Opinion Dynamics

Boston | Headquarters

617 492 1400 tel
617 497 7944 fax
800 966 1254 toll free

1000 Winter St
Waltham, MA 02451

Impact and Process Evaluation of 2016 (PY9) Illinois Power Agency Rural Efficiency Kits Program

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CADMUS

NAVIGANT

MichaelsEnergy

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Contributors

Jane Colby
Principal, Cadmus

Sara Wist
Associate, Cadmus

Jeana Swedenburg
Senior Associate, Cadmus

Andrew Carollo
Associate, Cadmus

Kari Heinrich
Senior Analyst, Cadmus

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1. Executive Summary

This report presents results from the Program Year 9 (PY9) Residential Rural Efficiency Kits (Rural Kits) Program—one of seven stand-alone Illinois Power Agency (IPA) energy efficiency programs, implemented from June 2016 to May 2017. PY9 represents the fourth full year of operation for the Rural Kits Program.[1] Since PY8, Leidos Engineering (Leidos) has provided program oversight on behalf of Ameren Illinois Company (AIC). CLEAResult has been the program implementer since PY6 (June 1, 2013–May 31, 2014).

In PY9, CLEAResult distributed 19,085 kits containing energy-efficient items via direct mail to unsolicited residential customers targeted for their higher energy use and residences in rural areas. The kits contained CFLs, faucet aerators, and shower heads, along with instructional materials to help customers properly set back their water heater temperatures. CLEAResult administers a follow-up survey to a sample of kit recipients to assess satisfaction with kit contents and interest in reducing energy consumption through other IPA and AIC programs. The program sought to increase sales and awareness of ENERGY STAR®-qualified lighting products and to increase awareness of and drive participation in other IPA and AIC program offerings.

Program Impacts

Table 1 summarizes the PY9 Rural Kits Program's gross and net energy and demand savings (4,892 MWh and 1.246 MW, respectively). To determine PY9 gross savings and net realization rates, the evaluation team applied deemed per-unit gross savings inputs, set forth in the Illinois Statewide Technical Reference Manual (IL-TRM) Version 5.0 (V5.0), in combination with the following:

- PY7 Rural Kits Program installation rate for the hot water temperature card thermometer[2] and electric water heater saturations, derived from PY7 participant survey results[3]
- Application of Stakeholder Advisory Group's (SAG) approved net-to-gross ratio (NTGR) for this program (derived from AIC's IPA filing from Docket 12-0544)
- Additionally, for PY9,[4] net savings for delayed CFL installations attributed from the PY8 and PY7 Rural Kits Program

As a result, the program achieved the gross and net savings shown in Table 1.[5]

[1] CLEAResult implemented the Rural Kits Program for the first time in PY6 (June 1, 2013–May 31, 2014). During PY6, CLEAResult offered the Rural Kits Program as a component of the Residential Energy Efficiency Kits Program (EEKits), which included a school-based delivery channel and a direct mail delivery channel. At the conclusion of PY6, Ameren Illinois Company (AIC) launched the School Kits Program as part of its ActOnEnergy portfolio of energy efficiency programs and the Rural Kits Program remained an IPA program.

[2] The IL-TRM V5.0 does not specify ISR values for the hot water temperature card thermometer. Both the implementer and the evaluation team used a 10% ISR, derived from PY7 Rural Kits Program participant survey results.

[3] The PY7 participant survey is the most recent survey the evaluation team conducted for this program.

[4] PY7 and PY8 Rural Kits Program participants' 14-watt and 23-watt CFLs, estimated as installed during PY9 (in accordance with IL-TRM V2.0 for PY7 and IL-TRM V4.0 for PY8), are credited to final PY9 Rural Kits Program net impacts.

[5] While this report seeks to summarize IPA program electric savings, the Rural Kits Program achieved some gas savings due to participants with natural gas water heating. This report's Appendix B presents those savings.

Table 1. PY9 Gross and Net Rural Kits Program Impacts

	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Initial PY9 Ex Post Net Savings	PY7 Ex Post CFL Net Savings Realized in PY9	PY8 Ex Post CFL Net Savings Realized in PY9	PY9 Ex Post Net Savings
Energy Savings (MWh)								
Total MWh	5,730	90%	5,154	0.860	4,431	179	282	4,892
Demand Savings (MW)								
Total MW	1.281	96%	1.230	0.974	1.199	0.019	0.028	1.246

Note: Totals may not sum due to rounding.

Key Findings and Recommendations

As determined through the evaluation team's process review, utility and implementation staff reported high satisfaction levels with program performance in PY9. These stakeholders reported that the program was successful. Over PY8 and PY9, CLEAResult exceeded the two-year, 40,000-kit distribution goal, distributing 21,484 kits in PY8 and 19,085 kits in PY9. In the fourth year of operation, program staff focused their participant selection efforts on high-energy use homeowners within "rural" zip codes. The evaluation team identified improvement opportunities and recommends considering the following actions:

- **Key Finding #1:** Due to effective communication among stakeholders and the simplicity of the program design, the program operated smoothly. A few participants, however, reported confusion with receiving an unsolicited kit, and participants indicated less satisfaction with kit contents in PY9 than in PY8. According to the implementer-administered survey, kit satisfaction ratings decreased from 4.6 out of 5 in PY8 to 4.0 in PY9. More PY9 respondents (20%) were not satisfied with at least one measure than in PY8 (5%).
  - **Recommendation:** Consider implementing future kit programs using an opt-in design. Shifting from an unsolicited kit delivery mechanism to a design that requires program staff to recruit participants may require more administrative costs, but it also may result in increased satisfaction, and possibly increased installation rates. Use low-cost recruitment efforts (e.g., mailings, electronic promotions) while encouraging participant buy-in. Consider offering participants options in choosing kit measures (e.g., LEDs, alternate-sized aerators, hand-held shower heads).
- **Key Finding #2:** Program staff could not measure the program's marketing effectiveness at increasing participation in other energy efficiency programs or driving traffic to AIC's website.
  - **Recommendation:** In future kit programs, implement a method to gauge whether kits influence recipients' participation in other energy efficiency programs. For example, include a customized URL on the marketing materials to track Rural Kits Program-generated traffic to AIC's website. The program could also consider including a coupon or discount code in the kit, offering a free or discounted Home Efficiency Program energy audit. The coupon or discount code would record customer cross-participation and help homeowners explore opportunities with minimal or no initial investment. The program also could send customized URLs to implementer-surveyed customers who express interest in additional ways to save energy but declined direct energy efficiency specialist follow-up.
- **Key Finding #3:** The program's implementer did not calculate separate savings estimates for different aerator types, instead using IL-TRM V5.0 inputs associated with an "unknown" aerator type, thus

overestimating bathroom faucet aerator savings and underestimating kitchen faucet aerator savings. This error has been noted in the four prior program evaluations. Correcting this calculation would produce more accurate estimates of aerator savings.

- **Recommendation:** Calculate separate ex ante per-unit savings for bathroom faucet aerators and kitchen faucet aerators.

- **Key Finding #4:** The implementer provided ex ante savings calculations estimates for a 14-watt CFL, while the program distributed a 13-watt CFL.

  - **Recommendation:** Calculate ex ante per-unit savings using actual wattages and specifications of distributed kit measures.

2. Evaluation Approach

The PY9 Rural Kits Program assessment included the process and impact research objectives, evaluation tasks, and identified potential sources of error, which are outlined in the following sections.

2.1 Research Objectives

The PY9 Rural Kits impact evaluation sought to provide estimates of gross and net electricity savings associated with the program.[6] The impact evaluation researched the following questions:

1. How many kits did the program distribute?
2. What estimated gross energy and demand impacts did the program produce?
3. What estimated net energy and demand impacts did the program produce?

A limited process evaluation investigated how the program performed, focusing on the following questions:

1. What, if any, implementation changes or challenges occurred in PY9?
2. Did the program operate effectively?
3. How was the program marketed?
4. What quality assurance and quality control processes did the program have in place? Were these processes sufficient to ensure that the program used high-quality products and that customers installed the program's measures?
5. What program changes could improve the program's effectiveness?

2.2 Evaluation Tasks

Table 2 summarizes PY9 evaluation activities conducted for the Rural Kits Program.

Table 2. PY9 Rural Kits Program Evaluation Methods

Activity	PY9 Process	PY9 Impact	Forward Looking	Details
Program Staff In-Depth Interviews	✓			Interviewed four program and implementation staff to gain insights into the program's design and delivery
Review of Program Materials and Data	✓			Reviewed the implementation plan, program materials, and instructional materials
Impact Analysis: Database Analysis	✓	✓	✓	Summarized database information to determine participation, key program statistics, savings, and delayed CFL installations credited to future program years

[6] The team allocated 14-watt delayed CFL installations and heating penalty savings from PY8 and PY7 (realized in PY9) to the 13-watt CFL line item in this report's PY9 reporting tables. Appendix B presents those savings.

2.2.1 Program Staff Interviews

The evaluation team interviewed four AIC and program staff members who managed, marketed, and delivered the program. Table 3 lists program stakeholders interviewed to assess the program's design, implementation, communications, strengths, and weaknesses.

Table 3. Program Staff Interviews

Company	Number of Staff Interviewed
AIC	1
Leidos	1
CLEAResult	2

2.2.2 Review of Program Materials and Data

The team conducted a review of the following materials to understand the program's performance in PY9 and document any key changes from previous program years:

- The program database
- Program marketing and outreach collateral
- Implementation plans
- Implementer participant survey responses

2.2.3 Impact Analysis

Gross Impacts

The team used the program's tracking database to verify the reported distribution of kits and—in combination with PY7 participant survey results—to apply IL-TRM V5.0's per-unit gross savings inputs in estimating gross electric savings values for program measures. To estimate water heater electric energy savings associated with the program, the team applied an 87% electric water heater saturation rate (determined through the PY7 participant survey) to verified energy kit measure. Table 4 lists ex post, per-unit, gross electric savings.

Table 4. PY9 Rural Kits Program Ex Post Gross Electric Savings—Per Unit Installed

Measure	Gross kWh	Gross kW
13-watt CFL	24.1	0.002
20-watt CFL	26.5	0.003
23-watt CFL	39.4	0.004
1.0 Gallon per Minute (GPM) Bath Faucet Aerator	17.0	0.027
2.0 GPM Kitchen Faucet Aerator	137.6	0.032
1.75 GPM High-Efficiency Shower Head	171.6	0.018
Hot Water Temperature Card Thermometer	81.6	0.009

By applying a 13% gas water-heating saturation (determined through the PY7 participant survey) to verified installations, the team produced estimated gross gas energy savings associated with the program, as shown in Table 5. The team used IL-TRM V5.0, deemed, per-unit gross gas savings inputs for program measures to calculate the gross gas savings, as detailed in Appendix B.

Table 5. PY9 Rural Kits Ex Post Gross Gas Savings—Per Unit Installed

Measure	Gross Therms
1.0 GPM Bath Faucet Aerator	0.7
2.0 GPM Kitchen Faucet Aerator	5.9
1.75 GPM High-Efficiency Shower Head	7.3
Hot Water Temperature Card Thermometer	3.5

Net Impacts

The evaluation team applied NTGRs, approved by the Illinois SAG, to PY9 program savings. Table 6 summarizes NTGRs used in the net impact analysis. Applying the NTGRs to the Rural Kits Program resulted in overall, savings-weighted PY9 NTGRs of 0.860 for kWh, 0.974 for kW, and 0.879 for therms.

Table 6. SAG-Approved PY9 NTGRs

Measure Type	Electric NTGR	Gas NTGR
13-watt CFL	0.63	N/A
20-watt CFL	0.54	N/A
23-watt CFL	0.54	N/A
1.0 GPM Bath Faucet Aerator	1.08	0.99
2.0 GPM Kitchen Faucet Aerator	0.99	0.90
1.75 GPM High-Efficiency Shower Head	0.92	0.83
Hot Water Temperature Card Thermometer	1.13	1.04

Table 7 lists the following: ex post, per-unit, gross electric savings; SAG-approved NTGRs; and ex post net electric savings values.

Table 7. PY9 Rural Kits Program Ex Post Net Electric Savings—Per Unit Installed

Measure	Gross kWh	Gross kW	NTGR	Net kWh	Net kW
13-watt CFL	24.1	0.002	0.63	15.2	0.001
20-watt CFL	26.5	0.003	0.54	14.3	0.001
23-watt CFL	39.4	0.004	0.54	21.3	0.002
1.0 GPM Bath Faucet Aerator	17.0	0.027	1.08	18.4	0.029
2.0 GPM Kitchen Faucet Aerator	137.6	0.032	0.99	136.2	0.032
1.75 GPM High-Efficiency Shower Head	171.6	0.018	0.92	157.9	0.017
Hot Water Temperature Card Thermometer	81.6	0.009	1.13	92.2	0.011

Table 8 lists the following: ex post, per-unit, gross gas savings; SAG-approved NTGRs; and ex post net gas savings values.

Table 8. PY9 Rural Kits Ex Post Net Gas Savings—Per Unit

Measure	Gross Therms	NTGR	Net Therms
1.0 GPM Bath Faucet Aerator	0.7	0.99	0.7
2.0 GPM Kitchen Faucet Aerator	5.9	0.90	5.3
1.75 GPM High-Efficiency Shower Head	7.3	0.83	6.1
Hot Water Temperature Card Thermometer	3.5	1.04	3.6

2.3 Sources and Mitigation of Error

Table 9 summarizes possible error sources associated with data collection conducted for the Rural Kits Program. Detailed discussions follow for each item.

Table 9. Possible Sources of Error

Research Task	Survey Error		Non-Survey Error
	Sampling Error	Non-Sampling Error	
Participant Surveys[a]	Yes	Non-response bias	N/A
Gross Impact Calculations	N/A	N/A	Data processing error
Net Impact Calculations	N/A	N/A	Data processing error

[a] Survey designed and data collected by the implementer, not the evaluator.

Throughout planning and implementing the PY9 evaluation, the evaluation team took a number of steps to mitigate potential error sources.

Survey Error

- **Implementer-Administered Phone-Based Participant Survey:** The implementer designed the survey sample to achieve relative precision of 10% or better at 90% confidence. To mitigate non-response bias, the implementer conducted the surveys using a random sample of 1,000 participants, rather than calling down their complete participant list. The implementer received responses from 153 households, a 15% survey response rate.

Non-Survey Error

- **Data Processing Errors:** The team applied deemed savings values to participant data in the tracking database to calculate gross impacts. The team also applied the deemed NTGRs to estimate the program's net impacts. To minimize data processing errors, different team members reviewed all calculations, verifying the calculations' accuracy.

3. Detailed Evaluation Findings

3.1 Program Description

The Rural Kits Program, first offered in PY6, provided unsolicited, direct-mail energy efficiency kits to rural residential customers. The program sought to serve rural, high energy-use homeowners who may not have access to the energy-efficient products typically available at big box stores in more urban settings.

As shown in Table 10, program kits included an array of efficient products, instructions for properly setting back a customer's water heater temperature, and a brochure on energy-saving opportunities available through other IPA and AIC programs. Due to product availability changes, CLEAResult revised the kit's contents in PY9, from two 14-watt CFLs to two 13-watt CFLs.

Table 10. PY9 Rural Kit Products

Product	Quantity per Kit
13-watt CFL	2
20-watt CFL	1
23-watt CFL	1
1.0 GPM Bath Faucet Aerator	2
2.0 GPM Kitchen Faucet Aerator	1
1.75 GPM High-Efficiency Shower Head	1
Hot Water Temperature Card Thermometer	1
Instructional Materials	N/A

CLEAResult and Energy Federation Incorporated (EFI) delivered the program under CLEAResult's management. EFI mailed branded kits and marketing materials directly to customers, drawn from lists created and screened by CLEAResult to target rural, high energy-use households. To ensure participant overlap did not occur between programs, CLEAResult cross-referenced the customer list with AM Conservation's Moderate Income Customer Kits Program list prior to delivering kits to households. CLEAResult reported delivery activities and results to Leidos. Greater detail follows regarding program operations.

3.2 Process Findings

3.2.1 Program Operations

Leidos provided oversight for the program, serving as the contact point for day-to-day operational activities, process issues, and program status tracking. CLEAResult's program manager was responsible for program implementation and for reporting activities to Leidos. A CLEAResult data manager produced a list of rural customers predicted to have electric space heat, based on annual kWh consumption. CLEAResult used available customer demographic data (described in Section 3.2.4) to select about 19,000 kit recipients. As noted, CLEAResult cross-referenced its targeted customer list with AM Conservation's Moderate Income Customer Kits Program list to avoid potential overlap between the kit programs' targeted recipients. CLEAResult sent participant lists to EFI for kit distribution, and EFI printed the marketing materials, assembled the kits, and shipped them to selected customers after verifying the customer names and addresses remained

the same, per the National Change of Address Database.[7] The implementer credited returned kits to the program's budget monthly.

Due to a contractual delay, CLEAResult and EFI consolidated kit shipments that the team expected to deliver in early PY9 into one shipment in November 2016. EFI also completed one shipment in February 2017 and a final shipment in March 2017.

3.2.2 Marketing and Outreach

With AIC's input, CLEAResult developed the marketing materials contained in the kit, including a label affixed to the kit's packaging and an insert that provided installation instructions and descriptions of the kit's contents. Although the program aimed to increase awareness of other programs, and the marketing insert provided summaries of other IPA and AIC programs available to residential customers, materials did not include program-specific (i.e., vanity) URLs or discount codes to assist staff with tracking conversions.

AIC staff reported that the team made some connections with the Illinois Environmental Protection Agency to help customers stay informed of proper CFL disposal methods.[8]

CLEAResult updated the program-level information in the program's brochure with AIC's changes to the residential programs offered in PY9 and to the Rural Kit program's kit contents. The program implementer did not make other changes or additions to the kit's materials in PY9.

Through part of its participant follow-up survey, CLEAResult tracked participant requests for more information about AIC's other energy efficiency programs (23% said they were interested), but while interest existed in obtaining materials with more information about saving energy, all of these respondents declined the offers to talk to an energy efficiency specialist beyond the initial follow-up call.

3.2.3 Program Goals

Over PY8 and PY9, CLEAResult exceeded the two-year, 40,000-kit distribution goal (stated in the PY9 Implementation Plan),[9] distributing 21,484 kits in PY8 and 19,085 kits in PY9. CLEAResult met the goal within its allotted program budget.

3.2.4 Screening and Participant Selection

CLEAResult determined which households would receive a kit by reviewing residential AIC electric accounts and selecting those meeting the following characteristics:

- Owner-occupied, single-family home within a rural zip code
- An electric heating load greater than 5,000 kWh and less than 40,000 kWh (to identify homes with electric heat and, consequently, a higher likelihood of electric water heating)
- No prior participation in a direct-install program (e.g., CFLs, shower heads) in the last three years

[7] Available online at http://www.nationalchangeofaddress.com.

[8] Available online at http://www.epa.illinois.gov/topics/waste-management/mercury/cfls/index.

[9] CLEAResult's PY9 Implementation Plan: *2016 Ameren Illinois IPA Programs Rural Efficiency Kits Program PY9 Implementation Plan*.

- Did not receive a kit from the Moderate Income Customer Kit Program in PY8 or PY9
- Did not receive a kit since the inception of the Rural Kits program in PY6

In PY9, CLEAResult changed how it defined whether a potential participant should be considered "rural" and therefore a program candidate. Prior to PY9, CLEAResult identified rural customers as those with zip codes outside of city centers. In PY9, CLEAResult identified rural customers as those with zip codes outside of city centers and with populations below 1,000 people per square mile (using the U.S. Census Bureau's population density data). CLEAResult said this criteria and the other housing characteristics restricted the list to an extent that it could no longer refine the selection with additional customer data used in the past (e.g., demographic, segmentation, participation [propensity] information).

Rather than calling down the participant list until reaching the survey quota (as done in PY8), CLEAResult reported selecting the sample of participants at random during PY9. The evaluation team reviewed these survey results for satisfaction with the kit measures and interest in receiving more information from program staff about energy efficiency.

The CLEAResult-administered survey asked respondents to rate their overall satisfaction with products in the kit using a five-point scale (where 1 was "very unsatisfied" and 5 was "very satisfied"). PY9 respondents rated their satisfaction with the kit's contents at an average of 4.0, significantly lower than PY8 respondents' 4.6 rating.[10]

To assess participant satisfaction with specific kit contents, CLEAResult asked respondents whether they were "less than satisfied" with any of the products. One-fifth of PY9 respondents (20%, n=152) mentioned dissatisfaction with at least one measure, compared to 5% of PY8 respondents (n=279). The evaluation team compared PY8 and PY9 respondents' mentions of CFLs, water-saving measures, and the water heater temperature card. Of those mentioning any measure, 32% of PY9 respondents (n=31) reported being less-than-satisfied with CFLs, a finding similar to PY8's responses (40% mentioned CFLs, n=15). Twenty-nine percent of PY9 respondents (n=31) said they were less-than-satisfied with both the aerators and shower heads, while 26% cited dissatisfaction with the aerators, 10% with the shower head, and 3% with the water heater temperature card.

PY9 respondents who mentioned being dissatisfied with CFLs said they preferred LEDs, while PY8 respondents mentioned particular concerns with CFL brightness, the amount of time required for the bulbs to become bright, and the bulb life. The primary reasons for lower satisfaction with water-saving measures arose from water pressure and issues with the product fitting the fixture.

Fewer PY9 respondents (23%, n=153) reported interest in learning about more ways to save energy and money than in PY8 (53%, n=279).[11] As CLEAResult changed its sampling strategy in PY9 to limit nonresponse bias, it is difficult to determine whether these changes reflected substantive differences in participants' perception of products offered or their future interest in AIC programs.

In following up on the survey, CLEAResult contacted customers identified as "interested in learning more ways to save energy and money" by phone, seeking to recruit them for an audit through the Home Performance with ENERGY STAR Program or to participate in other IPA or AIC energy efficiency programs. Similar to PY8 findings, the implementer reported that survey phone calls did not result in any kit recipients agreeing to pursue Home

[10] $p < 0.05$ at 95% confidence using a t-test for the difference in proportions.

[11] $p \leq 0.01$ at 99% confidence using a binomial t-test.

Performance with ENERGY STAR program audits, though CLEAResult did not track kit recipients' participation in other energy efficiency programs.

3.3 Impact Assessment

3.3.1 Gross Impacts

The evaluation team used the IL-TRM V5.0 estimates for kit item installation rates, except for the hot water temperature card thermometer measure (which, as discussed earlier, used the PY7 participant survey results). Table 11 lists reported ex ante and evaluated ex post installation rates for each kit measure used in the electric and gas savings calculations.[12] The implementer's ex ante savings calculations used installation rates derived from the IL-TRM V5.0 and evaluated values from the PY7 Rural Kits Program Evaluation Report.

Table 11. PY9 Rural Kits Program Installation Rates

Measure	Reported Ex Ante Installation Rate	Evaluated Ex Post Installation Rate
13-watt CFL	66%	66%
20-watt CFL	66%	66%
23-watt CFL	66%	66%
1.0 GPM Bath Faucet Aerator	60%	63%
2.0 GPM Kitchen Faucet Aerator	60%	60%
1.75 GPM High-Efficiency Shower Head	65%	65%
Hot Water Temperature Card Thermometer	10%	10%

Table 12 lists reported ex ante and evaluated ex post per-unit electric savings.

Table 12. PY9 Rural Kits Program Ex Ante and Ex Post Per-Unit Electric Savings

Measure	Reported Ex Ante Gross kWh	Evaluated Ex Post Gross kWh	Reported Ex Ante Gross kW	Evaluated Ex Post Gross kW
13-watt CFL	26.0	24.1	0.003	0.002
20-watt CFL	29.6	26.5	0.003	0.003
23-watt CFL	44.0	39.4	0.004	0.004
1.0 GPM Bath Faucet Aerator	72.2	17.0	0.031	0.027
2.0 GPM Kitchen Faucet Aerator	72.2	137.6	0.031	0.032
1.75 GPM High-Efficiency Shower Head	171.6	171.6	0.018	0.018
Hot Water Temperature Card Thermometer	81.6	81.6	0.009	0.009

Based on reported program participation and ex post savings values, the program achieved total gross electric savings of 5,154 MWh and demand savings of 1.230 MW. Table 13 (below) shows ex ante and ex post gross electric and demand impacts.

[12] Appendix B provides gas savings.

Table 13. PY9 Rural Kits Program Ex Ante and Ex Post Gross Electric Impacts*

Measure	Reported Ex Ante Installation Rate	Ex Ante Gross Impacts		Reported Measures[a]	Evaluated Ex Post Installation Rate[b]	Verified Measures[c]	Ex Post Gross Impacts		Gross Realization Rate[d]	
		MWh	MW				MWh	MW	MWh	MW
13-watt CFL	66%	656	0.066	38,170	66%	25,192	608	0.060	93%	91%
20-watt CFL	66%	373	0.037	19,085	66%	12,596	334	0.033	90%	88%
23-watt CFL	66%	554	0.055	19,085	66%	12,596	497	0.049	90%	88%
1.0 GPM Bath Faucet Aerator	60%	1,439	0.609	33,208	63%	20,921	356	0.560	25%	92%
2.0 GPM Kitchen Faucet Aerator	60%	720	0.304	16,604	60%	9,962	1,371	0.321	190%	105%
1.75 GPM High-Efficiency Shower Head	65%	1,852	0.194	16,604	65%	10,793	1,852	0.194	100%	100%
Hot Water Temperature Card Thermometer	10%	135	0.015	16,604	10%	1,660	135	0.015	100%	100%
Total	**58%**	**5,730**	**1.281**	**159,360**	**59%**	**93,721**	**5,154**	**1.230**	**90%**	**96%**

* Totals may not sum due to rounding.

[a] Based on PY7 Rural Kits Program participant survey data, assuming 87% of total verified water-saving measures were installed in homes with electric water heating.

[b] Reported percentages are rounded from their true value.

[c] The difference between reported measures and verified measures resulted from application of installation rates.

[d] Realization rates that differed from 100% resulted from differences between ex ante and ex post installation rates and per-unit savings: gross realization rate = ex post gross savings ÷ ex ante gross savings.

The evaluation team received ex ante electric savings estimates from the Rural Kits Program implementer and compared the assumed estimates with ex post electric savings methodologies. The differences between total ex ante and ex post electric savings estimates resulted from differences in ex ante and ex post gross electric per-unit savings assumptions and installation rates. Descriptions of these follow, addressing discrepancies for each program measure:

- **CFLs.** A component of the ex ante per-unit kWh savings estimate that, holding all else equal, resulted in overestimated ex ante savings was the implementer using an "unknown" location hours-of-use value of 847 for CFLs (from IL-TRM V5.0). The team used the most current "residential interior and in-unit multifamily" lighting hours-of-use value of 759 (from IL-TRM V5.0). Additionally, ex post per-unit demand savings were lower than ex ante estimates for all CFL measures as the implementer used an "unknown location" 8.1% coincidence factor value from the IL-TRM V5.0, while the team used the "interior single-family or multifamily in-unit" coincidence factor value of 7.1% from IL-TRM V5.0.

  The ex ante 13-watt CFL per-unit savings estimate of 26.0 kWh was greater than the ex post per unit savings estimate of 24.1 kWh, calculated in accordance with IL-TRM V5.0. The implementer provided ex ante savings calculations estimates for a 14-watt CFL, while the program distributed a 13-watt CFL, thus underestimating ex ante per-unit kWh savings, holding all else equal. The ex ante 20-watt CFL per-unit savings estimate of 29.6 kWh was greater than the ex post per-unit savings estimate of 26.5 kWh, calculated in accordance with IL-TRM V5.0. The ex ante 23-watt CFL per-unit savings estimate of 44.0 kWh was greater than the ex post per-unit savings estimate of 39.4 kWh, calculated in accordance with IL-TRM V5.0.

- **Bathroom Faucet Aerators.** The ex ante bathroom faucet aerator per-unit savings estimate of 72.2 kWh was higher than the ex post per-unit savings estimate of 17.0 kWh, calculated in accordance with the IL-TRM V5.0. The implementer did not calculate separate savings estimates for different aerator types, using 72.2 kWh and 0.031 kW gross per-unit savings estimates for both bathroom and kitchen faucet aerators. In calculating the single aerator savings value, the implementer relied on IL-TRM V5.0 inputs associated with an "unknown" aerator type, thus overestimating bathroom aerator gross savings. Ex post gross population savings less than ex ante gross population savings also resulted from differences in installation rates used for calculations. The implementer used a kitchen faucet aerator-specific ISR of 60% from IL-TRM V5.0 to calculate ex ante savings,[13] while the team used a bathroom faucet aerator-specific ISR of 63% from IL-TRM V5.0 to calculate ex post gross savings.

- **Kitchen Faucet Aerators.** The ex ante kitchen faucet aerator per-unit savings estimate of 72.2 kWh fell below the ex post per-unit savings estimate of 137.6 kWh, calculated in accordance with the IL-TRM V5.0. As discussed, the implementer did not calculate separate savings estimates for different aerator types, using 72.2 kWh and 0.031 kW gross per-unit savings estimates for kitchen and bathroom faucet aerators. In calculating the single aerator savings value, the implementer relied on IL-TRM V5.0 inputs, associated with an "unknown" aerator type and underestimated kitchen aerator gross savings.

- **Shower Heads.** The team found no issues with ex ante shower head calculations.

- **Water Heater Temperature Card Thermometers.** The team found no issues with ex ante water heater temperature card thermometer calculations.

[13] Deemed value from IL-TRM V5.0 for a kitchen faucet aerator.

In addition to gross savings achieved from measure installations in PY9, the team calculated gross savings from delayed CFL installations, per the IL-TRM V5.0. In particular, the TRM assumes consumers will install 93% of kit CFLs within three years. Table 14 shows savings from bulbs provided to participants (and realized) in PY9, along with later installations assumed for PY10 and PY11.

Table 14. Yearly Gross Impact of PY9 Residential Lighting Measures by Assumed Installation Year

Measure	Energy (MWh)			Demand (MW)		
	PY9	PY10	PY11	PY9	PY10	PY11
13-watt CFL	608	129	111	0.060	0.013	0.011
20-watt CFL	334	71	61	0.033	0.007	0.006
23-watt CFL	497	105	90	0.049	0.010	0.009
Total	**1,439**	**305**	**262**	**0.141**	**0.030**	**0.026**

In the PY10 evaluation report, the team will include PY10 CFL savings.

3.3.2 Net Impacts

The program achieved total net electric and demand savings of 4,431 MWh and 1.199 MW, respectively, based on the following: verified program participation; the IL-TRM V5.0, deemed, per-unit gross savings values, installation rates (calculated in accordance with the PY9 IPA Evaluation Plan); and the SAG-approved NTGRs.

Table 15 shows net electric savings results by measure. Additionally, the evaluation team included the PY7 and PY8 Rural Kits Program net CFL savings, realized in PY9, bringing the totals to 4,892 MWh and 1.246 MW.[14] The evaluation team credited the PY9 Rural Kits Program with the PY7 Rural Kits Program's 203 MWh gross energy savings and the 0.022 MW gross demand savings derived from delayed CFL installations realized in PY9.[15] The team applied these savings by multiplying gross savings by the PY7 Rural Kits Program's CFL-specific NTGR of 0.88, arriving at in 179 MWh net energy savings and 0.019 MW net demand savings for PY7-delayed CFL installations realized in PY9. The team also credited the PY9 Rural Kits Program with the PY8 Rural Kits Program's 332 MWh gross energy savings and 0.032 MW gross demand savings, derived from delayed CFL installations realized in PY9.[16] The team applied these savings by multiplying gross savings by the PY8 Rural Kits Program, CFL-specific 0.85 NTGR to arrive at 282 MWh in net energy savings and 0.028 MW in net demand savings for PY8-delayed CFL installations realized in PY9.

[14] The team credited the delayed 14-watt and 23-watt CFL installations by PY7 and PY8 Rural Kits Program participants, estimated as installed during PY9, to final PY9 Rural Kits Program net impacts.

[15] Delayed 14-watt and 23-watt CFL installations by PY7 Rural Kits Program participants, estimated to have been installed during PY9 (in accordance with IL-TRM V2.0), are credited to final PY9 Rural Kits Program net impacts.

[16] The team credited the delayed 14-watt and 23-watt CFL installations by PY8 Rural Kits Program participants, estimated as installed during PY9 (in accordance with Illinois Statewide TRM V4.0), to final PY9 Rural Kits Program net impacts.

Table 15. PY9 Total Rural Kits Program Net Electric Savings by Measure

Measure	Ex Ante Net Savings (MWh)	Ex Ante Net Savings (MW)	Initial Ex Post Net Savings (MWh)	Initial Ex Post Net Savings (MW)	PY7 Ex Post CFL Net Savings Realized in PY9 (MWh)	PY7 Ex Post CFL Net Savings Realized in PY9 (MW)	PY8 Ex Post CFL Net Savings Realized in PY9 (MWh)	PY8 Ex Post CFL Net Savings Realized in PY9 (MW)	PY9 Ex Post Net Savings (MWh)	PY9 Ex Post Net Savings (MW)
14-watt CFL	413	0.041	383	0.038	67	0.007	117	0.011	566	0.056
20-watt CFL	202	0.020	181	0.018	0	0	67	0.007	247	0.024
23-watt CFL	299	0.030	268	0.026	112	0.012	99	0.010	479	0.048
1.0 GPM Bath Faucet Aerator	1,554	0.658	385	0.604	0	0	0	0	385	0.604
2.0 GPM Kitchen Faucet Aerator	712	0.301	1,357	0.318	0	0	0	0	1,357	0.318
1.75 GPM High-Efficiency Shower Head	1,704	0.178	1,704	0.178	0	0	0	0	1,704	0.178
Hot Water Temperature Card Thermometer	153	0.017	153	0.017	0	0	0	0	153	0.017
Total	**5,038**	**1.246**	**4,431**	**1.199**	**179**	**0.019**	**282**	**0.028**	**4,892**	**1.246**
Net Realization Rate[a]			**88%**	**96%**					**97%**	**100%**

Note: Totals may not sum due to rounding.

[a] Net realization rate = ex post net savings ÷ ex ante net savings.

Table 16 shows gross and net savings associated with CFLs distributed and installed during PY9 as well as with gross and net savings associated with CFLs distributed in PY7 and PY8, but installed during PY9.

Table 16. PY9 Rural Kits Program Total Savings Claimed for CFL Measures by Program Year

Program Year/CFL Wattage	Reported CFLs Distributed	1st Year Installation Rate	2nd Year Installation Rate	3rd Year Installation Rate	CFLs Installed in PY9	Ex Post Gross Per-Unit kWh	Ex Post Gross Per-Unit kW	Ex Post Gross Impacts kWh	Ex Post Gross Impacts kW	NTGR	Ex Post Net Impacts kWh	Ex Post Net Impacts kW
PY9/13-watt	38,170	66%	–		25,192	24.1	0.0024	608,044	60	0.630	383,068	38
PY9/20-watt	19,085	66%	–		12,596	26.5	0.0026	334,424	33	0.540	180,589	18
PY9/23-watt	19,085	66%	–		12,596	39.4	0.0039	496,569	49	0.540	268,147	26
PY8/14-watt	42,052	–	14%		5,877	23.3	0.0023	137,360	13	0.851	116,893	11
PY8/20-watt	21,026	–	14%		2,944	26.5	0.0026	78,153	8	0.851	66,508	7
PY8/23-watt	21,026	–	14%		2,944	39.4	0.0039	116,046	11	0.851	98,755	10
PY7/14-watt	20,022	–	–	13.1%	2,626	28.8	0.0031	75,586	8	0.880	66,515	7
PY7/23-watt	20,022	–	–	13.1%	2,623	48.7	0.0052	127,714	14	0.880	112,388	12
							Total	1,973,896	195		1,292,864	128

4. Conclusions and Recommendations

Over PY8 and PY9, CLEAResult exceeded the two-year, 40,000-kit distribution goal, distributing 21,484 kits in PY8 and 19,085 kits in PY9. In the fourth year of operation, program staff focused their participant selection efforts on high-energy use homeowners within "rural" zip codes. The evaluation team identified improvement opportunities and recommends considering the following actions:

- **Key Finding #1:** Due to effective communication among stakeholders and the simplicity of the program design, the program operated smoothly. A few participants, however, reported confusion with receiving an unsolicited kit, and participants indicated less satisfaction with kit contents in PY9 than in PY8. According to the implementer-administered survey, kit satisfaction ratings decreased from 4.6 out of 5 in PY8 to 4.0 in PY9. More PY9 respondents (20%) were not satisfied with at least one measure than in PY8 (5%).
  - **Recommendation:** Consider implementing future kit programs using an opt-in design. Shifting from an unsolicited kit delivery mechanism to a design that requires program staff to recruit participants may require more administrative costs, but it also may result in increased satisfaction and possibly increased installation rates. Use low-cost recruitment efforts (e.g., mailings, electronic promotions) while encouraging participant buy-in. Consider offering participants options in choosing kit measures (e.g., LEDs, alternate-sized aerators, hand-held shower heads.
- **Key Finding #2:** Program staff could not measure the program's marketing effectiveness at increasing participation in other energy efficiency programs or driving traffic to AIC's website.
  - **Recommendation:** In future kit programs, implement a method to gauge whether kits influence recipients' participation in other energy efficiency programs. For example, include a customized URL on the marketing materials to track Rural Kits Program-generated traffic to AIC's website. The program could also consider including a coupon or discount code in the kit, offering a free or discounted Home Efficiency Program energy audit. The coupon or discount code would record customer cross-participation and help homeowners explore opportunities with minimal or no initial investment. The program also could send customized URLs to implementer-surveyed customers who express interest in additional ways to save energy but declined direct energy efficiency specialist follow-up.
- **Key Finding #3:** The program's implementer did not calculate separate savings estimates for different aerator types, instead using IL-TRM V5.0 inputs associated with an "unknown" aerator type, thus overestimating bathroom faucet aerator savings and underestimating kitchen faucet aerator savings. This error has been noted in the four previous program evaluations; correcting this calculation would produce more accurate estimates of aerator savings.
  - **Recommendation:** Calculate separate ex ante per-unit savings for bathroom faucet aerators and kitchen faucet aerators.
- **Key Finding #4:** The implementer provided ex ante savings calculations estimates for a 14-watt CFL, while the program distributed a 13-watt CFL.
  - **Recommendation:** Calculate ex ante per-unit savings using actual wattages and specifications of distributed kit measures.

Appendix A. Rural Kits Program Assumptions and Algorithms

CFLs

The evaluation team used the following equations from the IL-TRM V5.0 to estimate energy and demand savings for CFLs:

Equation 1. ENERGY STAR CFL Energy Algorithm

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1{,}000}\right) \times ISR \times (1 - Leakage) \times Hours \times WHFe$$

Equation 2. ENERGY STAR CFL Demand Algorithm

$$\Delta kW = \left(\frac{Watts_{base} - Watts_{EE}}{1{,}000}\right) \times ISR \times WHFd \times CF$$

Table 17 provides assumptions used to estimate ex post savings for the CFL measures.

Table 17. Ex Post Assumptions for ENERGY STAR CFL

Parameter	Value	Units	Notes/Reference
$Watts_{base}$	13W CFL: 43 20W CFL: 53 23W CFL: 72	watts	Base watts incandescent equivalent (IL-TRM V5.0).
$Watts_{EE}$	13W CFL: 13 20W CFL: 20 23W CFL: 23	watts	Actual wattage of CFL installed (IL-TRM V5.0).
1,000	1,000	W/kW	Conversion factor.
ISR	66%	N/A	Installation rate (IL-TRM V5.0): "Direct Mail Kits." The team applied the 66% ISR to reported measures distributed, and did not apply any ISR to the per-unit savings values reported in the evaluation report.
Leakage	0	N/A	Adjustment to account for the percentage of program bulbs moving out of the utility jurisdiction. Kits were not delivered to non-AIC customers, determined through evaluating the program tracking data.
Hours	759	Hours	IL-TRM V5.0: "Residential Interior and in-unit Multifamily."
WHFe	1.06	N/A	Waste heat factor for energy (IL-TRM V5.0): "Interior single-family or unknown location."
WHFd	1.11	N/A	Waste heat factor for demand (IL-TRM V5.0): "Interior single-family or unknown location."
CF	7.1%	N/A	Summer peak coincidence factor (IL-TRM V5.0).

Lighting Measures Heating Penalty

The team determined heating penalties for different heating fuel types using the algorithms below. Based on the agreement between the Illinois Commerce Commission (ICC) and AIC, we do not include heating penalties in the ex post energy savings, but will include this in the data for the PY9 cost-effectiveness analysis. The team used the PY7 Rural Kit Program participant survey results to estimate 90% of PY9 Rural Kit Program participants had electric resistance space heating and 10% gas space heating.

Equation 3. Heating Penalty Algorithms

Electric Heating Penalty: $\Delta kWh = -(((WattsBase - WattsEE)/1{,}000) * ISR * Hours * HF)/\eta Heat$

Gas Heating Penalty: $\Delta therms = -(((WattsBase - WattsEE)/1{,}000) * ISR * Hours * HF * 0.03412)/\eta Heat$

Where:

WattsBase = Wattage of existing equipment (see Table 17)

WattsEE = Wattage of installed CFLs (see Table 17)

ISR = In-service rate or the percentage of units rebated that get installed (see Table 17)

Hours = Annual operating hours (see Table 17)

HF = Heating Factor = 0.49

ηHeat = Efficiency of heating equipment

Table 18. ηHeat for Lighting Heating Penalties

Measure	ηHeat	Units
Heat Pump (Before 2006)	2.00	COP
Heat Pump (2006–2014)	2.26	COP
Heat Pump (2015 and Beyond)	2.40	COP
Electric Resistance	1.00	COP
Gas Heating	0.70	AFUE

Table 19 summarizes the heating penalties for the six lighting measures offered through the program by heating equipment type.

Table 19. Per-Measure Heating Fuel Penalties for CFL Lighting

Heating Equipment	Measure	ΔkWh	Δtherms
Electric Resistance	13-watt CFL	−10.04	N/A
	20-watt CFL	−11.05	N/A
	23-watt CFL	−16.40	N/A
Gas Heating	13-watt CFL	N/A	-0.05
	20-watt CFL	N/A	-0.06
	23-watt CFL	N/A	-0.09

Bathroom and Kitchen Faucet Aerators

The team used the following equations from the IL-TRM V5.0 to estimate energy and demand savings for faucet aerators:

Equation 4. Faucet Aerator Electric Energy Algorithm

$$\Delta kWh = \%ElectricDHW \left(\frac{(GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * 365.25 * DF)}{FPH}\right) \times EPG\_electric \times ISR$$

Equation 5. Faucet Aerator Gas Energy Algorithm

$$\Delta Therms = \%FossilDHW \times ISR \left(\frac{(GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * 365.25 * DF)}{FPH}\right) \times EPG\_gas$$

Equation 6. Faucet Aerator Demand Algorithm

$$\Delta kW = \left(\frac{\Delta kWh}{Hours}\right) \times CF$$

Table 20 provides assumptions used to estimate ex post savings for bathroom faucet aerators.

Table 20. Ex Post Assumptions for Bathroom Faucet Aerators

Parameter	Value	Units	Notes/Reference
%ElectricDHW	100%	N/A	In accordance with the PY9 Evaluation Plan, the team used the PY7 Rural Kits participant survey data to estimate electric and gas water heater saturation rates; 87% of program measures were installed in residences with electric water heating, and 13% were installed in homes with gas water heating. This evaluation used these fuel saturations, applying them to installed measures to create separate analyses for electric and gas.
%FossilDHW	100%	N/A	
GPM_{base}	1.39	gal/min	Base case flow (IL-TRM V5.0).
GPM_{low}	0.94	gal/min	Low case flow (IL-TRM V5.0).
L_{base}	1.6	min/day	Base case use length (IL-TRM V5.0).
L_{low}	1.6	min/day	Low case use length (IL-TRM V5.0).
Household	2.56	# of people	Average number of people per household (IL-TRM V5.0): “Single-Family”
365.25	365.25	Average days in a year	Days in a year, on average (IL-TRM V5.0).
DF	90%	Percent	Drain factor (IL-TRM V5.0): “Bath”
FPH	2.83	Faucets per household	Bath faucets per household (IL-TRM V5.0): “Single-Family”
EPG_electric	0.0795	kWh/gal	Energy per gallon of hot water supplied by electricity (IL-TRM V5.0): “Bath”
EPG_gas	0.00341	Therm/gal	Energy per gallon of hot water supplied by gas (IL-TRM V5.0): “Single-Family—Bath”
ISR	63%	N/A	Installation rate (IL-TRM V5.0): ‘Efficiency Kit Bathroom Aerator’. The team applied the 63% ISR to reported measures distributed, and did not apply ISRs to per-unit savings values reported in the evaluation report.
Hours	14	Hours/Year	Annual electric water heating recovery hours for faucet use per faucet (IL-TRM V5.0): “Single-Family—Bathroom”
CF	0.022	N/A	Coincidence Factor for electric load reduction (IL-TRM V5.0).

Table 21 provides assumptions used to estimate ex post savings for kitchen faucet aerators.

Table 21. Ex Post Assumptions for Kitchen Faucet Aerators

Parameter	Value	Units	Notes/Reference
%ElectricDHW	100%	N/A	In accordance with the PY9 Evaluation Plan, the team used the PY7 Rural Kits' participant survey data to estimate electric and gas water heater saturation rates; 87% of program measures were installed in residences with electric water heating, and 13% were installed in homes with gas water heating. This evaluation used these fuel saturations, applied them to installed measures to create separate analyses for electric and gas.
%FossilDHW	100%	N/A	
GPM_{base}	1.39	gal/min	Base case flow (IL-TRM V5.0).
GPM_{low}	0.94	gal/min	Low case flow (IL-TRM V5.0).
L_{base}	4.5	min/day	Base case use length (IL-TRM V5.0).
L_{low}	4.5	min/day	Low case use length (IL-TRM V5.0).
Household	2.56	# of people	Average number of people per household (IL-TRM V5.0): "Single-Family"
365.25	365.25	Average days in a year	Days in a year, on average (IL-TRM V5.0).
DF	75%	Percent	Drain factor (IL-TRM V5.0): "Bath"
FPH	1.0	Kitchen faucets per household	Kitchen faucets per household (IL-TRM V5.0).
EPG_electric	0.0969	kWh/gal	Energy per gallon of hot water supplied by electricity (IL-TRM V5.0): "Kitchen"
EPG_gas	0.00415	Therm/gal	Energy per gallon of hot water supplied by gas (IL-TRM V5.0): "Single-Family—Kitchen"
ISR	20%	N/A	Installation Rate (IL-TRM V5.0): : 'Efficiency Kit Bathroom Aerator'. The team applied the 60% ISR to reported measures distributed, and did not apply ISRs to per-unit savings values reported in the evaluation report.
Hours	94	Hours/Year	Annual electric water heating recovery hours for faucet use per faucet (IL-TRM V5.0): "Single-Family—Kitchen"
CF	0.022	N/A	Coincidence Factor for electric load reduction (IL-TRM V5.0).

Shower Heads

The team used the following equations from the IL-TRM V5.0 to estimate energy and demand savings for shower heads.

Equation 7. Shower Head Electric Energy Algorithm

$$\Delta kWh = \%ElectricDHW \left(\frac{(GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * SPCD * 365.25)}{SPH}\right) \times EPG\_electric \times ISR$$

Equation 8. Shower Head Gas Energy Algorithm

$$\Delta Therms = \%FossilDHW \left(\frac{(GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * SPCD * 365.25}{SPH}\right) \times EPG\_gas \times ISR$$

Equation 9. Shower Head Demand Algorithm

$$\Delta kW = \left(\frac{\Delta kWh}{Hours}\right) \times CF$$

Table 22 provides assumptions used to estimate ex post savings for shower heads.

Table 22. Ex Post Assumptions for Shower Heads

Parameter	Value	Units	Notes/Reference
%ElectricDHW	100%	N/A	In accordance with the PY9 Evaluation Plan, the team used the PY7 Rural Kits participant survey data to estimate electric and gas water heater saturation rates; 87% of program measures were installed in residences with electric water heating, and 13% were installed in homes with gas water heating. This evaluation used these fuel saturations, applying them to installed measures to create separate analyses for electric and gas.
%FossilDHW	100%	N/A	
GPM_{base}	2.35	gal/min	Base case flow (IL-TRM V5.0).
GPM_{low}	1.75	gal/min	Actual case flow.
L_{base}	7.8	min/day	Base case use length (IL-TRM V5.0).
L_{low}	7.8	min/day	Low case use length (IL-TRM V5.0).
Household	2.56	# of people	Average number of people per household (IL-TRM V5.0): "Single-Family"
SPCD	0.6	Showers per capita per day	Showers per capita per day (IL-TRM V5.0).
365.25	365.25	Average days in a year	Days in a year, on average (IL-TRM V5.0).
SPH	1.79	Shower heads per household	Shower heads per household (IL-TRM V5.0): "Single-Family"
EPG_electric	0.117	kWh/gal	Energy per gallon of hot water supplied by electricity (IL-TRM V5.0).
EPG_gas	0.00501	Therm/gal	Energy per gallon of hot water supplied by gas (IL-TRM V5.0): "Single-Family"
ISR	39%	N/A	Installation Rate (IL-TRM V5.0): "Efficiency Kits--One Showerhead Kit ". The team applied the 65% ISR to reported measures distributed, and did not apply ISRs to per-unit savings values reported in the evaluation report.
Hours	266	Hours/Year	Annual electric water heating recovery hours for shower head use (IL-TRM V5.0): "SF Retrofit & EE Kits & TOS"
CF	0.0278	N/A	Coincidence Factor for electric load reduction (IL-TRM V5.0).

Hot Water Temperature Card Thermometer

The team used the following equations from the IL-TRM V5.0 to estimate energy and demand savings for hot water temperature card thermometers:

Equation 10. Hot Water Temperature Card Thermometer Electric Energy Algorithm

$$\Delta kWh = \left(\frac{(UA * (T_{pre} - T_{post}) * Hours)}{3{,}412 * RE\_electric}\right)$$

Equation 11. Hot Water Temperature Card Thermometer Gas Energy Algorithm

$$\Delta Therms = \left(\frac{(UA * (T_{pre} - T_{post}) * Hours)}{100{,}000 * RE\_gas}\right)$$

Equation 12. Hot Water Temperature Card Thermometer Demand Algorithm

$$\Delta kW = \left(\frac{\Delta kWh}{Hours}\right) \times CF$$

Table 23 provides assumptions used to estimate ex post savings for hot water temperature card thermometers.

Table 23. Ex Post Assumptions for Hot Water Temperature Card Thermometers

Parameter	Value	Units	Notes/Reference
%ElectricDHW	100%	N/A	In accordance with the PY9 Evaluation Plan, the team used PY7 Rural Kits participant survey data to estimate electric and gas water heater saturation rates; 87% of program measures were installed in residences with electric water heating, and 13% were installed in homes with gas water heating. This evaluation used these fuel saturations, applied them to installed measures to create separate analyses for electric and gas.
%FossilDHW	100%	N/A	
U	0.083	Btu/Hr-°F-ft^2	Overall heat transfer coefficient of tank (IL-TRM V5.0).
A	24.99	Square Feet	Surface area of storage tank (IL-TRM V5.0).
T_{pre}	135	Degrees °F	Deemed hot water set point prior to adjustment (IL-TRM V5.0).
T_{post}	120	Degrees °F	Deemed new hot water set point (IL-TRM V5.0).
Hours	8,766	Hours	Number of hours in a year.
3412	3412	N/A	Conversion from Btu to kWh (IL-TRM V5.0).
RE_electric	0.98	kWh/gal	Recovery efficiency of electric hot water heater (IL-TRM V5.0).
RE_gas	0.78	Therm/gal	Recovery efficiency of gas water heater (IL-TRM V5.0): “Single-Family”
ISR	10%	N/A	The team applied the 10% ISR calculated from the PY7 Rural Kits Program participant survey data to reported measures distributed, and did not apply ISRs to per-unit savings values reported in the evaluation report. The IL-TRM V5.0 does not specify a deemed ISR for the measure.
CF	1	N/A	Coincidence Factor for electric load reduction (IL-TRM V5.0).

Appendix B. Natural Gas Impacts

Gross Impacts

Table 24 lists reported ex ante and evaluated ex post per-unit gas savings. Large differences occurred between ex ante and ex post per-unit gross savings for bathroom and kitchen faucet aerators as the implementer did not calculate separate savings estimates for the different aerator types.

Table 24. PY9 Rural Kits Ex Ante and Ex Post Per Unit Gas Savings

Measure	Reported Ex Ante Gross (therms)	Evaluated Ex Post Gross (therms)
1.0 GPM Bath Faucet Aerator	3.1	0.7
2.0 GPM Kitchen Faucet Aerator	3.1	5.9
1.75 GPM High-Efficiency Shower Head	7.3	7.3
Hot Water Temperature Card Thermometer	3.5	3.5

The implementer did not estimate ex ante gas population savings for the program since they assumed that 100% of the kits were distributed to homes using electricity as their primary water heating energy source. Of participants surveyed in PY7, however, 13% reported using natural gas as their primary water heating energy source. Given the implementer's assumptions, the evaluation team did not receive ex ante gross population therm savings values. Rather, the implementer provided ex ante per-unit therm savings estimates, and the team used those to calculate the ex ante gross population therm savings shown in Table 25.

Based on verified program participation, the program achieved total gross gas energy savings of 23,774 therms. Table 25 shows ex ante and ex post gross gas impacts.

Table 25. PY9 Program Ex Ante and Ex Post Gross Gas Impacts

Measure	Reported Ex Ante Installation Rate	Reported Ex Ante Gross Impacts (therms)	Reported Measures[a]	Evaluated Ex Post Installation Rate	Verified Measures[b]	Ex Post Gross Impacts (therms)	Gross Realization Rate[c]
1.0 GPM Bath Faucet Aerator	60%	9,221	4,962	63%	3,126	2,282	25%
2.0 GPM Kitchen Faucet Aerator	60%	4,610	2,481	60%	1,489	8,773	190%
1.75 GPM High-Efficiency Shower Head	65%	11,851	2,481	65%	1,613	11,851	100%
Hot Water Temperature Card Thermometer	10%	868	2,481	10%	248	868	100%
Total	**51%**	**26,550**	**12,405**	**52%**	**6,476**	**23,774**	**90%**

[a] Based on PY7 Rural Kits participant survey data; the evaluation team assumed 13% of total verified water-saving measures were installed in homes with gas water heating.

[b] The difference between reported measures and verified measures resulted from the application of installation rates developed from the PY7 Rural Kits participant survey effort.

[c] Realization rates different from 100% resulted from differences between ex ante and ex post per-unit savings. Reported results are rounded. Gross realization rate = ex post gross savings ÷ ex ante gross savings.

The team received ex ante gas savings estimates from the program implementer and reviewed the assumed estimates for comparisons to the ex post gas savings methodologies. The differences between total ex ante and ex post gas savings estimates resulted from differences in ex ante and ex post gross gas per-unit savings assumptions and installation rates. The following descriptions address discrepancies for each program measure:

- **Bathroom Faucet Aerators.** The ex ante bathroom faucet aerator per-unit savings estimate of 3.1 therms was more than the ex post per-unit savings estimate of 0.7 therms (calculated in accordance with IL-TRM V5.0). The implementer did not calculate separate savings estimates for the different aerator types, using a 3.1 therms gross per-unit savings estimate for bathroom and kitchen faucet aerators. In calculating the single aerator savings value, the implementer relied on IL-TRM V5.0 inputs associated with an "unknown" aerator type, and overestimated bathroom aerator gross savings.

- **Kitchen Faucet Aerators.** The ex ante kitchen faucet aerator per-unit savings estimate of 3.1 therms fell below the ex post per-unit savings estimate of 5.9 therms, calculated in accordance with the IL-TRM V5.0. The implementer did not calculate separate savings estimates for the different aerator types, using a 3.1 therms gross per-unit savings estimate in calculating kitchen and bathroom faucet aerator ex ante gross savings.

  In calculating the single aerator savings value, the implementer relied on IL-TRM V5.0 inputs associated with an "unknown" aerator type, thus underestimating kitchen aerator gross savings.

- **Shower Heads.** The evaluation team found no issues with ex ante shower head calculations.

- **Water Heater Temperature Card Thermometers.** The evaluation team found no issues with ex ante water heater temperature card thermometer calculations.

Net Impacts

The program achieved total net gas savings of 20,894 therms, based on the following: verified program participation; IL-TRM V5.0, deemed per-unit gross savings inputs; installation rates in accordance with the PY9 IPA Evaluation Plan; and SAG-approved NTGRs.

Table 26 shows net gas savings results by measure. The program's low overall net realization rate partially resulted from the implementer calculating only a single aerator savings value and applying it to both bathroom and kitchen faucet aerators, thus severely overestimating bathroom faucet aerator ex ante gross savings.

Table 26. PY9 Total Program Net Gas Savings by Measure*

Measure	Ex Ante Net Savings (therms)	Ex Post Net Savings (therms)
1.0 GPM Bath Faucet Aerator	9,129	2,260
2.0 GPM Kitchen Faucet Aerator	4,149	7,896
1.75 GPM High-Efficiency Shower Head	9,836	9,836
Hot Water Temperature Card Thermometer	902	902
Total	**24,017**	**20,894**
	Net Realization Rate[a]	**87%**

*Totals may not sum due to rounding.

[a] Net realization rate = ex post net savings ÷ ex ante net savings.

Appendix C. Cost-Effectiveness Inputs

Heating Penalty

Efficient lighting products generate less waste heat compared to baseline lighting products. When customers replace baseline products with more-efficient lighting, they must use more space heating to compensate for "lost" heat from lighting. The heating penalty represents this increased energy usage for space heating—a figure used in analyzing program cost-effectiveness.[17]

Heating Penalty Results

In addition to the gross heating penalty from measure installations in PY9, the evaluation team calculated the gross heating penalty from delayed CFL installations, per the IL-TRM V5.0. In particular, the IL-TRM V5.0 assumed that consumers would install 93% of kit CFLs within three years. Table 27 shows the gross electric-heating penalty resulting from efficient lighting installations provided to participants in PY9 and realized in PY9 and, given later installations, in PY10 and PY11.

Table 27. Yearly Gross Electric Heating Penalty Impact of Lighting Measures by Assumed Installation Year

Measure	Gross Heating Penalty (MWh)		
	PY9	PY10	PY11
13-watt CFL	−253	−54	−46
20-watt CFL	−139	−30	−25
23-watt CFL	−207	−44	−38
Total	**−599**	**−127**	**−109**

Table 28 shows the gross gas-heating penalty resulting from efficient lighting installations provided to participants in PY9 and realized in PY9 and, given later installations, in PY10 and PY11.

Table 28. Yearly Gross Gas Heating Penalty Impact of Lighting Measures by Assumed Installation Year

Measure	Gross Heating Penalty (therms)		
	PY9	PY10	PY11
13-watt CFL	−137	−29	−25
20-watt CFL	−75	−16	−14
23-watt CFL	−112	−24	−20
Total	**−324**	**−69**	**−59**

[17] The team used the PY7 Rural Kit Program participant survey results to estimate 90% of Rural Kit Program participants had electric space heating and 10% gas space heating.

Table 29 shows the net electric impacts for cost-effectiveness inputs.

Table 29. Net Electric Impacts

Measure	Net Electric Impacts (MWh)		
	PY9	PY10	PY11
13-watt CFL	224	−34	−29
20-watt CFL	105	−16	−14
23-watt CFL	157	−24	−20
1.0 GPM Bath Faucet Aerator	385	N/A	N/A
2.0 GPM Kitchen Faucet Aerator	1,357	N/A	N/A
1.75 GPM High-Efficiency Shower Head	1,704	N/A	N/A
Hot Water Temperature Card Thermometer	153	N/A	N/A
Total	**4,085**	**−73**	**−63**

Table 30 shows the net gas impacts for cost-effectiveness inputs.

Table 30. Net Gas Impacts

Measure	Net Gas Impacts (therms)		
	PY9	PY10	PY11
13-watt CFL	−86	−18	−16
20-watt CFL	−41	−9	−7
23-watt CFL	−60	−13	−11
1.0 GPM Bath Faucet Aerator	2,260	N/A	N/A
2.0 GPM Kitchen Faucet Aerator	7,896	N/A	N/A
1.75 GPM High-Efficiency Shower Head	9,836	N/A	N/A
Hot Water Temperature Card Thermometer	902	N/A	N/A
Total	**-20,707**	**−40**	**−34**

For more information, please contact:

Hannah Arnold
Managing Director

510 444 5050 tel
510 444 5222 fax
harnold@opiniondynamics.com

1 Kaiser Plaza, Suite 445
Oakland, CA 94612