implementation date for these customers, and can produce faulty pre/post period definitions.

Table 2-1: Analysis Challenges and Solutions

Challenge	Solution(s)
Inadequate participation	Only programs/measures/segments having adequate sample sizes can be reliably analyzed. Savings for programs/measures/segments with small numbers can still be reported, but will carry wide confidence bands. This was the primary challenge encountered in this study.
Small expected savings	Specific programs having very small savings cannot be analyzed independently using monthly billing data. This did not come into play during the course of this study, as all programs with adequate participation achieved large enough and statistically significant savings estimates.
Bias from lack of control group	Absent a valid control group for this study, Resource Innovations applied a weather-normalized pre-post analysis methodology.
Customers with multiple enrollments	For customers who implemented multiple measures separated by more than one month, Resource Innovations will use the earliest implementation date to define the post period.

2.3.1. Electric Bill Savings

ComEd's electric customers can elect to have their energy provided by Alternative Retail Electric Suppliers (ARES). Customers who select ARES are subject to different energy pricing than ComEd's standard rate. As of May 2022, 64 unique residential ARES offers were available in the ComEd service territory and approximately 867,000 ComEd customers (20%) were with an ARES.[1] However, at the time of RI's study, customer information identifying accounts on ARES was not available and, as such, the study was unable to determine which, or how many, program participants were on ARES during the study period. As a result, the true, customer-facing billed dollar amounts were not available.

Unable to identify which customers were on ARES, or which ARES supplier, RI applied information supplied by the Illinois Office of Retail Marketing Development (ORMD) Section 20-110 report, which states that *"As of May 2022, the number of ARES residential customers in the ComEd territory…comprises 20% of the total ComEd residential market."* In addition, the ORMD report provided average rate increases for customers who participated in ARES, shown in Table 2-2.

Table 2-2: Average ARES Rates for ComEd Customers

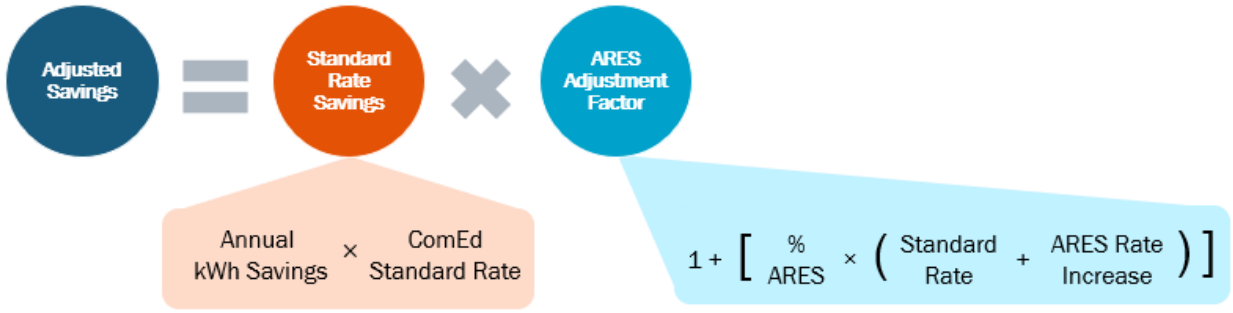
	ComEd Standard	ARES (Low)	ARES (Medium)	ARES (High)
Supply + Transmission ($/kWh)	$0.0749	$0.0820	$0.0915	$0.1190

[1] ORMD, IL Commerce Commission (July 2022), *Annual Report to the Illinois Commerce Commission, the General Assembly, and the Governor*

Other ($/kWh)	$0.0472	$0.0472	$0.0472	$0.0472
Est. Tax ($/kWh)	$0.0100	$0.0100	$0.0100	$0.0100
Total ($/kWh)	**$0.1321**	**$0.1392**	**$0.1487**	**$0.1762**

In order to estimate bill savings for participating customers, RI applied two approaches. First, an ARES adjustment factor was calculated and applied to the average annual energy (kWh) savings found by the energy savings analysis results described above. This top-down approach resulted in a single, per customer annual dollar savings value. Figure 2-3**Error! Reference source not found.** shows the calculation used for the ARES adjustment factor.

Figure 2-3: ARES Adjustment Factor Calculation



The second approach involved randomly selecting 20% of program participants and assigning them to the medium ARES electricity rates, while the remaining 80% of participants were assumed to be on the ComEd standard rate. This second, bottom-up approach allowed for a monthly savings analysis, similar to what was performed in the energy savings analysis, and provides a more granular look at how savings are achieved over the course of the calendar year.

2.4. Future Potential Savings

In addition to estimating the energy and bill savings achieved by the programs, Resource Innovations estimated future potential savings attainable by the programs, based on the savings estimates found by the achieved savings analysis described above.

In order to forecast estimated future savings for these programs, RI used the historical annual enrollment counts for each program, as well as the yearly savings estimates determined by the achieved savings analysis, and applied a three-year rolling average to estimate future participation and per customers savings for the next five years of program performance.

Resource Innovations conducted a broad assessment of the measures offered through the programs included in this study with an aim to identify any glaring omissions and/or additional measures for

consideration. RI determined that collectively, these programs offer an extensive list of measure types that are well-suited for the target populations and appropriately focused on the program objectives. In addition, measures implemented through these programs are identified and recommended to participating customers based on the needs of their home or premise, rather than selected by the participant. A comparison of current program offerings to the IL TRM (v11) and RI's cultivated measure library identified a list of additional measures for consideration by the utilities (Section 6.3). However, for purposes of estimating future savings forecasts, the study assumes that programs maintain their existing measure offerings and implementation modes.

3. Bill Impacts Research Findings

As part of the Income Eligible Energy Efficiency Bill Impacts Analysis project, Resource Innovations performed a literature review and series of interviews to obtain an understanding of methodologies, successes, and challenges regarding tracking and communicating bill savings to customers. The following are the key findings from this activity:

- No utilities in the RI team's review or experience are tracking actual bill impacts post-participation, and thus are not communicating them to customers
- None of the interviewed utilities are communicating estimated bill impacts prior to program participation for single family customers or multi-family tenants
- Two of the utilities interviewed are communicating *potential* bill impacts to multi-family building owners, not tenants, and only for larger system upgrades as part of the ROI discussion

3.1. Bill Tracking and Communication

This section outlines insights into the tracking and communication of bill savings, both expected and achieved, for weatherization programs. Expected bill savings are driven by energy savings estimations, which are done by the interviewed utilities in two ways: measure specific savings using regional TRM-calculated savings, or a 12-month pre/post billing analysis[2]. Of the interviewed utilities, expected bill impacts are rarely communicated to single-family customers or multi-family tenants, but are sometimes used as a tool to secure participation from multi-family building owners.

Despite these expected energy savings estimates being calculated for internal program reporting, all program staff interviewed mentioned that communicating the expected energy or bill savings directly with participating customers must be done with caution, if at all. All interviewees expressed the need to manage customer expectations, and acknowledged that promising specific savings to customers that do not align with actual savings can lead to customer dissatisfaction. Several unknown factors, such as customer behaviors, home occupancy, and fuel prices, can change year to year, leading to significant changes in energy consumption that are not related to the program. Put simply, communicating customer-specific expected savings to participants exposes the program's provider(s) to animosity, confusion, or dissatisfaction from discontented customers who do not meet the savings expectations.

For single-family homes, for example, saving estimates are not generally communicated with customers as this would require a tailored approach for each customer that would be costly and time intensive. The program staff also mentioned that there may be equity issues should customers compare the measure received with their neighbors who may not have qualified. However, some

[2] Individual dwelling level calibrated energy modeling is a possible third method, but none of the interviewed utilities utilize this method because it is too costly and time prohibititive.

programs use average expected savings values as part of their marketing (e.g., save up to 30% by taking advantage of our program!).

For multi-family building managers, some programs provide a customer report outlining savings estimates based on the TRM. This customer report tends to be provided to help building owners decide whether to participate in the program by outlining the savings values attached to each measure available (e.g., if you change your boiler, these savings can be attributed). Though some measures are offered at no-cost, many projects require a portion of payment from the building manager, and thus providing the financial potential pay-back period is an important program design element to ensure participation.

While program bill savings are sometimes estimated prior to participation, it was unanimous across all interviewees that utility companies are not tracking *actual* bill savings through their programs after participation. As a result, actual bill savings are not communicated with customers after participating in these income eligible programs. Jurisdictions felt that providing that level of information opened them up to an unacceptable amount of risk, reasons including but not limited to:

- **Equity**: Some customers may qualify for measures that their neighbors do not qualify for, and as a result receive different savings. The utility companies want to avoid comparisons between customer homes that may not understand reasoning for different measures received.
- **Changes in Usage**: The concern with changes in usage is twofold. First, if occupancy in homes changes, energy usage will inevitably change as well. Second, as customers get more efficient measures installed, they may feel as though they can increase their usage of a measure, such as turning up the heat now that the home is better weatherized. These changes in pre- and post-usage patterns may lead to lower bill savings than expected.
- **Weather**: Unseasonal or extreme temperature fluctuations may cause heating or cooling equipment to run for longer than in pre-treatment periods, and thus impact actual bill savings.
- **Price Changes**: Electricity or natural gas rates may change from when the measures were initially installed. This could produce a situation where the actual energy consumption in a home is indeed reduced after program treatment, but increased energy prices act to make the annual bills larger than before treatment.
- **Education Barriers**: Customers may not understand that expected dollar savings are only an estimate and actual savings vary based on a myriad of factors, such as those described above.

3.1.1. Self-Guided Savings Analysis

Self-guided energy savings analysis tools, bill analysis tools, and other online audit tools are often available to customers through their utility websites. The home audit tools include features that allow customers to input what measures they have installed and get tips on how to save energy based on those measures. Bill analysis tools allow customers to see where their average energy consumption

falls currently, as well as over various time periods: hourly, daily, weekly, and monthly, year over year. This allows customers to see trended energy usage and how it impacts their energy bills. Though these services are widely available, income eligible weatherization programs did not point customers to these tools for doing their own analysis. One respondent noted the challenge for customers who do not have internet access.

In addition, some utility-sponsored programs, such as Home Energy Report (HER) programs, instrinsically involve communicating with customers about their usage habits. However, HER programs have different objectives, targeting behavioral-based energy savings, and are different in nature than the programs covered by this study.

3.1.2. Bill Tracking and Communication Considerations

To synthesize the different potential methodologies for tracking energy and bill savings, as well as the specific considerations for communicating those to residential customers, the following table summarizes these findings.

Table 3-1: Energy and Bill Tracking, and Communications Considerations

Savings Tracking Method	Considerations
TRM-Based Deemed Savings	• Provides consistent savings values adopted for a given jurisdiction. • Additive measure savings likely overstate whole home savings because interactive effects and some site specific information is not taken into account.
Whole Home Billing Analysis	• If sufficient participation is available, a pre/post billing analysis can provide more accurate results that take into account interactive effects. • Accounts for customers' responsiveness to changes in weather and market conditions.
Calibrated Energy Modeling	• Able to provide robust per home savings. • Cost is extremely expensive.
Bill Tracking Method	**Considerations**
Pre/Post Treatment Comparison	• Customer bills should be examined in the same number of months and seasons. • Changes in per unit energy costs (kWh or Therms) as well as non-energy charges should be taken into account.
Self-Guided Comparison	• Customer bills should be examined in the same number of months and seasons. • Changes in per unit energy costs (kWh or Therms) as well as non-energy charges should be taken into account.
Communicaton Method	**Considerations**
Pre-Treatment Savings Expectation	• Set the expectation that homes, occupancy, weather, and treatment measures are different and will yield different savings.

	• Providing a conservative average percentage of savings for residential dwelling may be reasonable to attract participation, but assurances should not be given. • Multi-family building managers can likely be given more custom energy or dollars savings if estimates are tailored to the building.
Post-Treatment Individual Report	• A program may wish to create a per-home comparison of bill cost before and after weatherization program participation (via web or paper mail), but important caveats should be given about weather variation, energy unit cost, non-energy bill costs, occupancy, and other factors. • Providing both web and paper reports will allow greater access for disadvantaged communities.
Post-Treatment Self-Guided Assistance	• A program can provide guidance to customers on how to use available online bill analysis tools, and provide assistance on how best to make a comparison from a pre- and post-treatment time period taking into account external factors like occupancy, weather, and energy and non-energy costs.

3.2. Conclusions

Though the study set out to determine the best methods to track and communicate bill savings to customers, the researched jurisdictions unanimously confirmed that they do not track bill impacts at the customer level outside of a study. Furthermore, the potential risk of confused or dissatisfied customers with expected or realized savings provided ample reason to dissuade utilities from considering such a practice.

Given these findings, Resource Innovations suggests the following considerations for addressing bill impacts:

Point customers to online bill analysis tools: To provide customers with the ability to quantify their own usage pre- and post-weatherization treatment, consider pointing customers who have internet access to online analytical tools offered through their utility. This will allow customers to have a better understanding of their energy usage, money spent on energy, as well as any savings. When encouraging the use of online bill analysis tools however, it is important to temper customer expectations as these tools show actual energy consumption, and that there may be many other factors influencing their savings after a home weatherization treatment besides the project itself (such as changing number of occupants, weather, price shifting, etc). Consideration should be given to those customers who might not have consistent internet access.

Provide an estimate report of bill savings to multi-family customers: For multi-family buildings, providing an estimate of energy and bill savings seems to help building owners decide whether they want to participate in the program. If it is emphasized that these are *estimates only*, providing the estimate report seems to be an accepted method across utilities to drive participation in their programs that may be applied in the single-family sector.

4. Achieved Savings Results

Resource Innovations implemented the analysis methodology described in Section 2.3 separately for each utility and program, and combined programs and/or utility data where suitable to get a more holistic picture of utility bill savings across ComEd's territory. However, many of the results needed to be omitted because they are not statistically significant, driven primarily by low participation counts at the program level. Table 4-1-1 identifies the program analyses that achieved statistical significance (✓) at the 90% confidence level. Programs that did not achieve significance (✘) are deemed unreliable and therefore results are not included in this report. As such, all results presented in this report are statistically significant at 90% confidence.

Table 4-1: Programs with Statistical Significance

Program	ComEd	Nicor Gas	PG-NSG
Single Family IHWAP	✓	✓	✓
Multi-Family IHWAP	✓	✘	✘
Income-Eligible Multi-Family Savings	✘	--	✓
Public Housing Energy Savings	✘	✘	✘
Chicago Bungalow Association	✓	--	✓

The remainder of Section 4 presents the results of the utility bill savings analyses.

4.1. Utility Program Savings Results

One of the primary study objectives was to assess the performance of these programs, in terms of both energy (kWh or Therm) and bill ($) savings, among those who participated during the period 2018-2021. To achieve this objective, Resource Innovations applied regression modeling to estimate the average change in energy usage and utility bill amounts resulting from program participation. The approach involves comparing customers' monthly utility bills prior to joining the program (the "pre" period) to their bills after joining the program (the "post" period). The models are weather-normalized to account for any changes in usage that occur in response to weather conditions. The models used are consistent for both energy and bill savings estimates, and across the utility program providers.

Savings are estimated at the annual and monthly levels. The benefit of the monthly analysis is that it provides a more detailed look at seasonal trends in savings. The potential drawback to a monthly analysis is that each month's estimate is based on a limited portion of the data, which can result in wider margins of error and less precise estimates.

ComEd provided ample data for three programs that yielded reliable savings estimates: SF IHWAP, MF IHWAP, and CBA. Two of ComEd's programs, IEMS and PHES, did not have adequate participation

over the study period to produce statistically valid savings estimates. Table 4-2 presents average household annual energy and dollar savings, as well as the associated percent savings values, for the programs analyzed.

Table 4-2: Summary of ComEd Program Savings per Household

Program	Avg. Annual kWh Savings	Avg. Percent kWh Savings	Avg. Annual USD Savings	Avg. Percent USD Savings
SF IHWAP	787 kWh	9.5%	$107	9.6%
MF IHWAP	822 kWh	14.6%	$111	14.5%
CBA	272 kWh	3.1%	$37	3.1%

4.1.1.1. Electric Savings

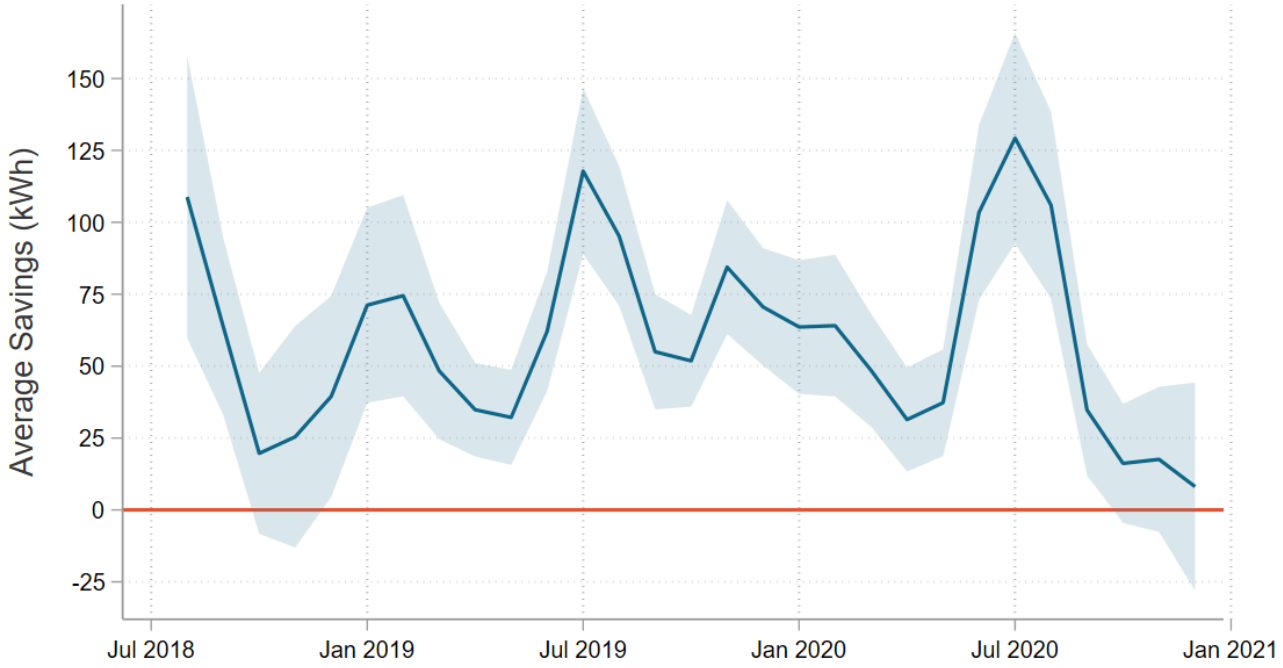
4.1.1.1.1. Single-Family IHWAP

The Single-Family IHWAP program generates average household-level savings of 787 kWh per year, representing 9.5% annual electric savings among program participants.

Figure 4-1 displays the estimated monthly kWh savings for the period August 2018 through December 2020. The shaded area around the dark blue line represents the 90% confidence bounds for each month's savings estimate. Months whose confidence bounds do not include zero are considered statistically significant.

The key takeaway is that the SF IHWAP program consistently generates positive electric savings in all months of the year. Savings tend to be largest during the summer months, when cooling needs are greatest. Only five months (October 2019, November 2019, October 2020, November 2020, and December 2020) are not statistically significant.

Figure 4-1: SF IHWAP Monthly Electric Savings

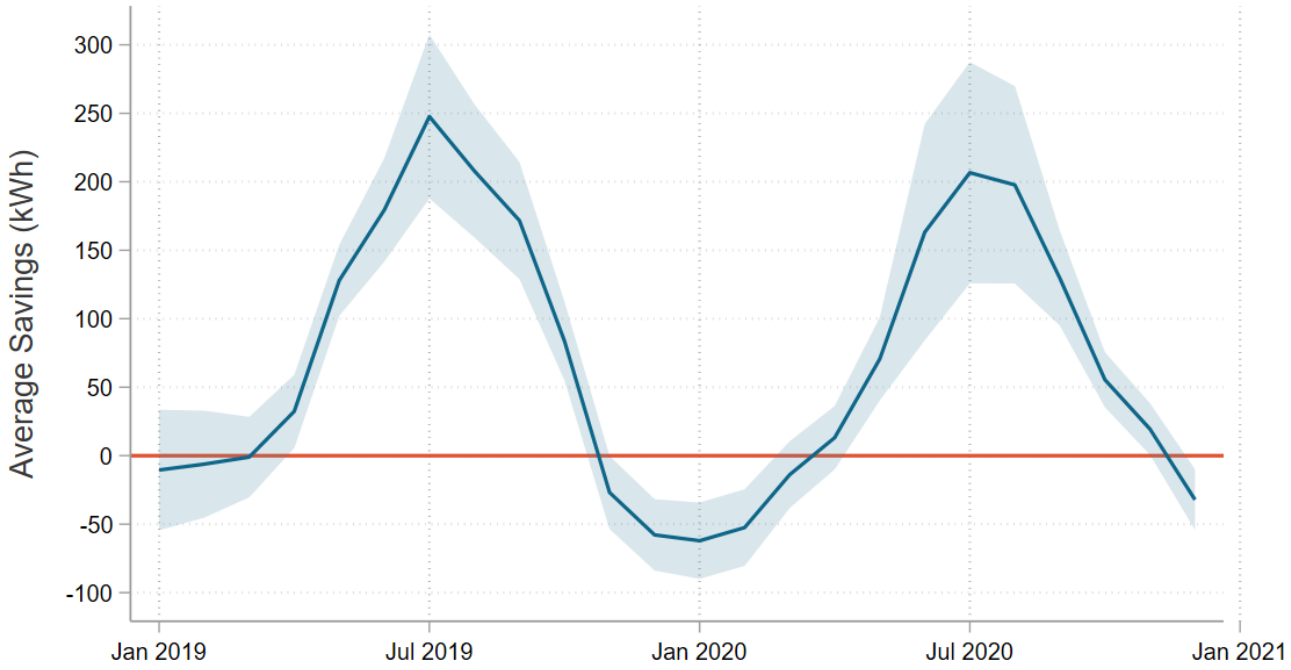


4.1.1.1.2. Multi-Family IHWAP

The Multi-Family IHWAP program generates average household-level savings of 822 kWh per year, representing 14.6% annual electric savings among program participants (Table 4-2).

The monthly results exhibit a seasonal trend, where savings tend to be the largest during the summer months, when cooling needs are high and electric consumption is greatest. Notably, the monthly results indicate negative savings (i.e., increase in consumption) during winter months. Absent other factors, efficiency measures installed through the program should never lead to increases in energy consumption. In this case, the winter increases are likely explained by the mix of the more prevalent electric-saving measures installed through the program, as well as the assumed makeup of the participant population (i.e., customers with gas heat). The measures that generate the most impactful electric savings (e.g., space cooling and building envelope measures) tend to perform better during the summer months and are largely dormant during the winter season. In other words, any significant changes in electric consumption during the winter months are likely not related to the program.

Figure 4-2: MF IHWAP Monthly Electric Savings

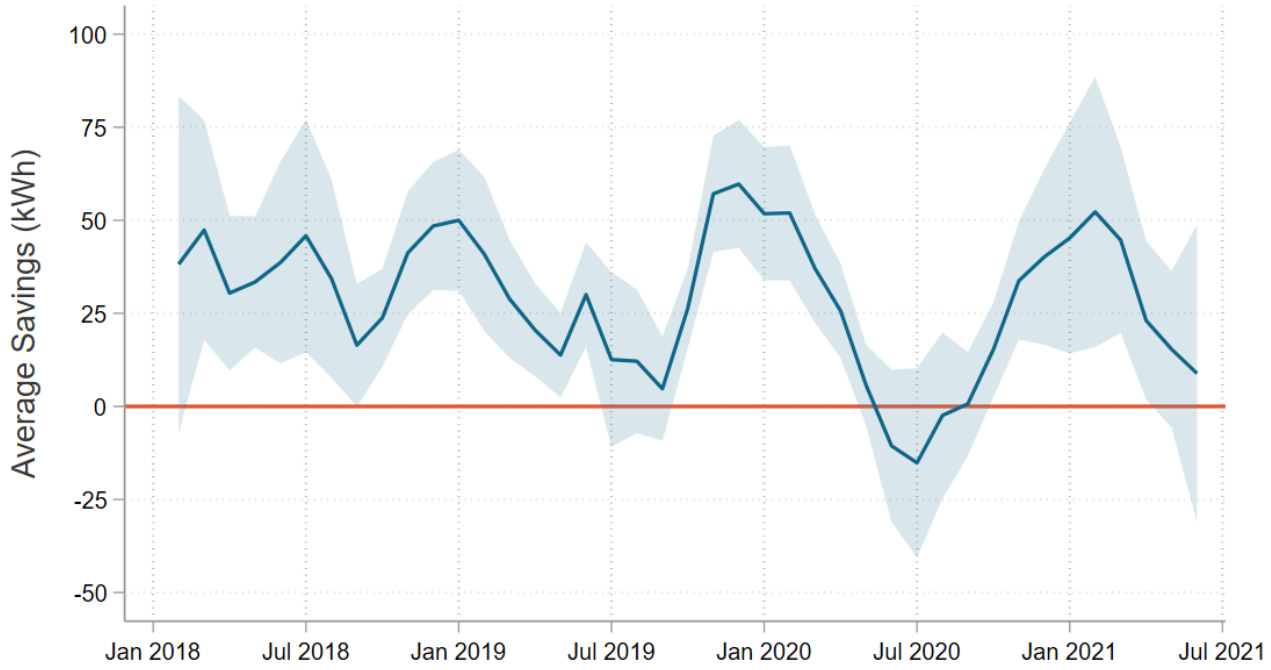


4.1.1.1.3. Chicago Bungalow Association

The Chicago Bungalow Association program generates average household-level savings of 272 kWh per year, representing 3.1% annual electric savings among program participants (Table 4-2).

The monthly results show that the CBA program consistently generated positive, statistically significant savings in most months during the study period. Certain months showing low or negative savings are not statistically significant.

Figure 4-3: CBA Program Monthly Electric Savings



4.1.1.2. Billed Dollars Savings

Using this first approach described in Section 2.3.1, bill savings were estimated for the low, medium, and high ARES scenarios, which are based on the average rate increases for customers on ARES suppliers throughout ComEd's territory. **Error! Reference source not found.** presents estimated bill savings for the low, medium, and high scenarios. On average, customers participating in the SF IHWAP, MF IHWAP, and CBA programs savings $107, $111, and $37 per year, respectively.

Table 4-3: ComEd Program Bill Savings Approach 1

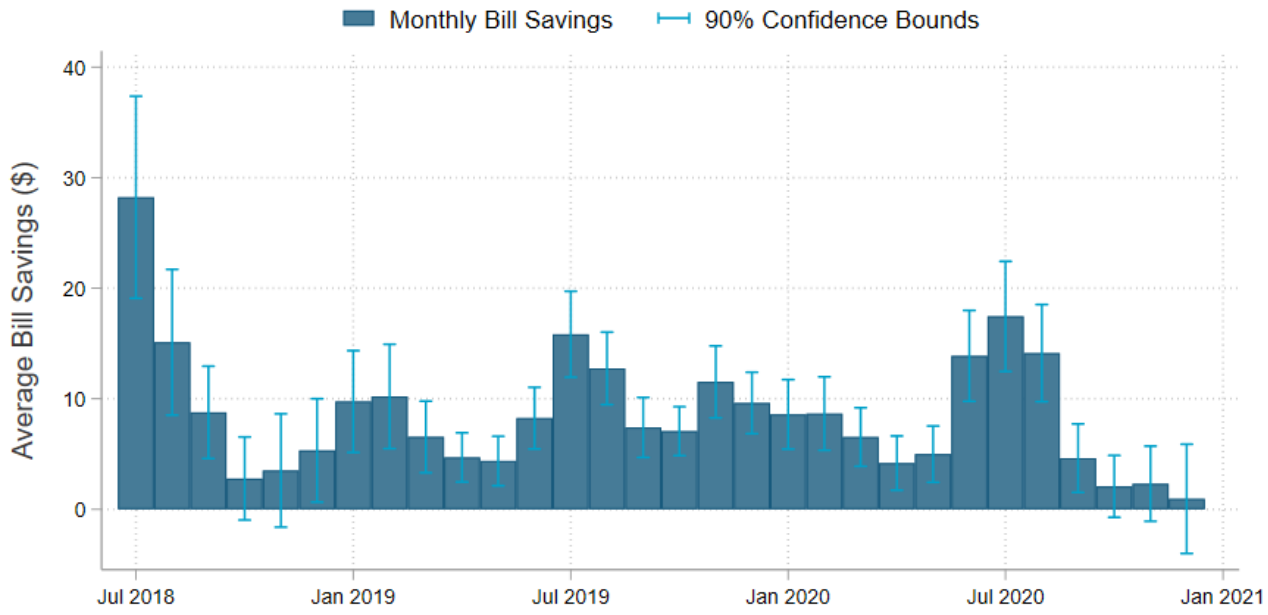
ComEd Program	Annual kWh Savings	% ARES	Standard Rate	ARES Rate ↑ (Low)	ARES Rate ↑ (Medium)	ARES Rate ↑ (High)	ARES Adjustment Factor	Standard $ Savings	Adjusted $ Savings (Low)	Adjusted $ Savings (Medium)	Adjusted $ Savings (High)
SF IHWAP	787 kWh	20%	0.1321	0.0071	0.0166	0.0441	1.0297	$103.96	**$106.86**	**$107.05**	**$107.63**
MF IHWAP	822 kWh	20%	0.1321	0.0071	0.0166	0.0441	1.0297	$108.59	**$111.61**	**$111.82**	**$112.41**
CBA	272 kWh	20%	0.1321	0.0071	0.0166	0.0441	1.0297	$35.93	**$36.93**	**$37.00**	**$37.20**

The remainder of this section presents results of the bill savings analysis using Approach 2 described in Section 2.3.1.

4.1.1.2.1. Single-Family IHWAP

The Single-Family IHWAP program achieves consistent savings throughout the year, with the greatest savings achieved during the summer months, when cooling consumption is highest. Figure 4-4 shows monthly bill savings achieved by customers participating in the SF IHWAP program. Only four of the months presented in Figure 4-4 are not statistically significant.

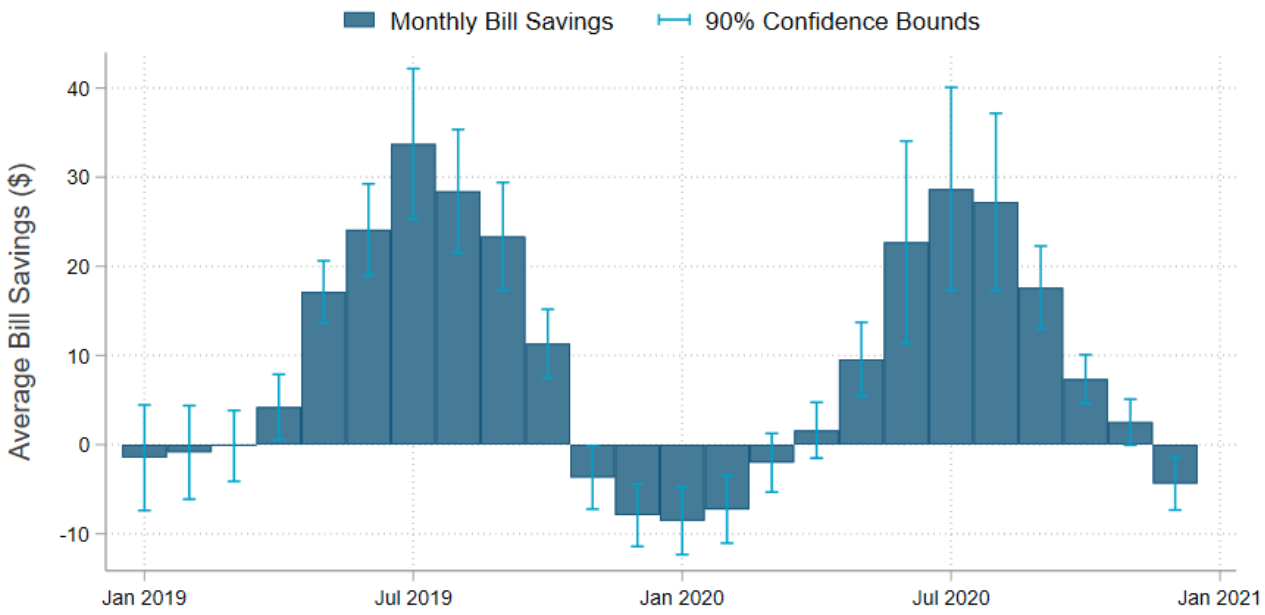
Figure 4-4: SF IHWAP Monthly Bill Savings



4.1.1.2.2. Multi-Family IHWAP

The Multi-Family IHWAP program also showed large summer savings, when space cooling needs are greatest. Savings during the winter heating months were negligible or negative, as shown in Figure 4-5 below. Similar to the electric savings results summarized in Section 4.1.1.1.2, the monthly bill savings estimates indicate mild bill increases during some of the winter months. This again is likely due to the seasonal nature of the electric-specific measures.

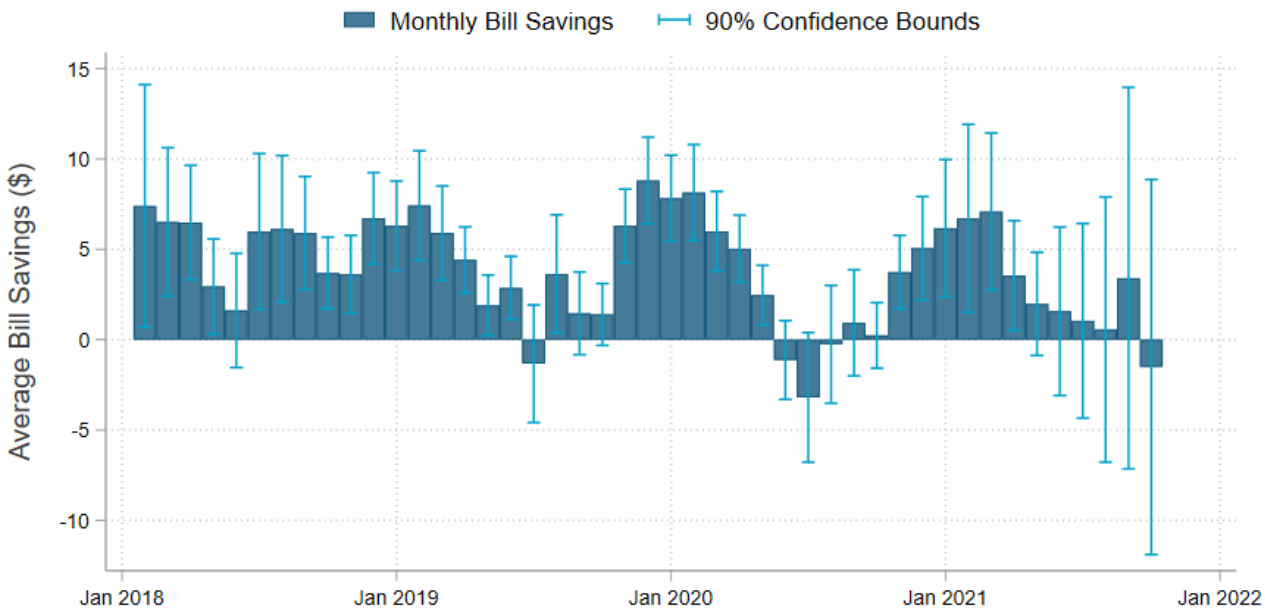
Figure 4-5: MF IHWAP Monthly Bill Savings



4.1.1.2.3. Chicago Bungalow Association

The Chicago Bungalow Association program achieves positive bill savings for its customers throughout a majority of the study period. The monthly results show certain months that estimated bill increases; however, due to the limited data and/or inherent variability contained in those data, none of these months are statistically significant, as depicted by the confidence bounds in Figure 4-6.

Figure 4-6: CBA Monthly Bill Savings



4.1.2. Nicor Gas

Of the three income-eligible programs offered by Nicor Gas, only the Single-Family IHWAP generated reliable savings results. The other Nicor Gas programs, Multi-Family IHWAP and PHES, did not have adequate participation over the study period to produce usable results. A summary of Nicor program results is given in Table 4-4.

Table 4-4: Summary of Nicor Gas Program Savings

Program	Avg. Annual Gas Savings	Avg. Percent Gas Savings	Avg. Annual USD Savings	Avg. Percent USD Savings
SF IHWAP	129 Therm	11.5%	$117.12	17.5%

4.1.2.1. Gas Savings

An analysis of energy savings showed a monthly trend that correlates with expected gas consumption. Average gas savings among program participants is largest during the winter months when gas consumption is expected to be higher due to increased heating loads. Segmentation by participation year shows relatively consistent therm savings, regardless of participation date.

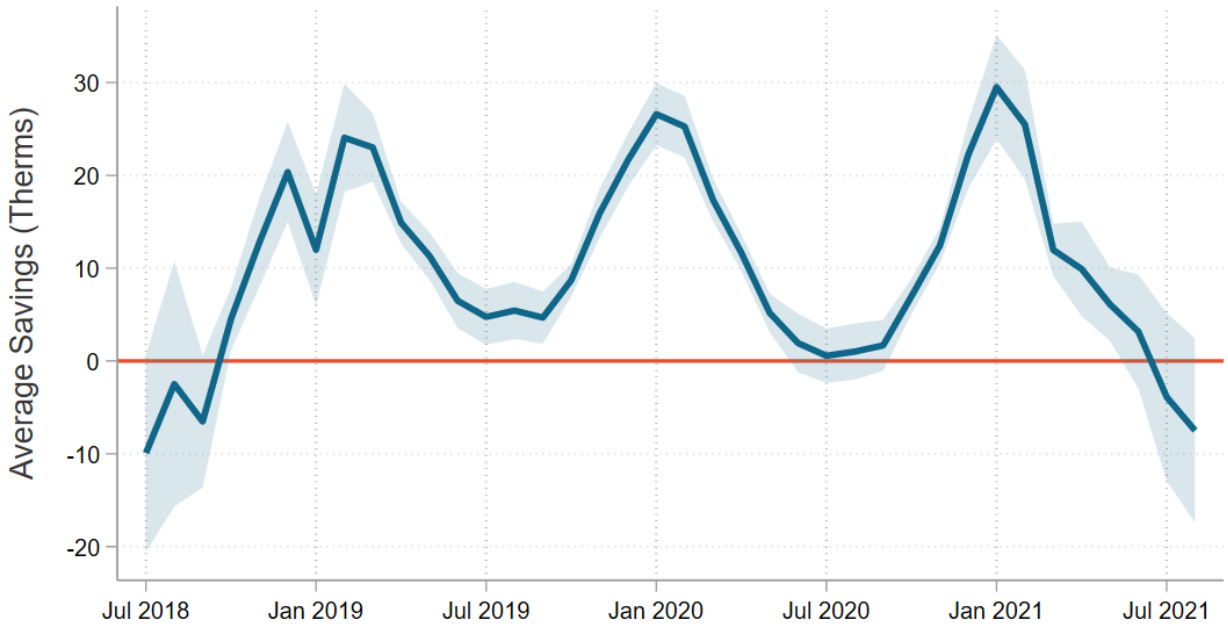
4.1.2.1.1. Single Family IHWAP

The Single-Family IHWAP generates average household-level savings of 129 therm per year, representing 11.5% annual gas savings among program participants (Table 4-4).

The monthly results exhibit a seasonal trend, where savings tend to be the largest during the winter months when heating needs are high and gas consumption is greatest. Savings during the summer months are small because the most prevalent measures offered by the program are almost exclusively space heating-related, and do not generate gas savings during warmer months.

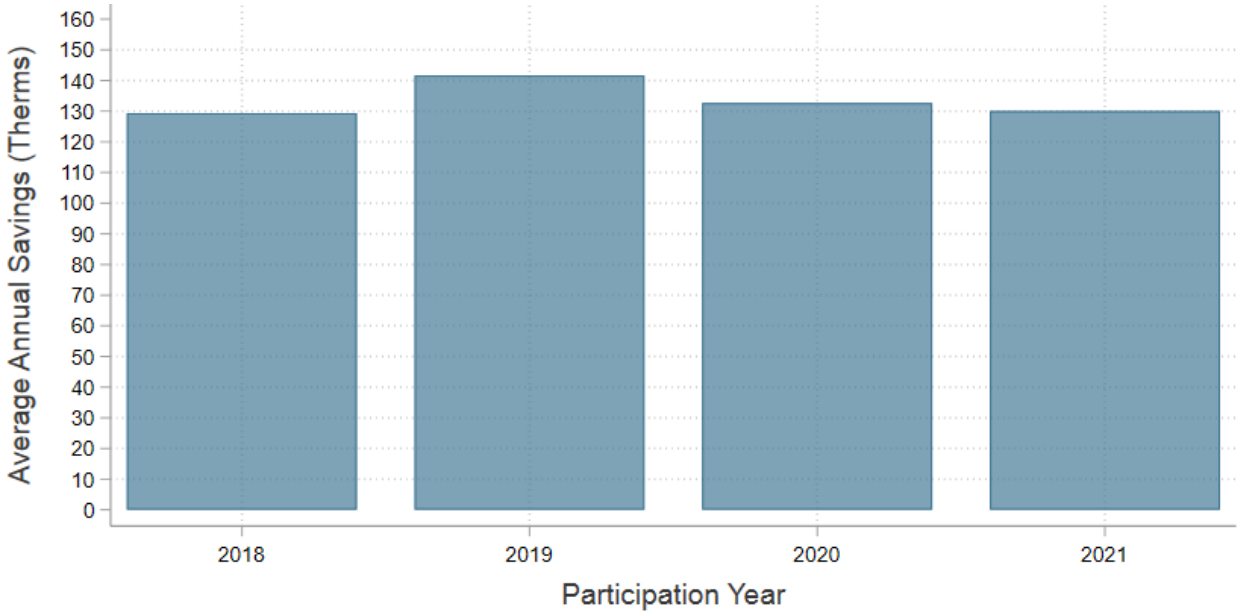
Average monthly gas savings among program participants is shown in Figure .

Figure 4-7: SF IHWAP Program Monthly Therm Savings



The program population was segmented by participation year to examine the development of savings trends over time. Average annual gas savings appear to be relatively consistent by participation year, as shown in Figure .

Figure 4-8: SF IHWAP Annual Therm Savings by Participation Year



4.1.2.2. Billed Dollars Savings

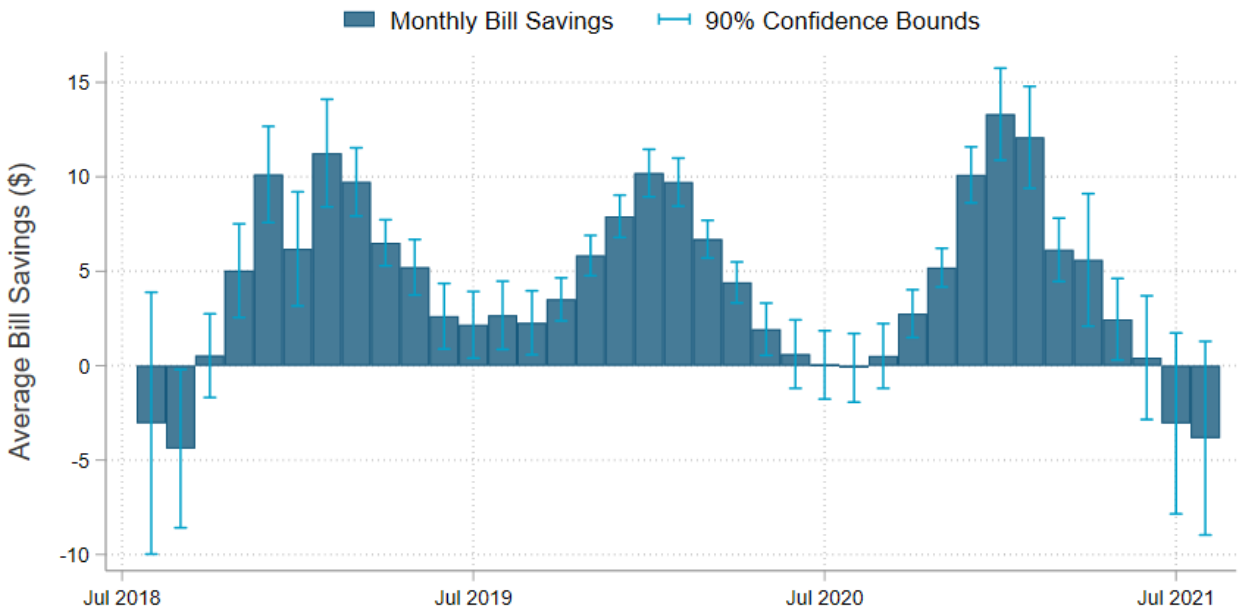
The bill savings analysis benefitted by having the actual, customer-facing monthly billed dollar amounts for Nicor's program population. An analysis of financial savings among program participants showed a monthly trend that mirrors the monthly gas savings trend. Participants experienced larger bill savings in winter months when gas consumption is expected to be higher due to increased heating loads. Segmentation by participation year showed that customers who participated in 2020 and 2021 experienced significantly lower financial savings, likely caused by increased gas prices in 2021 and 2022.

Single Family IHWAP

The Single-Family IHWAP generates average household-level savings of $117.12 per year, representing 17.5% annual cost savings among program participants (Table 4-4).

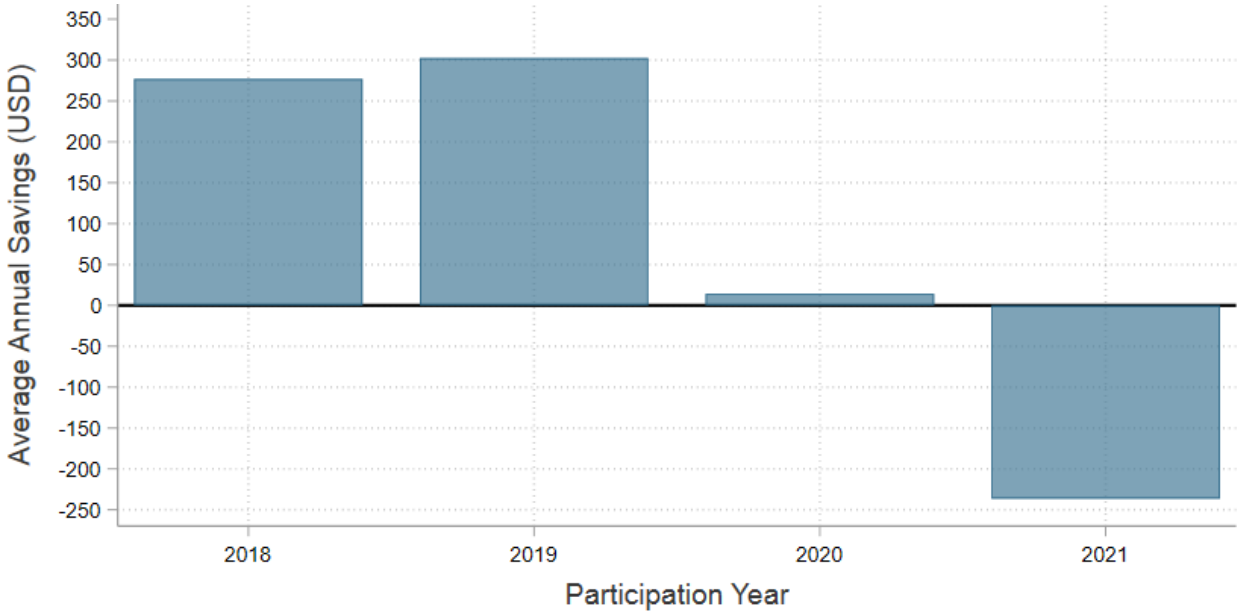
The monthly results exhibit a seasonal trend, where savings tend to be the largest during the winter months when heating needs are high and gas consumption is greatest. Average monthly bill savings among program participants are shown in Figure .

Figure 4-9: SF IHWAP Program Monthly USD Savings



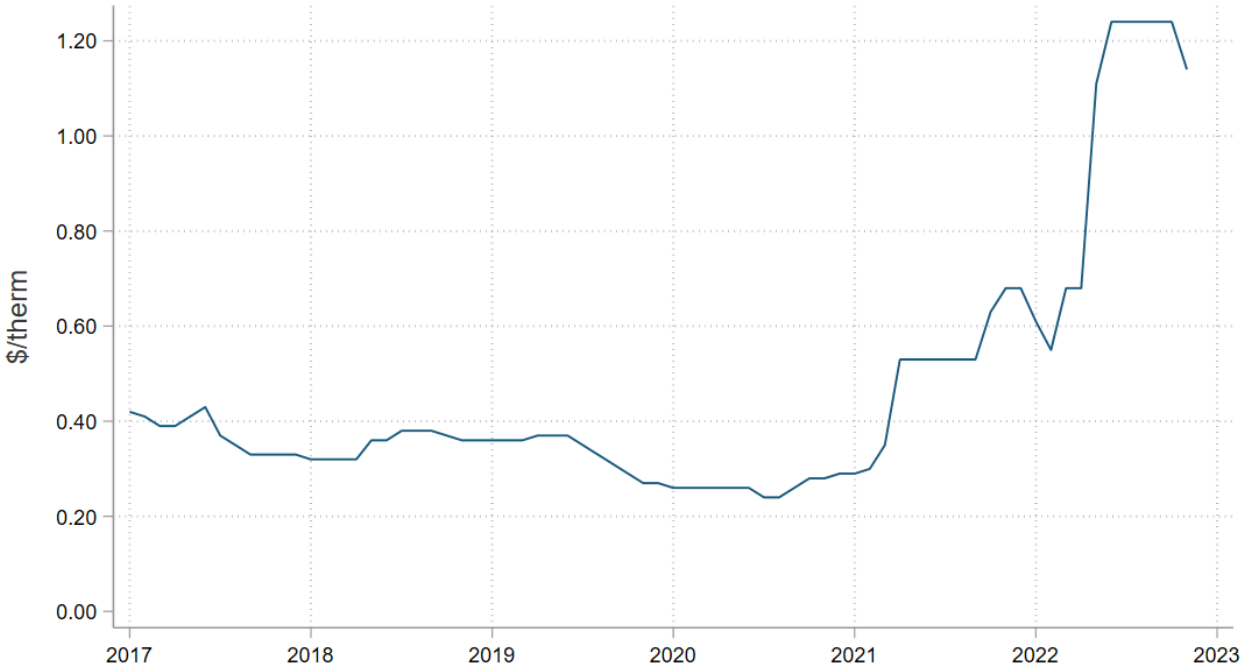
The program population was segmented by participation year to examine the development of savings trends over time. This shows that customers who participated in 2018 and 2019 received significant financial savings, while 2020 participants received very little savings and 2021 participants experienced cost increases. Average participant bill savings by participation year is shown in Figure 4-10.

Figure 4-10: SF IHWAP Annual USD Savings by Participation Year



The decrease in savings of 2020 and 2021 participants is due in large part to increases in per unit gas costs ($/therm). The pre period for these participants included 2019 or 2020, when gas prices were lower compared to the 2021 or 2022 post period. Nicor Gas's monthly unit gas cost is shown below in Figure for 2017-2022.

Figure 4-11: Nicor Monthly Unit Gas Cost



The critical consequence is simple: bill savings are affected dramatically by gas market conditions, regardless of program performance. Natural gas is a commodity and its price fluctuates according to supply and demand across the country. There are several factors that influence supply and demand, such as economic conditions, weather, and other factors that ultimately set the price of gas. Even if the program continues to achieve energy savings at levels consistent to prior years, the surge in gas supply costs during 2021 and 2022 results in severe declines in bill savings for customers. Likewise, looking to future years, if gas supply costs were to decline in 2023 (and beyond) to 2017-2020 levels, the programs' 2022 enrollees would experience a massive increase in bill savings relative to their pre-enrollment utility expenditures. Put simply, bill savings achieved by customers are a function of the energy costs experienced during the post-enrollment period relative to energy costs experienced during the pre-enrollment period.

4.1.3. Peoples Gas - North Shore Gas

Of the five income-eligible programs offered by People Gas – North Shore Gas, three programs generated reliable savings results: SF IHWAP, IEMS and CBA. The other two programs, Multi-Family IHWAP and PHES, did not have adequate participation over the study period to produce usable results. A summary of People Gas – North Shore Gas program results are given in Table 4-5.

Table 4-5: Summary of PG-NSG Program Savings

Program	Avg. Annual Gas Savings	Avg. Percent Gas Savings	Avg. Annual USD Savings	Avg. Percent USD Savings

SF IHWAP	169 Therm	16.7%	$84.1	8.3%
IEMS	605 Therm	6.4%	$480.82	7.4%
CBA	112 Therm	8.6%	$85.62	6.5%

4.1.3.1. Gas Savings

Of the three income-eligible programs with reliable results, the analysis of energy savings for two programs showed a monthly trend that correlates with expected gas consumption, namely SF IHWAP and CBA. For the aforementioned programs the average gas savings among program participants is largest during the winter months when gas consumption is expected to be higher due to increased heating loads. The IEMS program showed the greatest annual therms savings, likely due to the makeup of the program's population, which would include both single tenants as well as master-metered buildings.

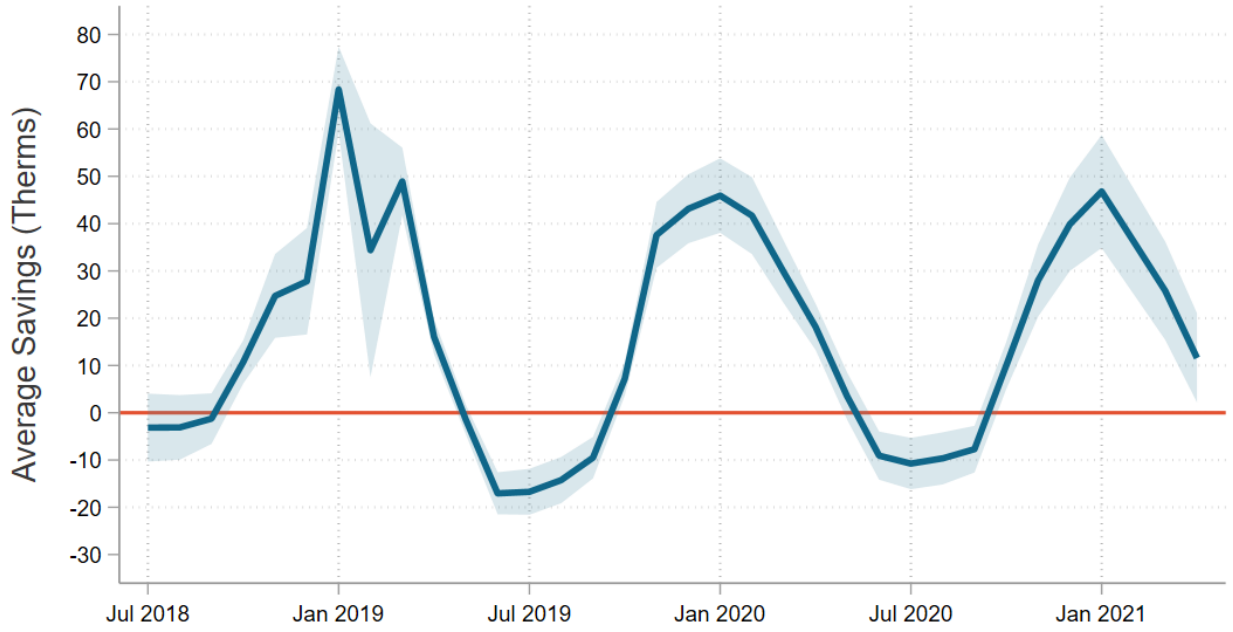
Segmentation by participation year shows varied therm savings trends among the programs over the study period. CBA/SFIE experiences a downward trend followed by a rise in 2021, while SF IHWAP and IESMS show upward and downward trends, respectively.

4.1.3.1.1. Single Family IHWAP

The PG-NSG Single-Family IHWAP generates average household-level savings of 169 therm per year, accounting for 16.7% annual gas savings among program participants (Table 4-5).

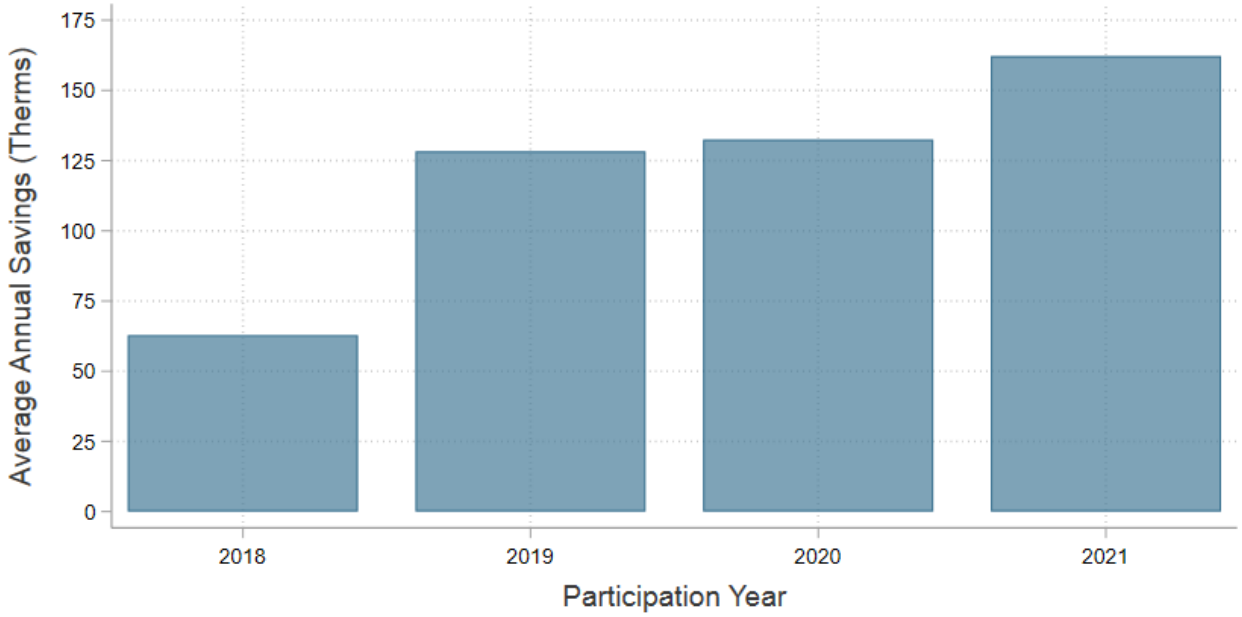
The monthly results exhibit a seasonal trend, where savings tend to be the deepest during the winter months when heating needs are high and gas consumption is greatest. Another interesting takeaway relates to the negative savings (or increased consumption) observed during the summer months. The efficiency measures installed through the program should never naturally lead to increased usage. However, the nature of the measures that predominate the program are almost exclusively space heating-related, and do not generate gas savings during warmer months. Any change in usage during non-heating periods are more likely due to changes in behavior and/or changes in non-heating gas needs (e.g., water heating, cooking, etc.) but not attributable to the program.

Figure 4-12: PG-NSG SF IHWAP Program Monthly Therm Savings



The program population was segmented by participation year to examine the development of savings trends over time. Average annual savings increased significantly from 2018 to 2019 followed by a slight rise in 2020. There was almost 19% growth in average annual savings from 2020 to 2021.

Figure 4-13: PG-NSG SF IHWAP Annual Therm Savings by Participation Year

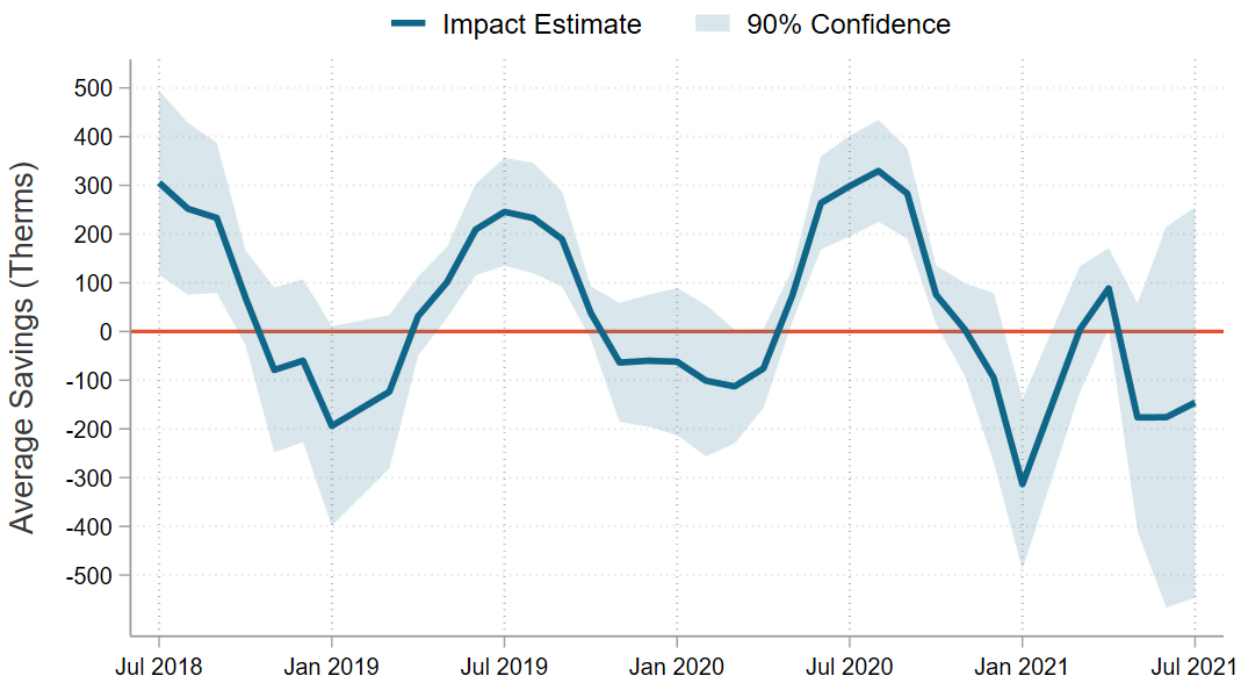


4.1.3.1.2. Income-Eligible Multi-Family Savings

The PG-NSG Income-Eligible Multi-Family (IEMS) generates average household-level savings of 605 Therm per year, accounting for 6.4% annual gas savings among program participants (Table 4-5).

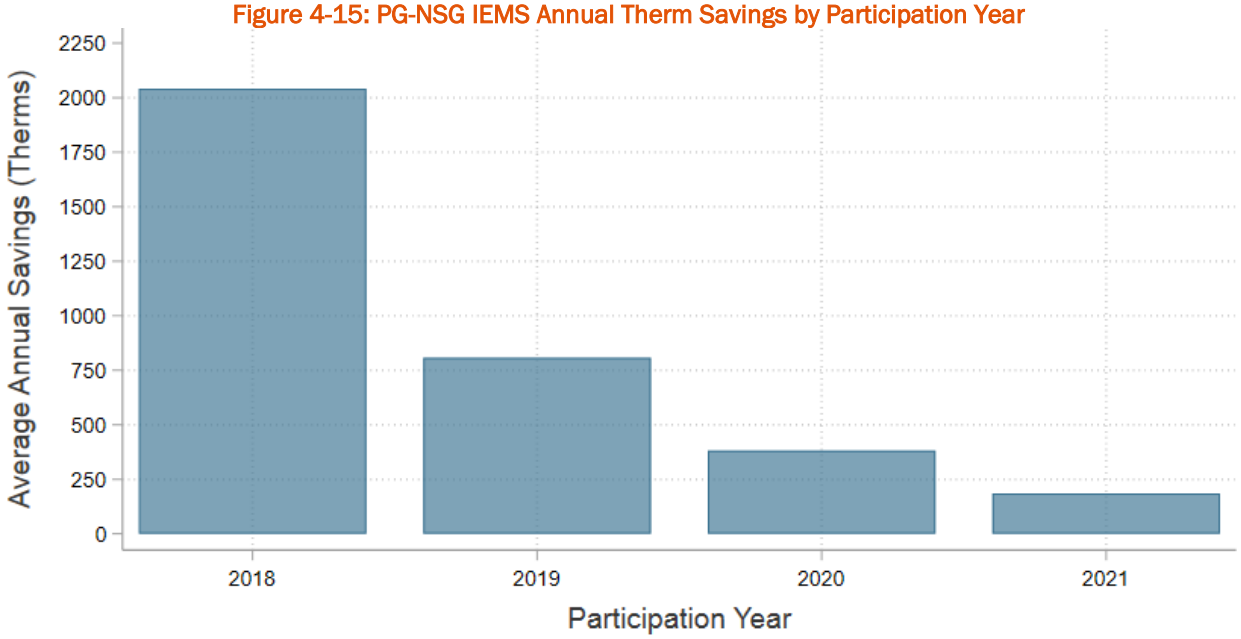
Unlike the SF IHWAP and CBA programs, savings from the IEMS program tend to be largest during the summer months. One possible reason for this is the participant makeup of the program, which includes master-metered buildings that may have different operational patterns and/or equipment needs that result in distinct seasonal energy demands compared to single family residences. Another possible reason could be explained by the prevalent measures offered under this program. Unlike the IHWAP program, which is focused predominantly on space conditioning measures, the IEMS program shows a preference for water-related measures (e.g., bathroom and kitchen aerators, showerheads, shower timers, etc.)

Figure 4-14: PG-NSG IEMS Program Monthly Therm Savings



The program population was segmented by participation year to examine the development of savings trends over time. Overall, the average annual savings experienced a downward trend, decreasing noticeably from 2,042 therms in 2018 to 185 therms in 2021.

Figure 4-15: PG-NSG IEMS Annual Therm Savings by Participation Year

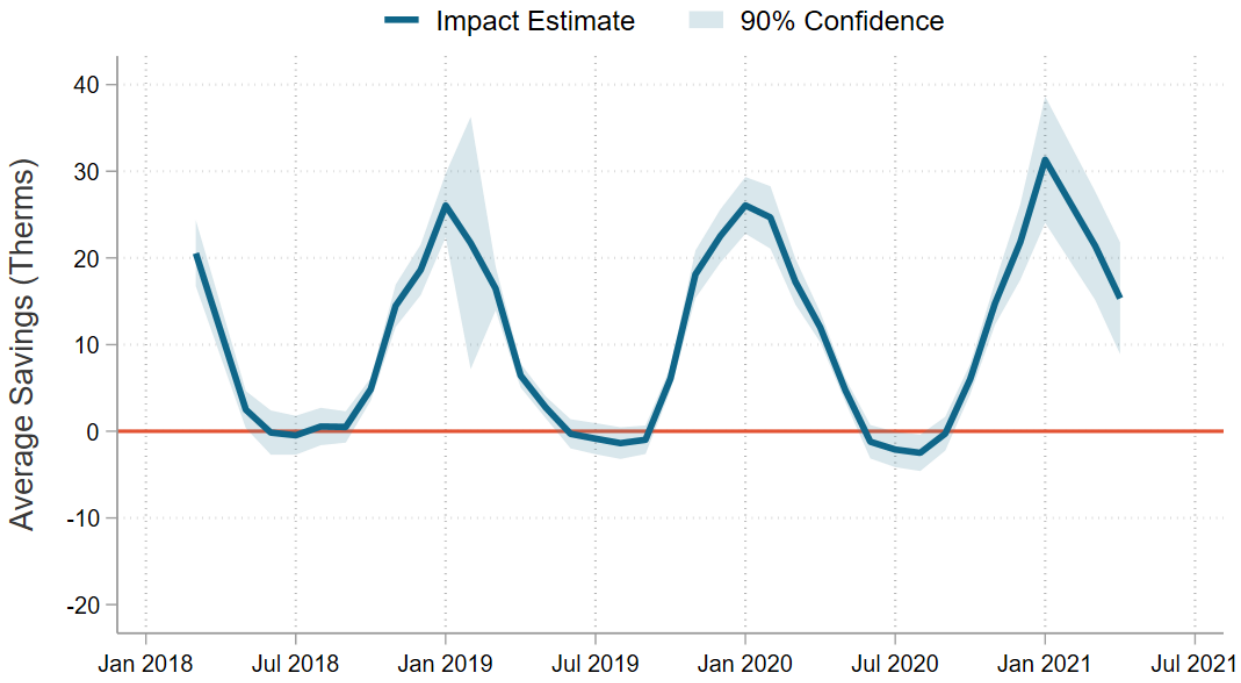


4.1.3.1.3. Chicago Bungalow Association

The PG-NSG Chicago Bungalow Association (CBA) generates average household-level savings of 112 Therm per year, accounting for 8.6% annual gas savings among program participants (Table 4-5).

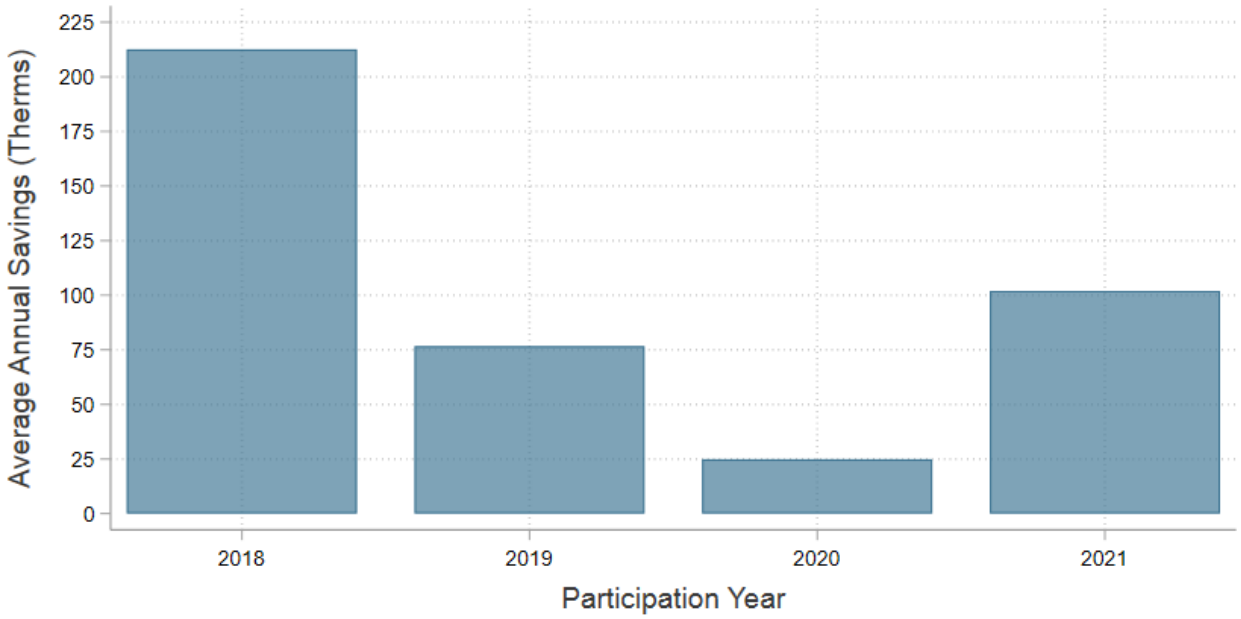
The monthly results exhibit a seasonal trend, where savings tend to be largest during the winter months when heating needs are high and gas consumption is greatest.

Figure 4-16: PG-NSG CBA / SFIE Program Monthly Therm Savings



The program population was segmented by participation year to examine the development of savings trends over time. There was a significant decrease in the average annual savings from 213 therms in 2018 to 25 therms in 2020, followed by a noticeable rise in 2021, reaching around 102 therms.

Figure 4-17: PG-NSG CBA/SFIE Annual Therm Savings by Participation Year



4.1.3.2. Billed Dollars Savings

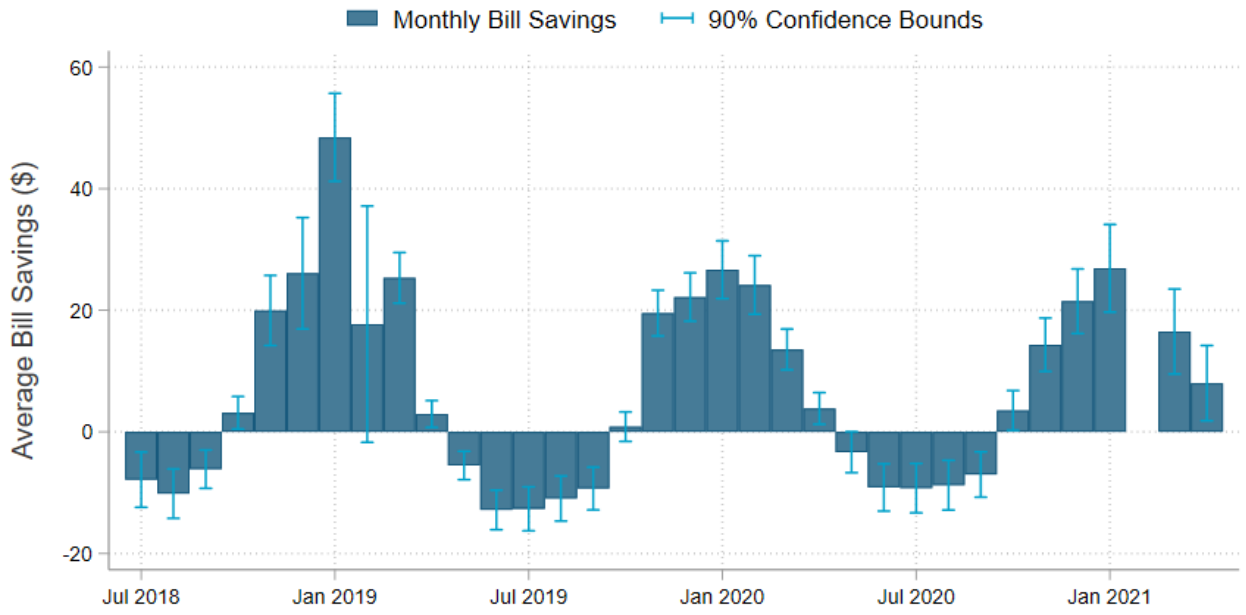
The bill savings analysis benefitted by having the actual, customer-facing monthly billed dollar amounts for PG-NSG's program populations. An analysis of financial savings among program participants showed a monthly trend that mirrors the monthly gas savings trend. SF IHWAP and CBA/SFIE participants experienced larger bill savings in winter months when gas consumption is expected to be higher due to increased heating loads as opposed to IEMS participants for whom the largest bill savings observed in summer months. Segmentation by participation year showed that customers who participated in 2020 and 2021 experienced significantly lower financial savings, which were were due primarily to increased gas prices in 2021 and 2022.

4.1.3.2.1. Single Family IHWAP

The Single-Family IHWAP generates average household-level savings of $84 per year, representing 8.3% annual cost savings among program participants (Table 4-5).

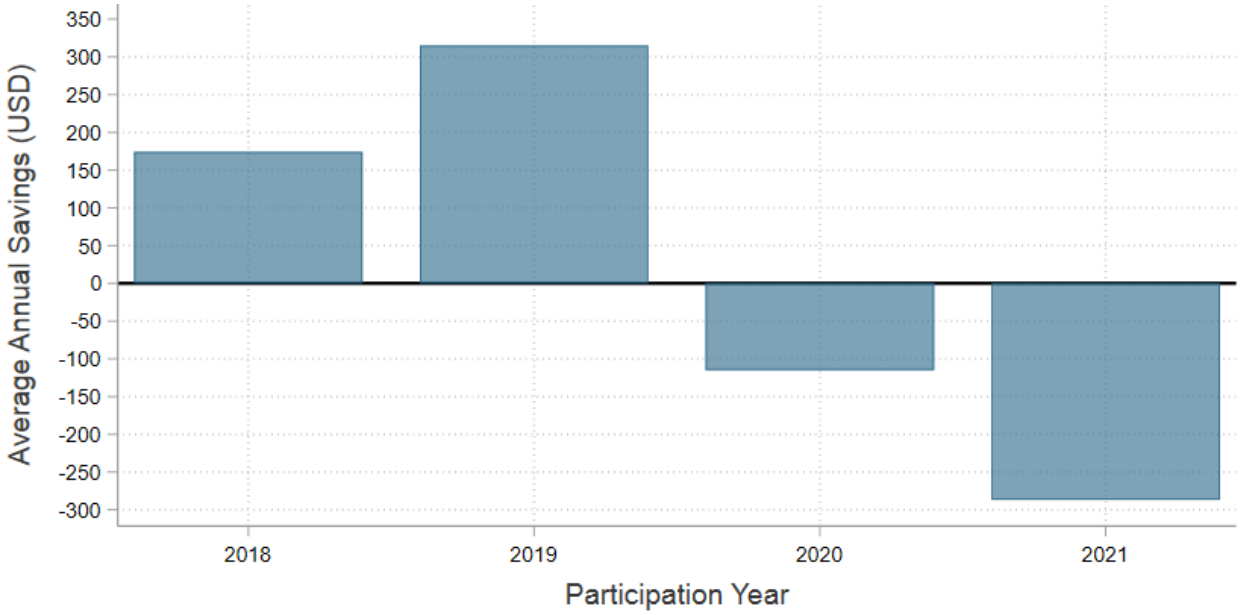
The monthly results exhibit a seasonal trend, where bill savings are largest during the winter months when heating needs are high and gas consumption is greatest. Average monthly bill savings among program participants is shown in Figure 4-18. Similar to the gas savings results shown in , the monthly bill savings exhibit statistically significant negative savings (or increased bills) during the summer months, indicating that the measures offered through the SF IHWAP program are primarily heating-related measures and are not impactful during the warmer summer months.

Figure 4-18: PG-NSG SF IHWAP Program Monthly USD Savings



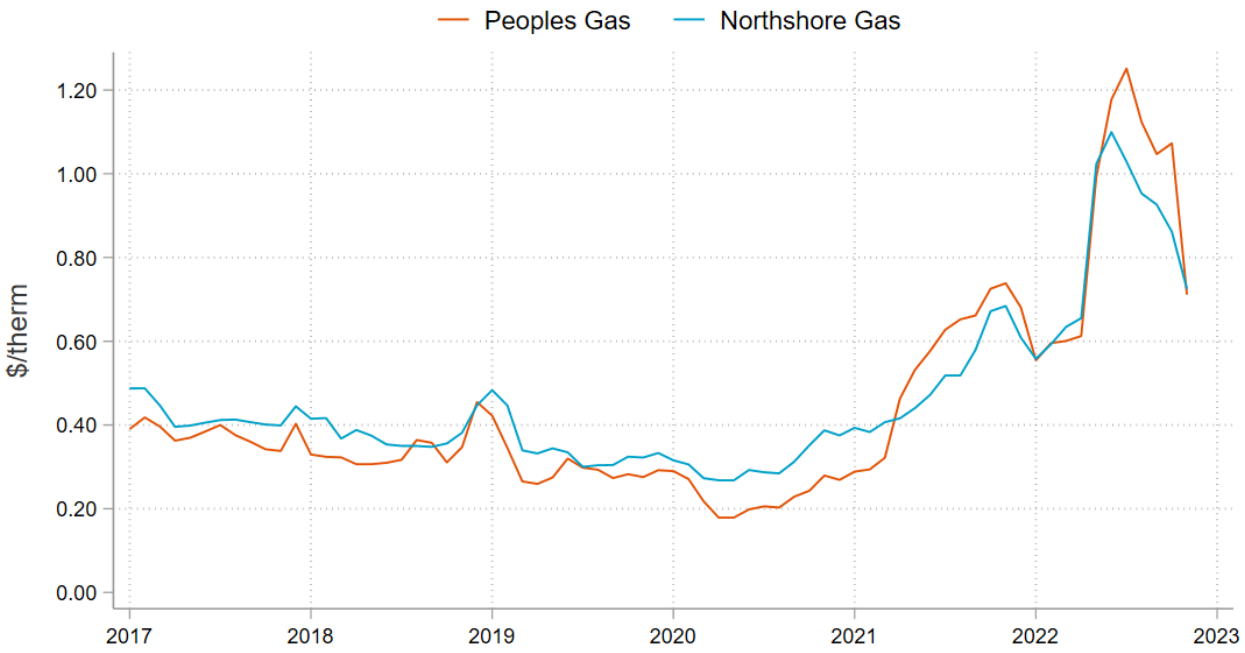
The program population was segmented by participation year to examine the development of financial savings trends over time. This shows that the financial savings for the customers who participated in this program in 2018 is lower than those in 2019. Due to the increase in unit gas price in 2020 onwards, participants experienced cost increases in 2020 and 2021.

Figure 4-19: PG-NSG SF IHWAP Annual USD Savings by Participation Year



The decrease in savings of 2020 and 2021 participants is most likely due to increases in per unit gas costs (USD / Therm). The pre period for these participants included 2019 or 2020, when gas prices were lower compared to the 2021 or 2022 post period. Peoples and Northshore Gas's monthly unit gas cost is shown below in Figure for 2017-2022.

Figure 4-20: PG/NSG Monthly Unit Gas Cost



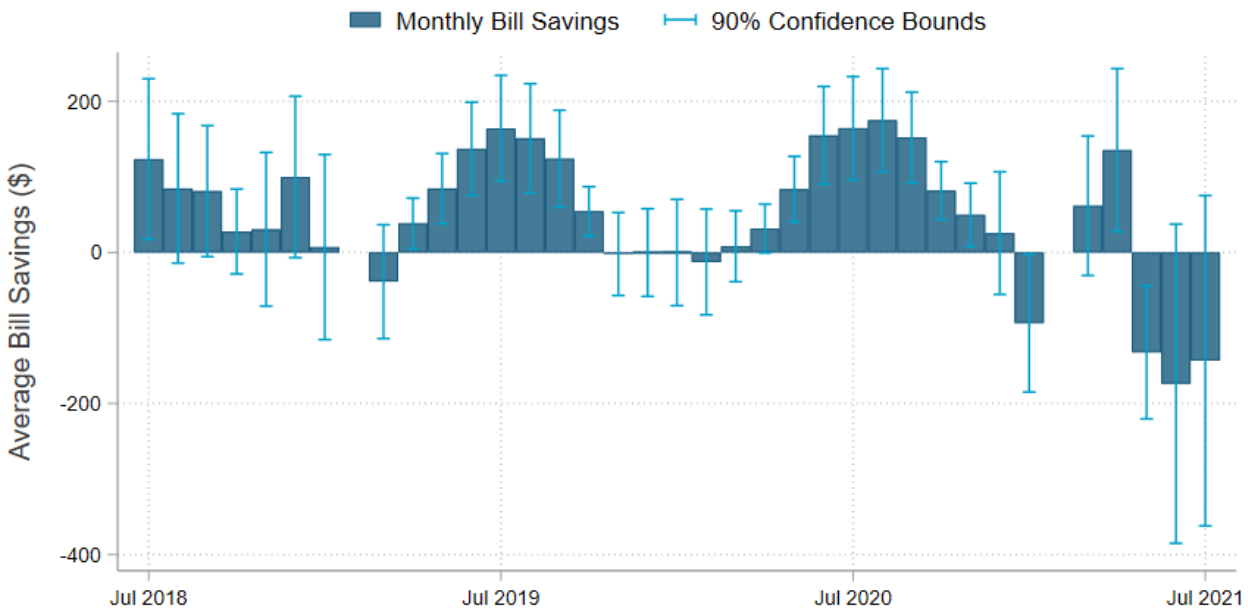
Bill savings are strongly influenced by gas market commodity price, regardless of program performance. Even if the program continues to achieve energy savings at levels consistent to prior years, the spike in gas rates during 2021 and 2022 results in severe declines in bill savings for PG-NSG's customers. Bill savings achieved by customers are a function of the energy rates experienced during the post-enrollment period relative to energy rates experienced during the pre-enrollment period.

4.1.3.2.2. Income-Eligible Multi-Family Savings

The Income-Eligible Multi-Family generates average household-level savings of $480.82 per year, representing 7.4% annual cost savings among program participants (Table 4-5).

Similar to the energy savings results, the monthly bill savings exhibit a seasonal trend where savings are largest during the summer months. Furthermore, the summer months by and large are statistically significant, whereas many of the winter months lack statistical significance.

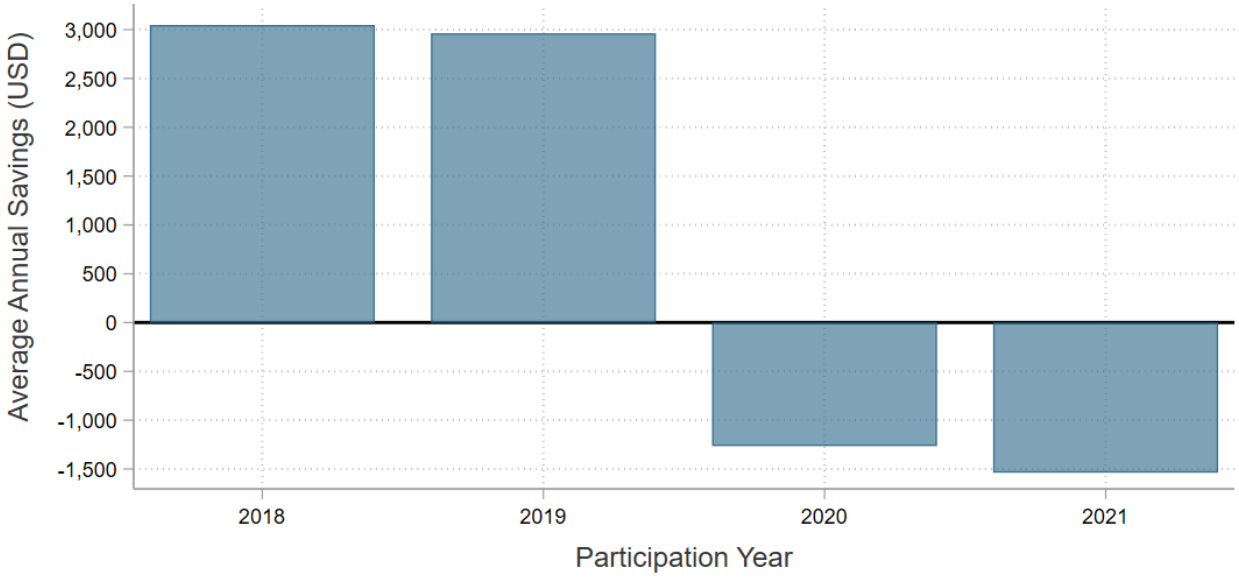
Figure 4-21: PG-NSG IEMS Program Monthly USD Savings[3]



The program population was segmented by participation year to examine the development of financial savings trends over time. This shows that the financial savings for the customers who participated in this program in 2018 is lower than those in 2019. Due to the increase in unit gas price in 2020 onwards, participants experienced cost increases in 2020 and 2021. This is explained and supported graphically above in Section 4.1.3.2.1.34

[3] February 2019 and February 2021 are intentionally excluded from the graphic due to questionable data observed in those months.

Figure 4-22: PG-NSG IEMS Annual USD Savings by Participation Year

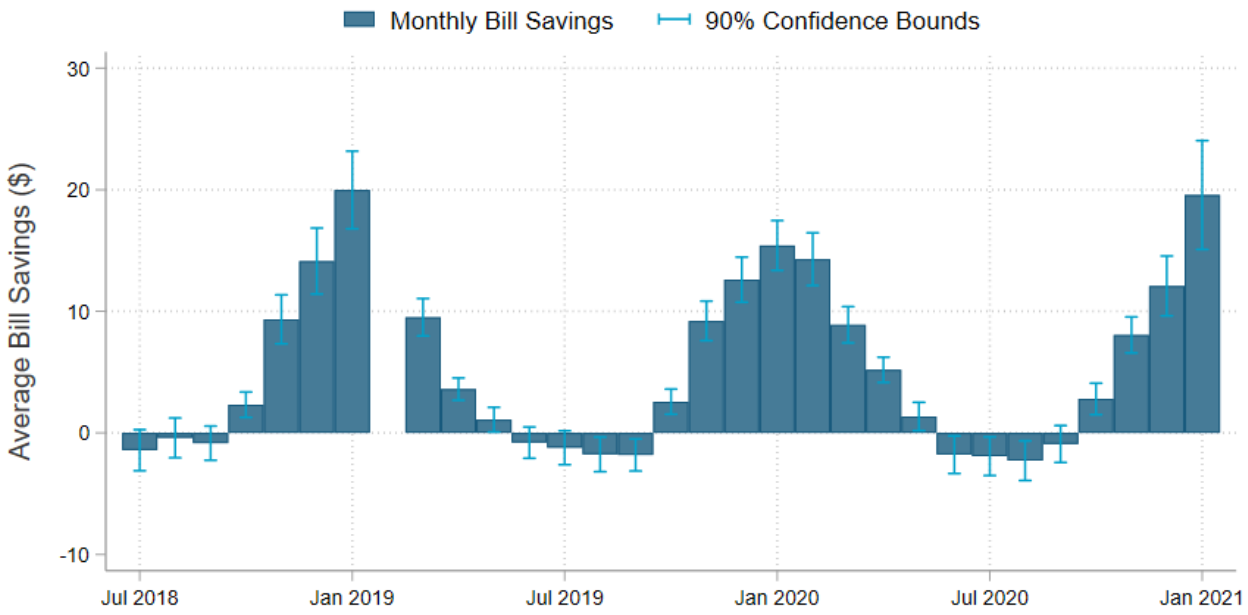


4.1.3.2.3. Chicago Bungalow Association

The Chicago Bungalow Association generates average household-level savings of $85.62 per year, representing 6.5% annual cost savings among program participants (Table 4-5).

The monthly results exhibit a seasonal trend, where savings tend to be the largest during the winter months when residential heating needs are high and gas consumption is greatest. Average monthly bill savings among program participants is shown in Figure 4-23.

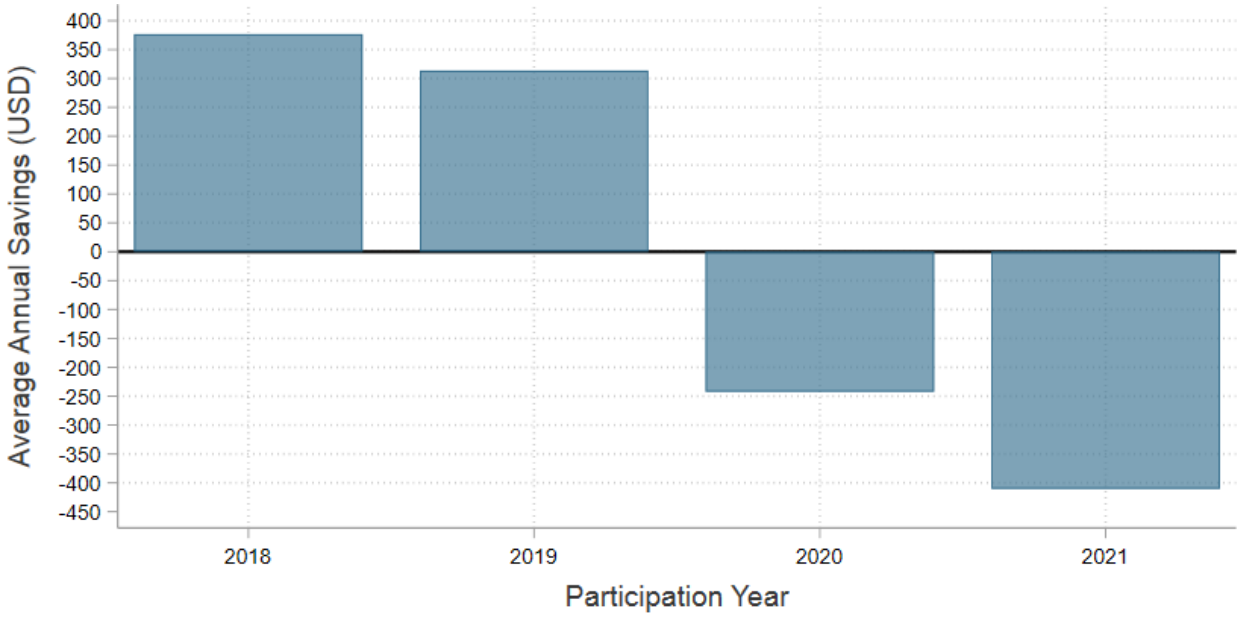
Figure 4-23: PG-NSG SFIE/CBA Program Monthly USD Savings[4]



The program population was segmented by participation year to examine the development of financial saving trends over time. This shows that the financial savings for the customers who participated in this program in 2018 is lower than those in 2019. Due to the increase in unit gas price in 2020 onwards, participants experienced cost increases in 2020 and 2021. This is explained and supported graphically above in Section 4.1.3.2.1.34

[4] February 2019 is intentionally excluded from the graphic due to questionable data observed in that month.

Figure 4-24: PG-NSG SFIE/CBA Annual USD Savings by Participation Year



4.2. Aggregate Utility Savings Results

Wherever possible, the analysis combined datasets across utilities and/or programs in order to produce a more comprehensive set of results that represent the broader impact these programs have on their customers. The specific research questions include:

- What are the estimated gas and dollars savings achieved by the program across participants from both Nicor Gas and PG-NSG service territories?
- What is the incremental change in energy use intensity (EUI) after participation among participants from Nicor Gas and PG-NSG?
- What is the total annual utility bill savings, including electric and gas bills, among program participants?

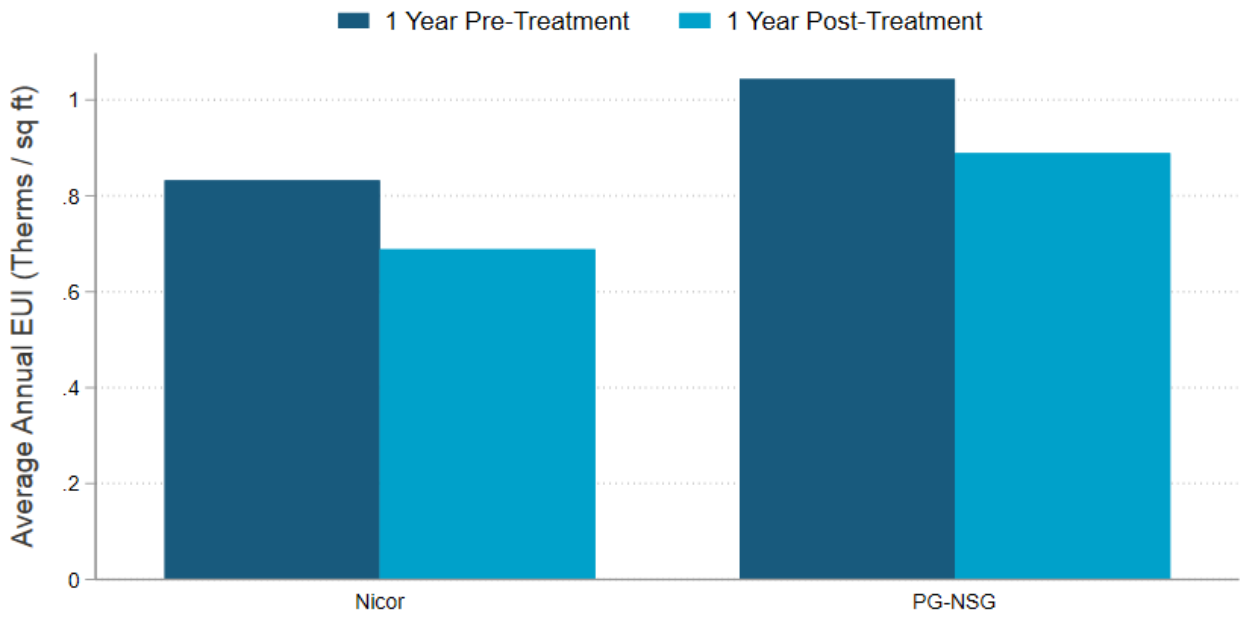
As mentioned previously, the ability to perform the analysis relies on sufficient and reliable data.

4.2.1. Aggregate Gas Savings Analysis

Annual energy use intensity (EUI) is a useful metric for contextualizing the energy use of homes by examining energy consumption per square foot of living space. Square feet of living space was provided for significant portions of Nicor Gas and Peoples Gas – North Shore Gas program participants. Annual EUI for the year immediately preceding participation was compared to annual EUI for the year immediately after participation for participants of all Nicor Gas and Peoples Gas –

North Shore Gas programs. Figure shows a noticeable decrease in EUI after participation in at least one of the available programs.

Figure 4-25: Average Annual Energy Use Intensity (Therm / sq ft) of Participating Gas Customers



Of the three income-eligible programs offered by both gas utilities, only the Single-Family IHWAP generated reliable savings results. The other programs, Multi-Family IHWAP and PHES, did not have adequate participation over the study period to produce usable results. Combined gas program results are given in Table 4-6.

Table 4-6: Summary of Combined Gas Program Savings

Program	Avg. Annual Gas Savings	Avg. Percent Gas Savings	Avg. Annual USD Savings	Avg. Percent USD Savings
SF IHWAP	163 Therm	14.3%	$97.17	13.3%

4.2.1.1. Gas Savings

An analysis of energy savings showed a monthly trend that correlates with expected gas consumption. Average gas savings among program participants is largest during the winter months when gas consumption is expected to be higher due to increased heating loads. Segmentation by participation year shows relatively consistent Therm savings, regardless of participation date.

4.2.1.1.1. Single Family IHWAP

The Single-Family IHWAP generates average household-level savings of 163 Therm per year, representing 14.3% annual gas savings among program participants.

The monthly results exhibit a seasonal trend, where savings tend to be the largest during the winter months when heating needs are high and gas consumption is greatest. Average monthly gas savings of all program participants is shown in Figure 4-26, and average monthly gas savings by utility are displayed in Figure 4-27.

Figure 4-26: SF IHWAP Program Monthly Therm Savings

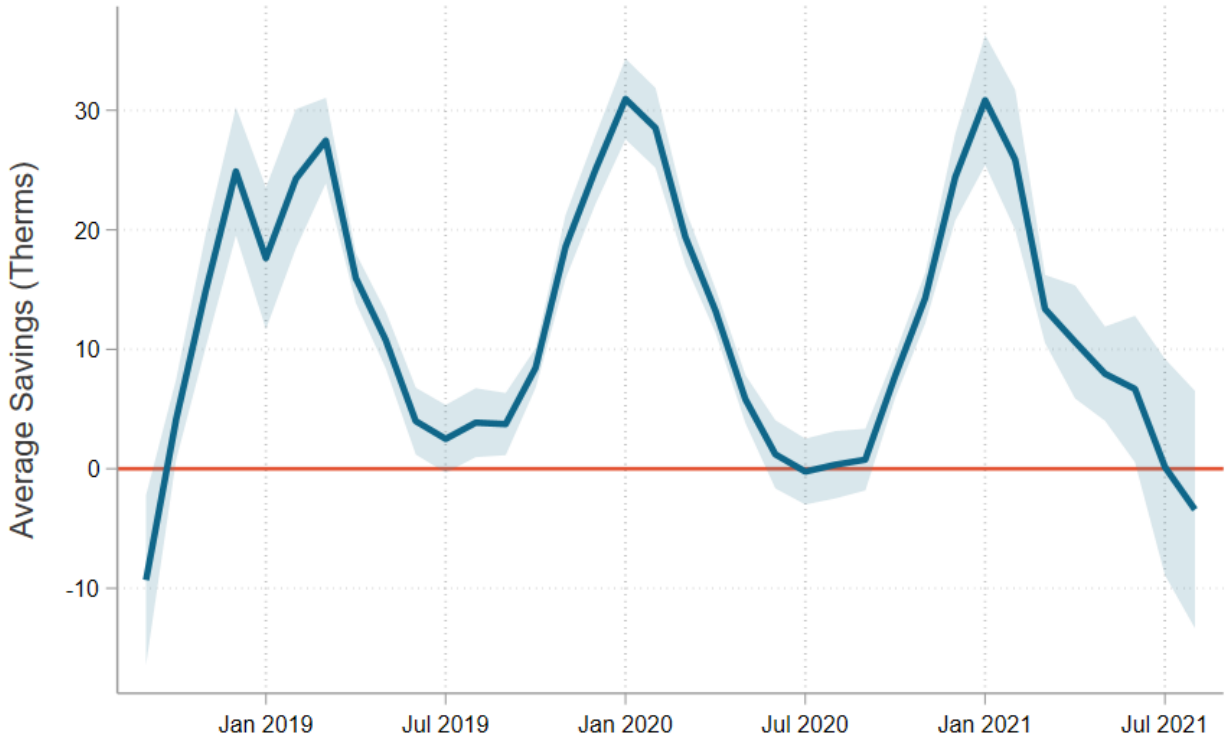
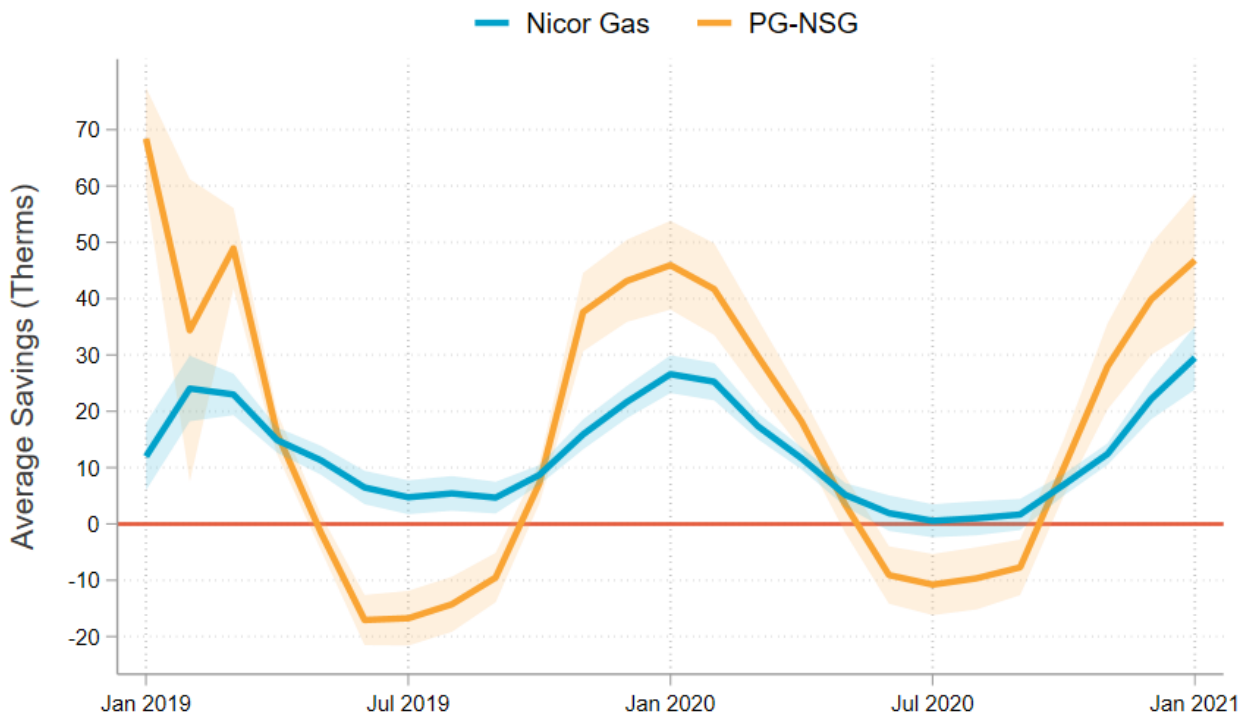
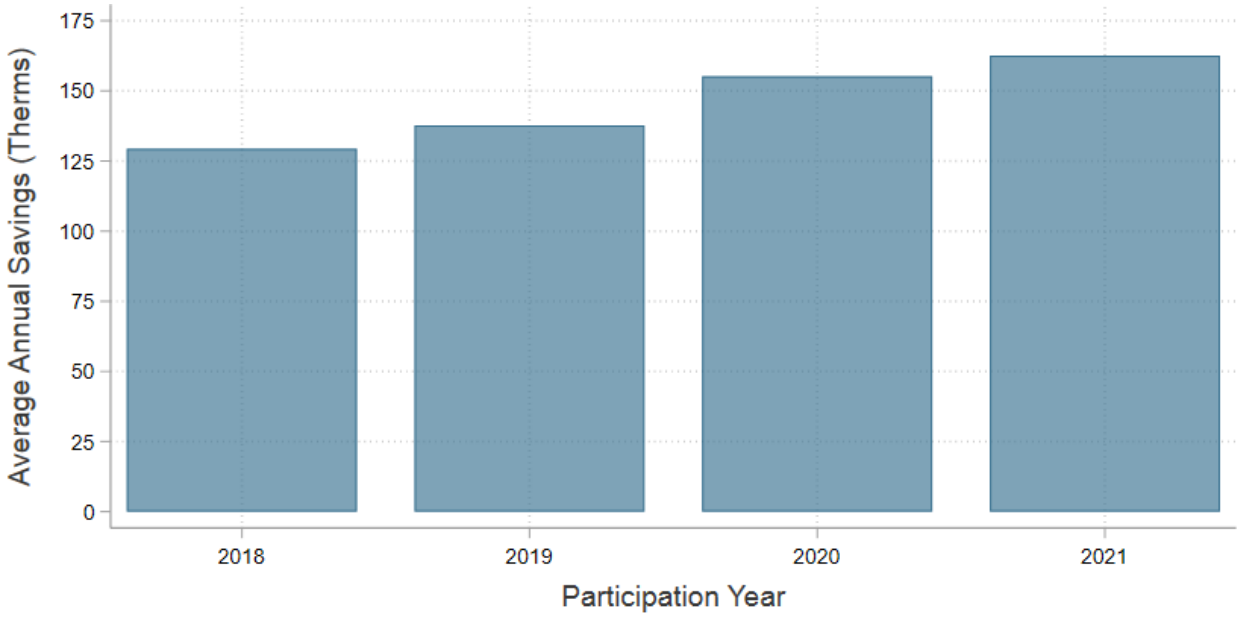


Figure 4-27: SF IHWAP Program Monthly Therm Savings by Utility



The program population was segmented by participation year to examine the development of savings trends over time. Average annual savings appear to be steadily increasing with each participation year, as shown in Figure .

Figure 4-28: SF IHWAP Annual Therm Savings by Participation Year



4.2.1.2. Billed Dollars Savings

An analysis of financial savings among program participants showed a monthly trend that mirrors the monthly gas savings trend. Participants experienced larger bill savings in winter months when gas consumption is expected to be higher due to increased heating loads. Segmentation by participation year showed that customers who participated in 2020 and 2021 experienced significantly lower financial savings, which may be caused by increased gas prices in 2021 and 2022.

Unlike energy savings, which are derived entirely from efficiency and/or reductions in usage, bill savings are influenced by market conditions. Natural gas is a commodity and its price fluctuates according to supply and demand across the country. During times of high gas prices, some costs are passed through to customers, increasing their bills. Customers pay more per unit of consumption, which can offset program impacts and result in higher utility bills.

4.2.1.2.1. Single Family IHWAP

The Single-Family IHWAP program generates average household-level savings of $97.17 per year, representing 13.3% annual cost savings among program participants.

The monthly results exhibit a seasonal trend, where savings tend to be the deepest during the winter months when heating needs are high and gas consumption is greatest. Average monthly gas bill savings of all participants is given in Figure , while average monthly gas bill savings by utility are shown in Figure 4-30.

Figure 4-29: SF IHWAP Program Monthly USD Savings

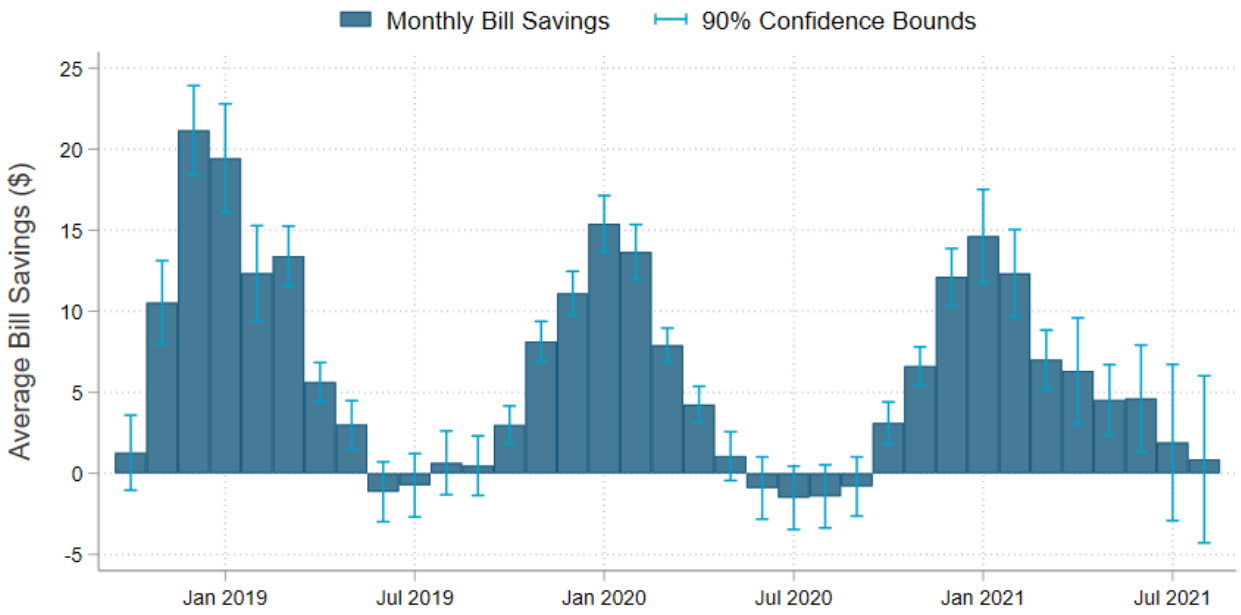
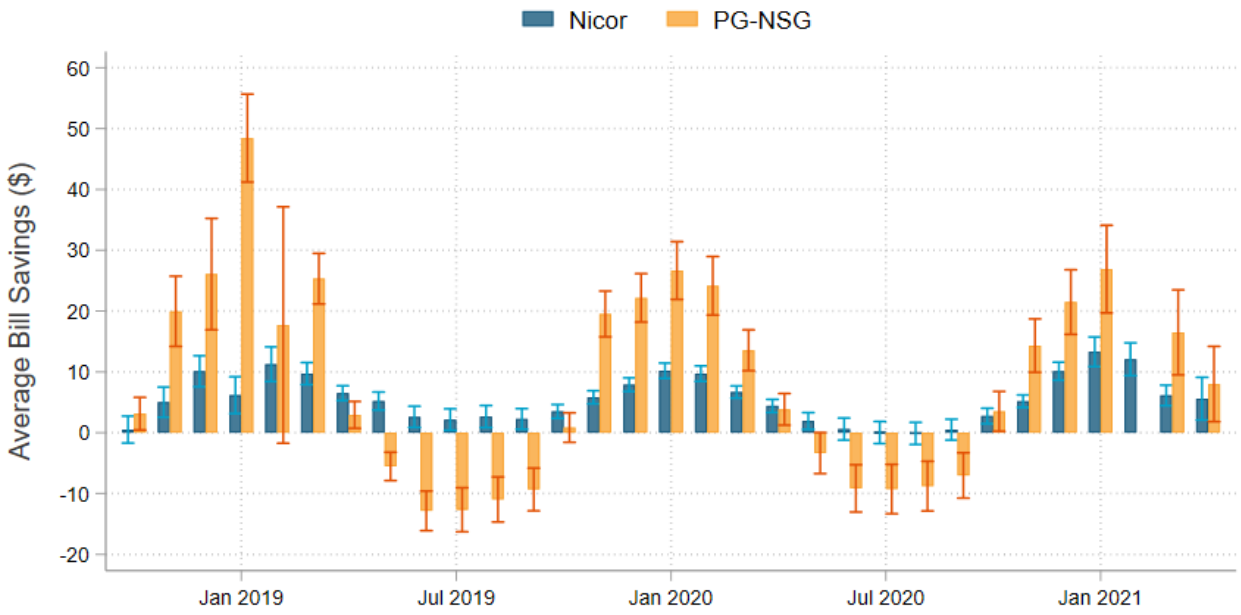
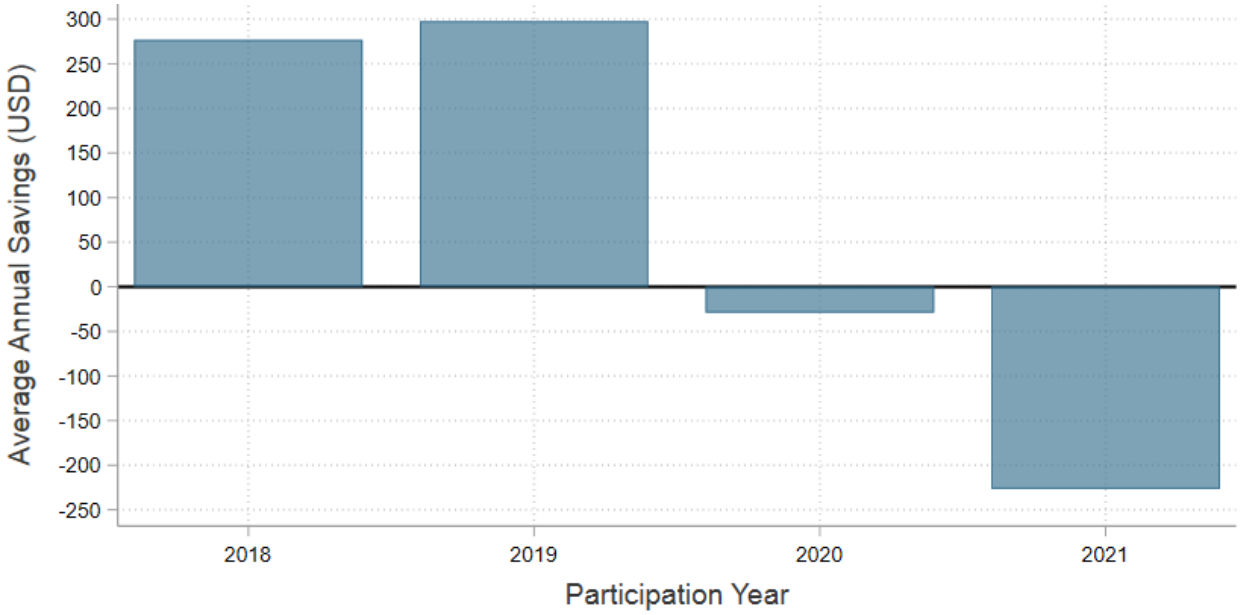


Figure 4-30: SF IHWAP Program Monthly USD Savings by Utility



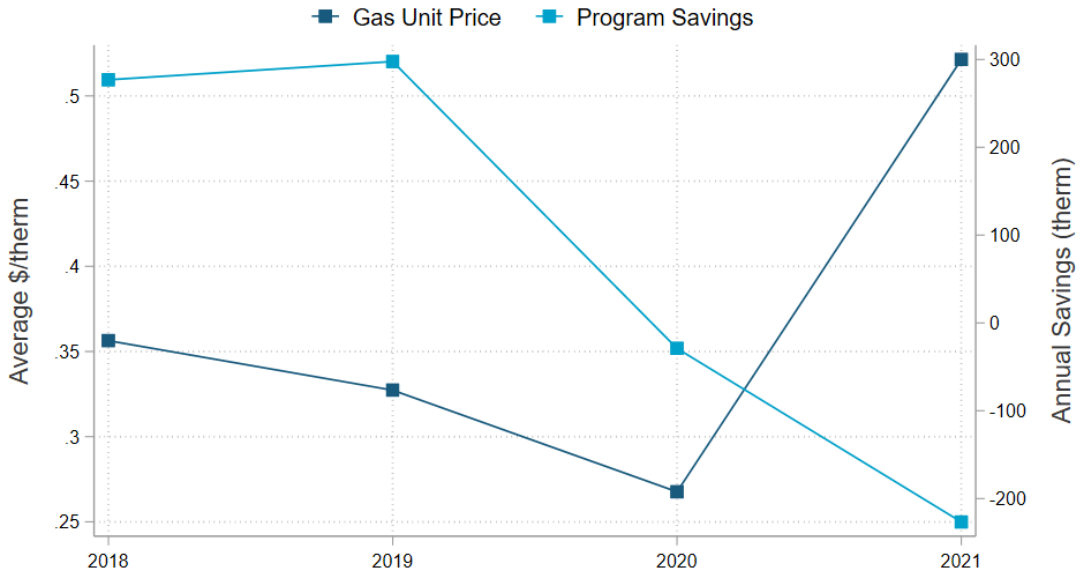
The program population was segmented by participation year to examine the development of savings trends over time. This shows that customers who participated in 2018 and 2019 received significant financial savings, while 2020 and 2021 participants experienced cost increases, as shown in Figure 4-31.

Figure 4-31: SF IHWAP Annual USD Savings by Participation Year



During the study period, customers who enrolled in programs during 2020-2021 experienced higher gas commodity pricing after joining the program than before joining. This led to negative bill savings, on average, for customers enrolling during that period. Figure 4-32 shows how annual savings (therms) declines in years that experience rising per unit gas prices.

Figure 4-32: Average Gas Price vs. SF IHWAP Savings by Year



5. TRM Savings Review and Comparison

As noted in Section 2.3, a direct comparison of savings values estimated by billing analysis to those calculated by a TRM can pose notable challenges. While TRMs provide a logical framework for measuring expected savings for a given measure under a specific, common set of assumptions, they are limited in their ability to incorporate outside forces that may influence real-world energy consumption and associated savings (e.g., weather, commodity prices, premise-level characteristics, baseline scenarios, etc.) and do not account for scenarios in which multiple efficiency measures are implemented simultaneously. Nevertheless, studies based on empirical consumption data are often benefited by assessing the degree of similarity between estimated savings results and TRM-calcualted values.

Resource Innovations conducted a review of TRM-calculated energy savings approved by the IL SAG. TRM-calculated savings values were specified at the measure and project level within the datasets provided by ComEd, Nicor, and PG-NSG. These savings values were aggregated across the full suite of measures installed by each customer in each year of participation and then compared to the average per customer savings found by RI's billing analysis.

Table 5-1 shows the average annual project-level TRM-calculated savings, RI's estimated savings derived from billing analysis, and the estimated savings as a percentage of the TRM-calculated savings for each program. With the exception of PG-NSG's IEMS program, RI's analysis estimated annual savings that range from 25% to 39% of the utilities' average TRM-calculated values.

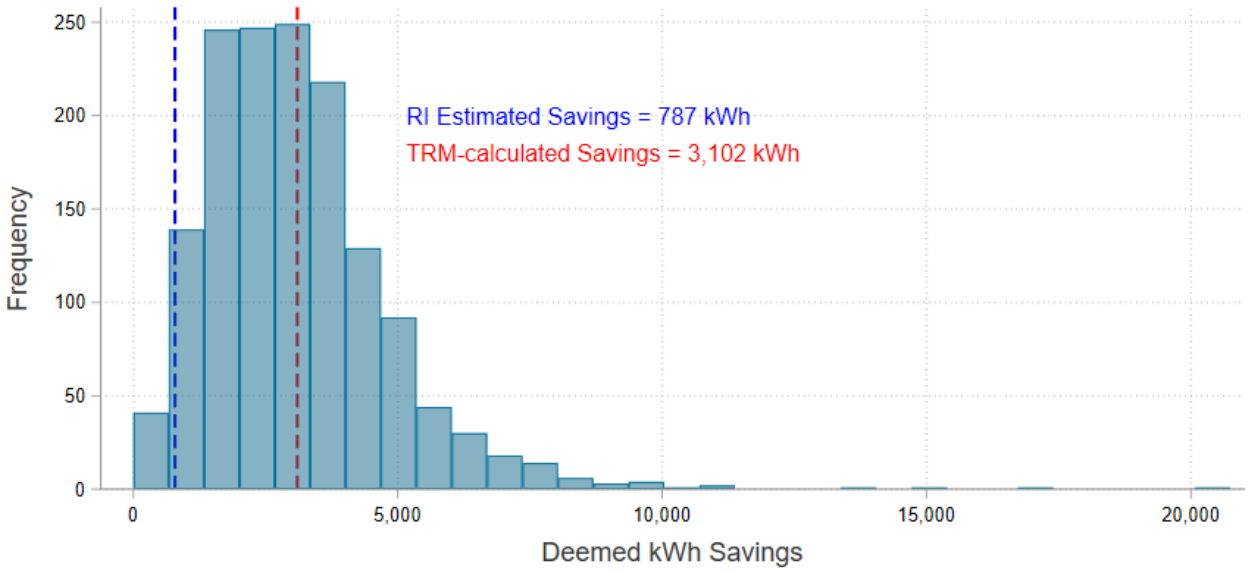
Table 5-1: TRM-Calculated Savings Comparison Summary

Utility	Program	TRM-calculated Savings	RI Estimated Savings	Estimated Savings as % of TRM
ComEd	SF IHWAP	3,102	787	25%
ComEd	MF IHWAP	2,121	822	39%
ComEd	CBA Program	1,059	272	26%
Nicor	SF IHWAP	369	129	35%
PG-NSG	SF IHWAP	450	169	38%
PG-NSG	IEMS	535	605	113%
PG-NSG	CBA Program	379	112	30%

5.1. ComEd

Figure 5-1 shows the distribution of average per customer annual TRM-calculated kWh savings for customers participating in ComEd's SF IHWAP program (2018-2020). Two reference lines have been added to the figure: the red line represents the average per customer annual estimated savings of the distribution based on the TRM-based data, while the blue line represents the annual savings found by RI's billing analysis.

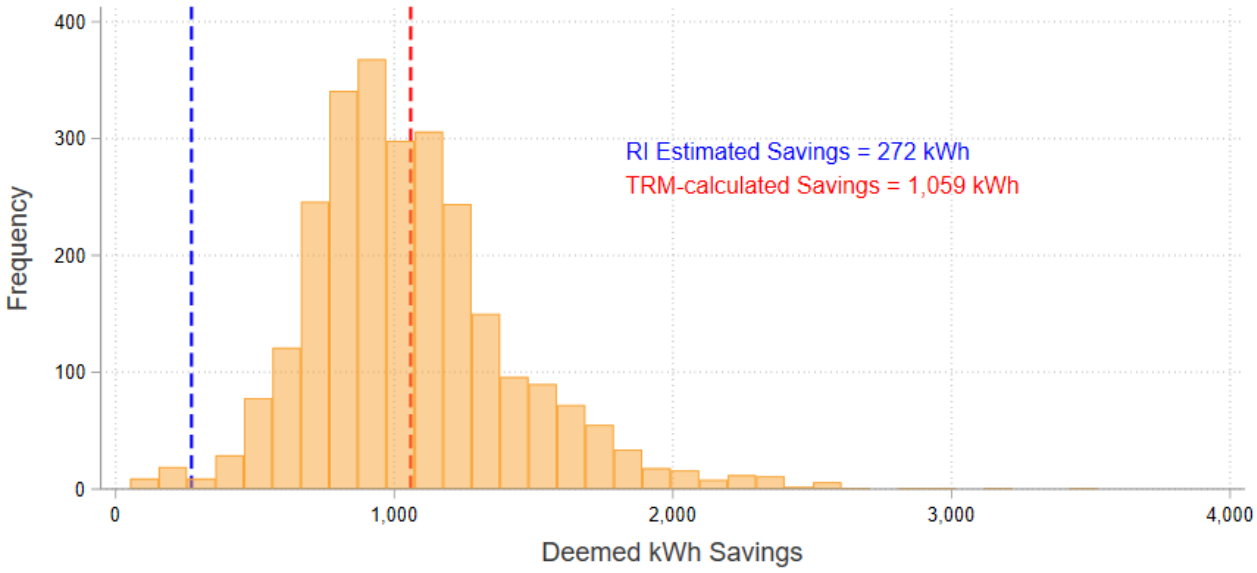
Figure 5-1: TRM-calculated kWh Savings - SF IHWAP



Similar histograms are shown in Figure 5-2 and Figure 5-3 for ComEd's MF IHWAP and CBA programs, respectively.

Figure 5-2: TRM-calculated kWh Savings - MF IHWAP

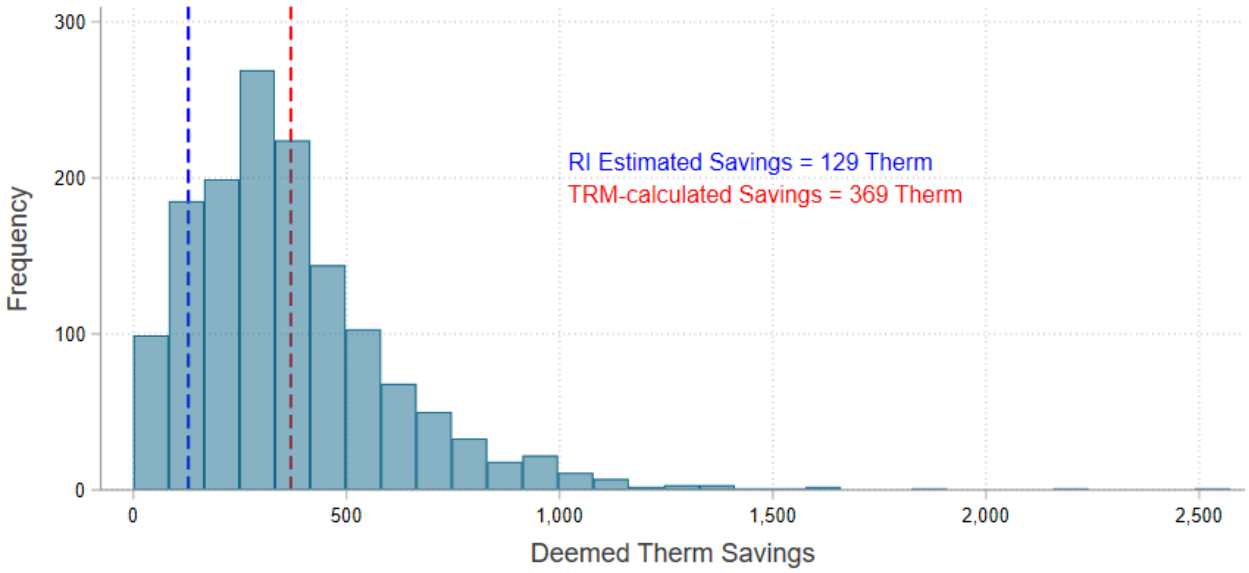
Figure 5-3: TRM-calculated kWh Savings - CBA Program



5.2. Nicor

Figure 5-4 shows the distribution of average per customer annual TRM-calculated Therm savings for customers participating in Nicor's SF IHWAP program (2018-2021). Two reference lines have been added to represent the average annual TRM-calculated savings of the population and the average savings found by the billing analysis.

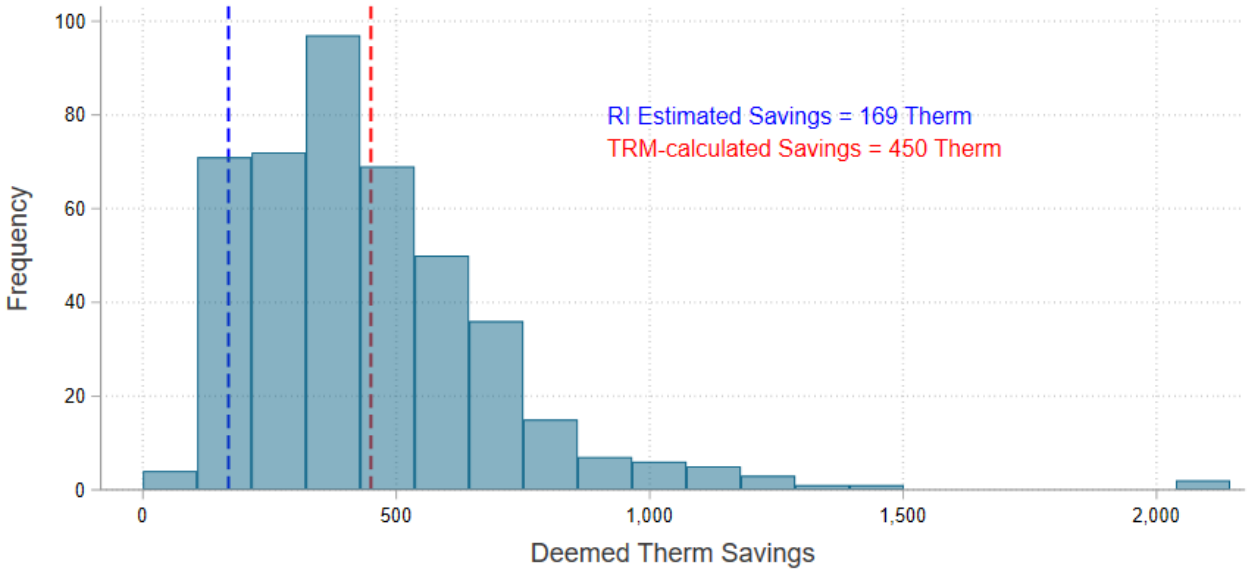
Figure 5-4: TRM-calculated Therm Savings - Nicor SF IHWAP



5.3. Peoples Gas - North Shore Gas

Figure 5-5 shows the distribution of average per customer annual TRM-calculated Therm savings for customers participating in PG-NSG's SF IHWAP program (2018-2021). Two reference lines have been added to represent the average annual TRM-calculated savings of the population and the average savings found by the billing analysis

Figure 5-5: TRM-calculated Therm Savings - PG-NSG SF IHWAP



Similar histograms are shown in Figure 5-6 and Figure 5-7 for PG-NSG's IEMS and CBA programs, respectively.

Figure 5-6: TRM-calculated Therm Savings - PG-NSG IEMS

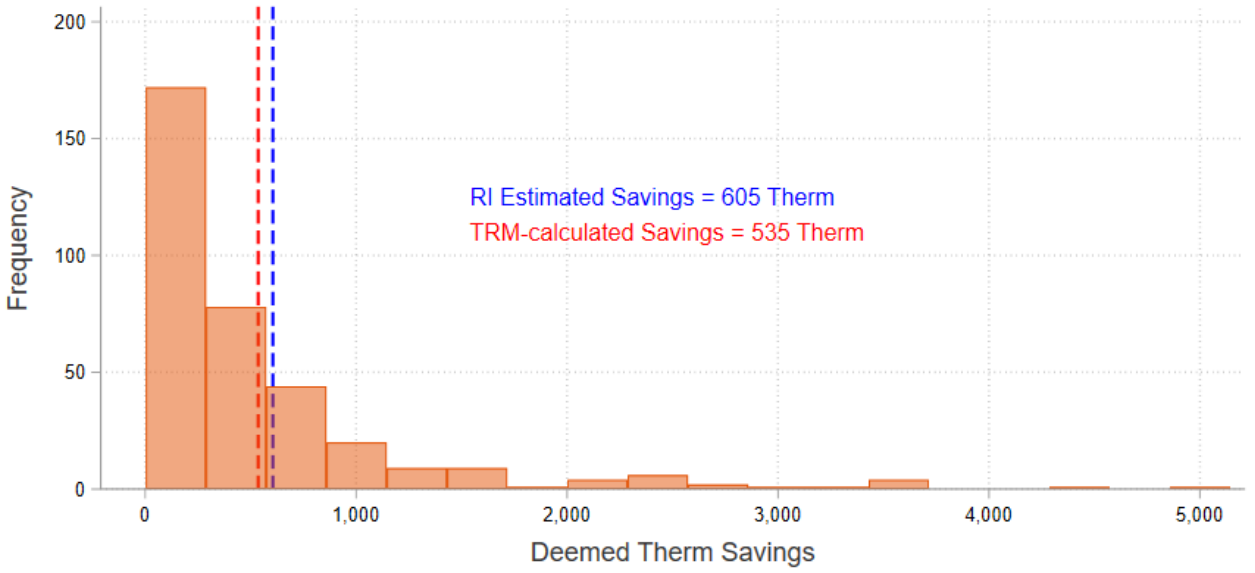
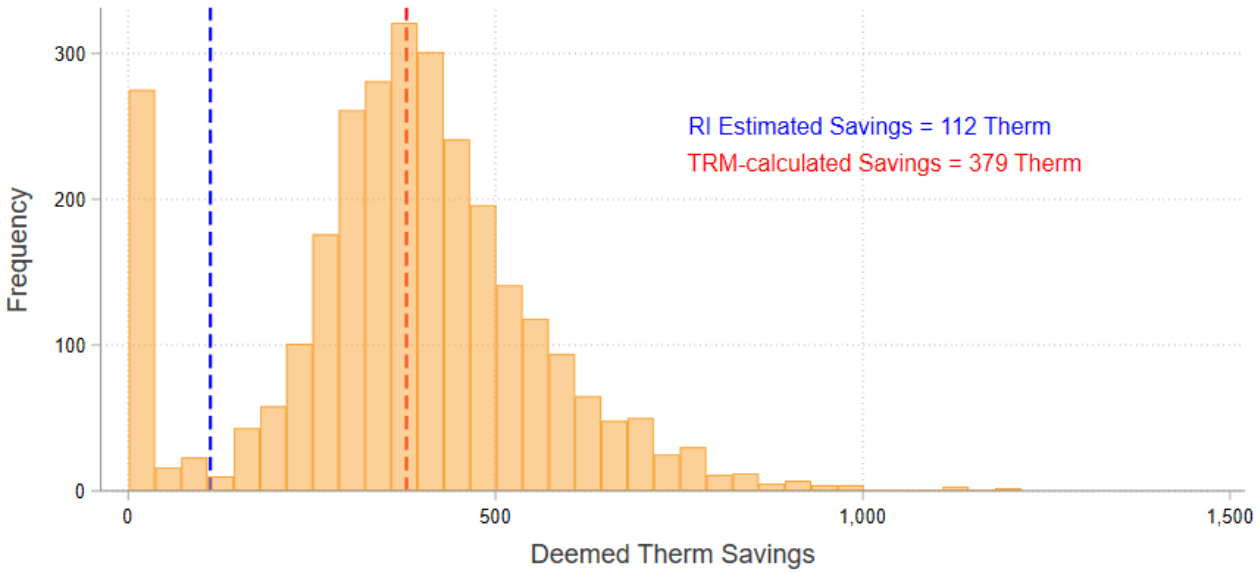


Figure 5-7: TRM-calculated Therm Savings - PG-NSG CBA Program



5.4. Program Benchmarking

RI performed secondary research to compile a list of similar programs that underwent measurement and verification (M&V) to estimate energy savings achieved by the programs. RI was intentional in identifying programs that target similar measures (i.e., weatherization-type retrofits) and populations

(i.e., income-eligible customers) as the programs analyzed under this study to provide a more apples-to-apples comparison.

Still, there are inherent challenges and considerations associated with aligning secondary sources for direct peer comparison of energy savings. For example, differences in geography can mean differences in customers' baseline energy usage behaviors, preferences for certain home efficiency interventions, and responsiveness to varying weather or market conditions. In addition, differences in primary data sources used and/or analysis methodologies on the part of the evaluator can potentially result in a range of estimated savings values. This comparison is not intended to reflect the accuracy or efficacy of the studies included; but rather to offer general insights on how the performance of the programs aligns with other estimated savings across the industry.

Table 5-2 provides a comparison of RI's estimated savings (kWh and Therm) to those from other programs that underwent M&V and are publicly available. RI was careful to select similar programs and, wherever possible, similar geographies to provide a more meaningful comparison.

Table 5-2: Program Savings Benchmarking Table

Utility	Program Name	State	Evaluator	Year	Measures Offered	Estimation Approach	kWh	Therm
Indiana (Statewide)	Indiana Weatherization Assistance Program	IN	Indiana Community Action Association	2017-2018	Audit Furnace Air Sealing Insulation	Billing Analysis	2,405	246
IESO	Energy Affordability Program	Ontario, CAN	NMR/Resource Innovations	2021	Audits Water savings measures Pipe Wrap Weatherization Energy Savings Kits	Engineering Analysis	1,665	n/a
IESO	Home Assistance Program	Ontario, CAN	NMR/Resource Innovations	2021	Audits Water savings measures Pipe Wrap Weatherization	Engineering Analysis	1,273	n/a
Nicor	**Income Eligible Multifamily Savings (IEMS)**	**IL**	**Resource Innovations**	**2018-2021**	**See Appendix A**	**Billing Analysis**	**n/a**	**605**
Mississippi Power Company (MPC)	EnergyWise Low-Income Energy Efficiency Program	MS	Synapse Energy Economics, Inc.	2016-2018	Lighting Attic/Floor Insulation Air Sealing HVAC replacement Tune-ups Water Heaters Showerheads Aerators	Billing Analysis	935	n/a
ComEd	**Multi-Family IHWAP**	**IL**	**Resource Innovations**	**2018-2021**	**See Appendix A**	**Billing Analysis**	**822**	**n/a**
DE DNREC	Weatherization Assistance Program (WAP)	DE	EcoMetric	2019	Air Sealing Insulation Duct Sealing Water Heating Measures	Billing Analysis	788	115
ComEd Nicor PG-NSG	**Single Family IHWAP**	**IL**	**Resource Innovations**	**2018-2021**	**See Appendix A**	**Billing Analysis**	**787**	**149**

Keyspan; Northern Utilities; Public Service of NH; NH Electric Cooperatives	New Hampshire Weatherization Program	NH	M. Blasnik & Associates	2005	Audit Insulation Air Sealing Duct Sealing Hot Water Saving Measures Lighting Refrigerator Replacement	Billing Analysis	741	191
ConEd NGRID NYSEG RG&E	HPwES EmPower	NY	NMR	2017-2018	Air Sealing Attic & Wall Insulation HVAC Lighting Pipe Wrap Refrigerators & Freezers Showerheads Thermostats Water Heating Measures	Billing Analysis	357	93
NIPSCO	Income Qualified Weatherization Program	IN	Illume	2021	Lighting (LED) Programmable Thermostat Aerators Showerheads Filter Whistle Pipe Wrap Water Heater Wrap Duct Sealing Refrigerator Air Sealing Insulation	Engineering Analysis	287	57
ComEd PG-NSG	**Chicago Bungalow Association Program**	**IL**	**Resource Innovations**	**2018-2021**	**See Appendix A**	**Billing Analysis**	**272**	**112**

6. Future Potential Savings Results

A key consideration when estimating future savings potential is that these programs are well-established and operate consistently both in terms of the customer population served and the collection of measures offered. Absent some fundamental change(s) to the programs, the expectation is that these programs will continue to achieve per customer and aggregate savings that are in line with the savings that have been achieved in recent years.

Another factor that must be considered, particularly when estimating future bill savings ($), is that those savings are a function not only of the change in energy consumption, but also the electricity and gas rates in place at the time of participation. Forecasting future rates that will be applied to customers energy bills is not feasible as part of this study and, therefore, the analysis was limited to the most recent data available. Due to those limitations, RI opted to estimate future savings for these programs using a rolling three-year average approach, where savings in future years are based on the program enrollment levels and achieved savings during the prior three years.

The future potential savings analysis focused only on the SF IHWAP and CBA programs since those were the only programs that achieved statistical significance for each of the utilities offering the program.

6.1. Single Family IHWAP

Figure 6-1 and Figure 6-2 show forecasted electric savings (kWh) and gas savings (Therms) for the SF IHWAP program for the future period 2022-2026.[5] The lighter colored bars to the right of each of the following graphics represent the forecasted savings for each future year, while the darker bars show achieved savings for each year of the study.

[5] ComEd's 2021 SF IHWAP participation is forecasted because 2021 program data was not provided to RI.

Figure 6-1: Forecasted Electric Savings (2022-2026) - SF IHWAP

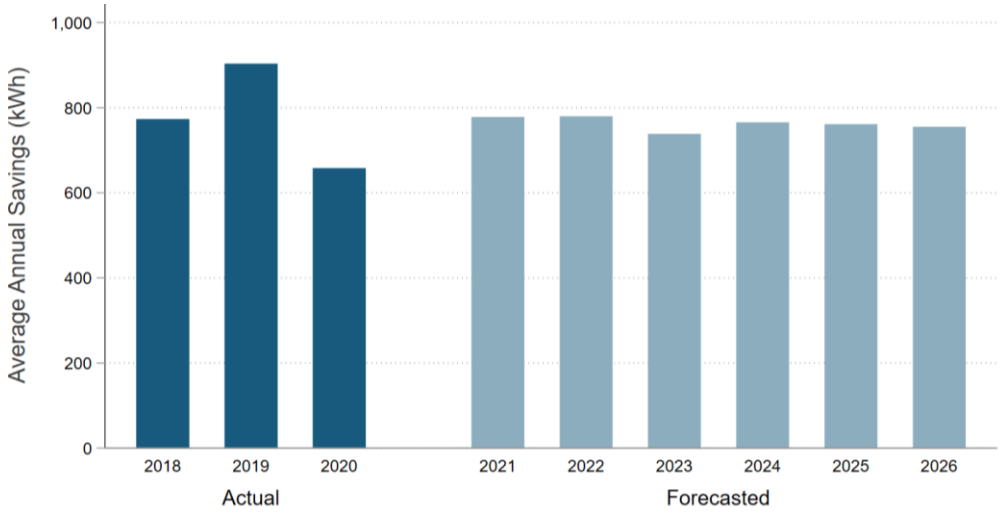


Figure 6-2: Forecasted Gas Savings (2022-2026) - SF IHWAP

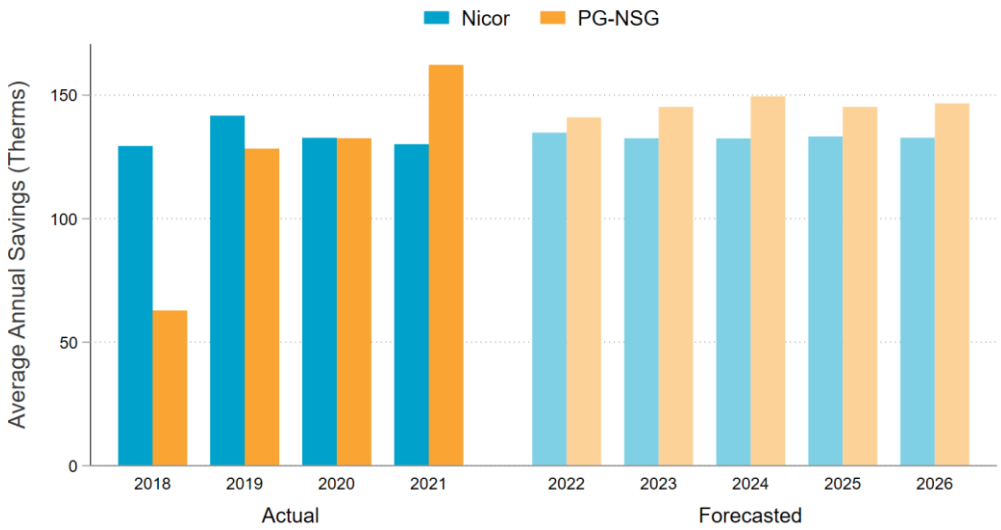
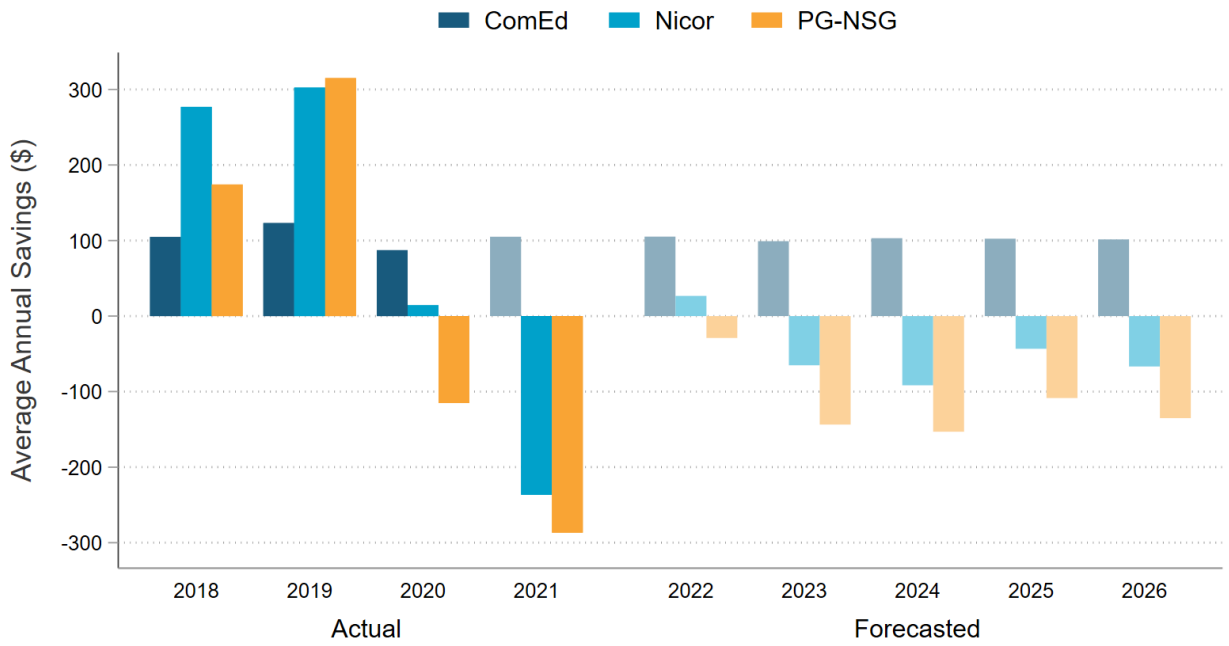


Figure 6-3 shows forecasted bill savings ($) for the SF IHWAP program by utility. As aforementioned, the predicted future gas savings are negative due to the fact that the most recent years under the study (2020-2021) showed negative bill savings (i.e. increases in customer bill amounts) because of the increasing gas rates in recent years. If gas rates decline in future years compared to current levels, bill savings would be expected to grow.

Figure 6-3: Forecasted Bill Savings (2022-2026) - SF IHWAP



6.2. Chicago Bungalow Association

The CBA program is forecasted to continue to provide consistent energy savings (kWh and Therms) as shown in Figure 6-4 and Figure 6-5 below.

Figure 6-4: Forecasted Electric Savings (2022-2026) - CBA

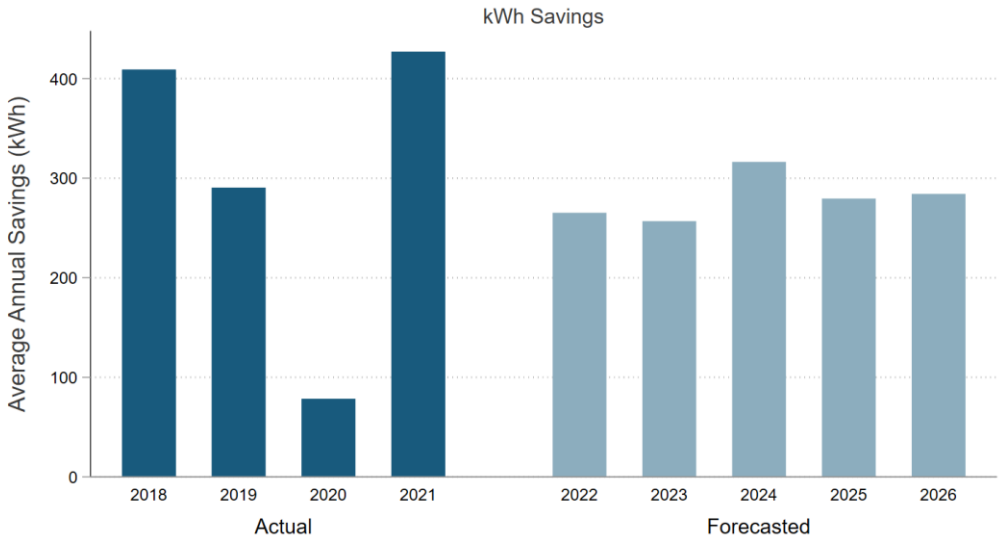
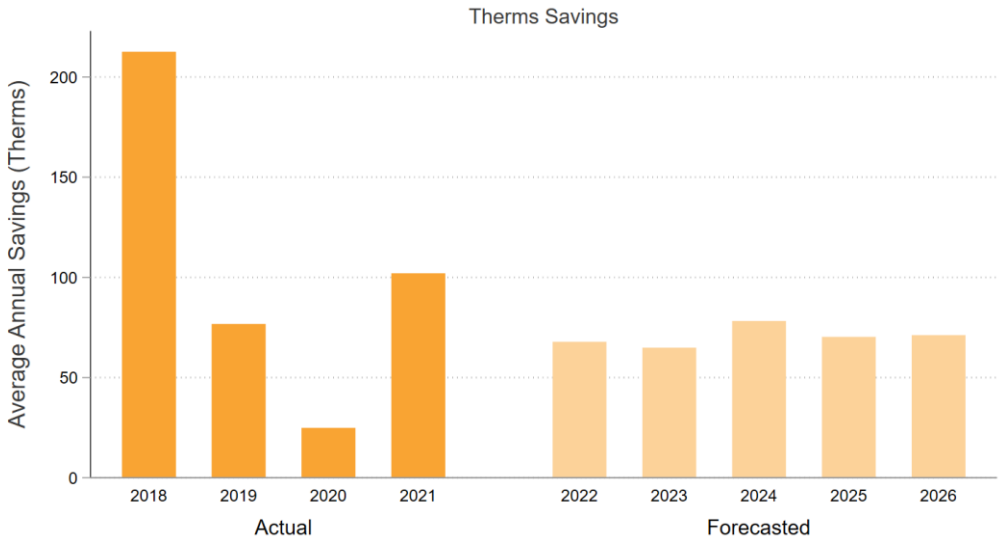
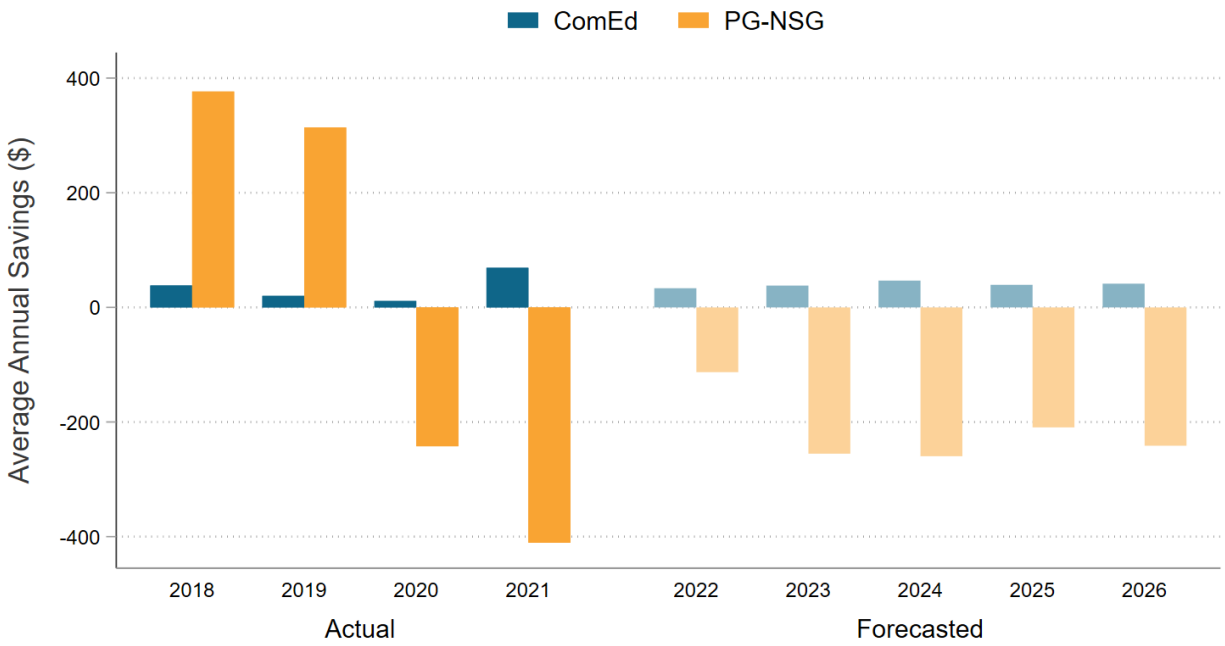


Figure 6-5: Forecasted Gas Savings (2022-2026) - CBA



Similar to SF IHWAP, the CBA program is expected to continue to provide positive bill savings for ComEd's electric customers, but shows negative future bill savings among PG-NSG's gas customers, primarily due to the high gas rates observed in recent years.

Figure 6-6: Forecasted Bill Savings (2022-2026) - CBA



6.3. Additional Measures for Consideration

Resource Innovations conducted a broad assessment of the measures offered through the programs included in this study with an aim to identify the potential for any additional measures to be considered for inclusion by the utilities. RI determined that collectively, these programs offer an extensive list of measure types that are well-suited for the target populations and appropriately focused on the program objectives. In the interest of being enhaustive, RI conducted a comparison of current program offerings to the IL TRM (v11) and RI's cultivated measure library to identify the following list of potential measures for consideration to be added to the program offerings.

- **Heat pump water heater** - provides efficient domestic water heating by moving heat between indoor air and a storage water heater
- **Triple pane windows** - reduces heat loss through building envelope by adding a third pane of glass
- **Thermostatic restrictor shower valve** - valve installed to showers that restrict hot water flow through the showerhead once the water temperature reaches a certain setpoint
- **Water heater thermostat setback** - reduce standby heat losses by turning down the hot water temperature setpoint on the domestic hot water heater
- **Energy Star doors** - similar to windows, reduce heat loss by installing doors with multiple glass panes, improved core materials and air-tight frames
- **Green roof** - reduce building heating and cooling costs by installed vegetated roof systems that absorb heat and manage stormwater

7. Conclusions and Recommendations

7.1. Key Findings

Key findings for the savings analyses include:

- Certain programs offered under each utility were not able to produce statistically significant savings results through billing analysis due to low participation.
- All programs with sufficient participation for analysis showed significant annual energy savings (kWh or Therms) among program participants.
- Likewise, programs with adequate participation also showed bill savings ($) for their participants; however, unlike energy savings, these results are subject to changes in electricity and gas rates and, therefore, showed more variation year-to-year.
- In general, savings for these programs followed expected seasonal trends, where achieved savings were greatest during months of higher energy consumption.
- Programs of this type, which predominantly offer bundles of low-cost, "as needed" weatherization measures, are difficult to increase savings without significant participation growth, greater customer recruitment, and/or expanded suite of high-impact measure offerings.
- Research conducted on outside jurisdictions overwhelmingly revealed that utilities do not communicate expected bill savings to customers as an enticement to enroll in efficiency programs, nor do they provide post-treatment bill impact reports due to a myriad of risk exposure reasons.
- One possible method to provide post-treatment bill savings analysis, without the risk of individualized reports, is through online software designed to share energy usage information that can be provided with online accounts. However, while they can be effective resources for tracking utility bills and usage trends, such tools rely on the motivations and actions of the customer. To help drive awareness and engagement with these tools where they exist, utilities may consider promoting them to customers through targeted marketing.
- For multi-family buildings, providing an estimate of energy and bill savings seems to help building owners decide whether they want to participate in the program. If it is emphasized that these are *estimates only*, providing the estimate report seems to be an accepted method across utilities to drive participation in their programs that may be applied in the single-family sector.

Appendix A Measures Enrolled by Program

Program	ComEd	Nicor Gas	PG-NSG
SF IHWAP	Aerator Air Conditioner Air Sealing Air Source Heat Pump Bathroom Aerator Boiler Custom Duct Sealing ECM Exhaust Fan Freezer Furnace Insulation LED Pipe Insulation Power Strip Refrigerator Service Showerhead Tank Wrap Thermostat Water Heater	Air Sealing Bathroom Aerator Boiler Furnace Insulation Kitchen Aerator Pipe Insulation Service Showerhead Thermostat Water Heater	Aerator Air Sealing Basement/Sidewall Insulation Boiler Custom Measure Duct Sealing Floor Insulation Furnace Furnace Tune-Up Health & Safety Natural Gas Water Heater Pipe Insulation Programmable Thermostat Rim Joist Insulation Showerhead Thermostat Wall + Ceiling Attic Insulation
MF IHWAP	Aerator Air Conditioner Air Sealing Bathroom Aerator Custom Duct Sealing Exhaust Fan Freezer Furnace Insulation LED Pipe Insulation Refrigerator Service Showerhead Thermostat Water Heater	Air Sealing Bathroom Aerator Custom Furnace Insulation Kitchen Aerator Pipe Insulation Showerhead Thermostat Water Heater	Aerator Air Sealing Custom Measure Furnace Furnace Tune-Up Health & Safety Natural Gas Water Heater Pipe Insulation Showerhead Thermostat Wall + Ceiling Attic Insulation

Program	ComEd	Nicor Gas	PG-NSG
IEMS	Aerator Air Conditioner Air Sealing Blower Boiler Boiler Tune-Up Controls Door Sweep Furnace Insulation LED Lighting Packaged HP Pipe Insulation Refrigerator Sensors Showerhead Smart Strip Steam Trap Thermostat	Program not offered by Nicor Gas	Air Sealing Air Sealing + Attic Insulation Attic Insulation Basement/Sidewall Insulation Bathroom Aerator Boiler Boiler Tune-Up Furnace CAP Health & Safety Hydronic Boiler - Tier 1 Hydronic Boiler - Tier 2 Kitchen Aerator LED Pipe Insulation Power Strip Programmable Thermostat Pump Control Service Shower Timer Showerhead Showerhead - Handheld Smart Thermostat Steam Boiler Steam Controls Steam Trap Vending Wall Insulation
PHES	Aerator Air Conditioner Air Sealing Blower Boiler Custom Door Sweep Furnace Insulation LED Lighting Refrigerator Sensors Showerhead Smart Strip Steam Trap Thermostat VSD	Air Sealing Bathroom Aerator Boiler Furnace Insulation Kitchen Aerator Service Shower Timer Showerhead Thermostat Water Heater	Air Sealing Bathroom Aerator Boiler Tune-Up Kitchen Aerator Programmable Thermostat Service Showerhead Showerhead - Handheld Steam Trap

Program	ComEd	Nicor Gas	PG-NSG
CBA / SFIE	Air Sealing Air Sealing + Attic Insulation Attic Insulation Bathroom Aerator Bathroom Exhaust Fan Chimney Liner Co Detector Corroded Flue Floor Insulation Foundation Insulation Health & Safety Heating System Tune-Up Kitchen Aerator Light Box Pipe Insulation Programmable Thermostat Rim Joist Insulation Service Showerhead Showerhead - Handheld Smart Thermostat Vent - Passive Door Vent - Powered Vent - Static Roof Wall Insulation Wall Repair	Program not offered by Nicor Gas	Air Sealing Air Sealing + Attic Insulation Attic Insulation Bathroom Aerator Bathroom Exhaust Fan Chimney Liner Co Detector Corroded Flue Floor Insulation Foundation Insulation Health & Safety Heating System Tune-Up Kitchen Aerator Light Box Pipe Insulation Programmable Thermostat Rim Joist Insulation Service Showerhead Showerhead - Handheld Smart Thermostat Vent - Passive Door Vent - Powered Vent - Static Roof Wall Insulation Wall Repair