

Evaluation of Energy Efficient Affordable Housing Construction Program

June 2015 through May 2016

Prepared for:
Illinois Department of Commerce Economic Opportunity

Prepared by:



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Executive Summary

This report presents results of impact and process evaluations performed by ADM Associates, Inc. of the Energy Efficient Affordable Housing Construction Program (AHC Program) offered by the Illinois Department of Commerce & Economic Opportunity (hereinafter referred to as the “Department of Commerce”). The report presents results for electric program year seven and natural gas program year four (EPY8/GPY5), the period June 2015 through May 2016.

The main features of the evaluation approach include:

- Data collection through review of program materials, interviews with Department of Commerce staff members, and interviews with program participants.
- Engineering review verifying gross savings using the Illinois Statewide Technical Reference Manual (TRM), and other sources as appropriate.

The gross and net ex post kWh savings of the AHC Program during EPY8/GPY5 are summarized below in Table ES-1. Because the program targets energy efficiency improvements in low income resident housing, the net ex post savings are assumed to equal the gross ex post savings. For EPY8/GPY5, net ex post electricity savings total 3,561,902 kWh. The gross realization rate is 110%.

Table ES-1 Summary of kWh Savings for Affordable Housing Construction Program

<i>Utility</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	<i>Net Ex Post kWh Savings</i>	<i>Net-to-Gross Ratio</i>
Ameren	778,610	474,552	61%	474,552	100%
ComEd	2,473,698	3,087,350	125%	3,087,350	100%
Total	3,252,308	3,561,902	110%	3,561,902	100%

Gross and net ex post natural gas savings are shown in Table ES-2. Net ex posts natural gas savings total 187,698 therms. The gross realization rate is 127% for natural gas savings.

Table ES-2 Summary of Therm Savings for Affordable Housing Construction Program

<i>Utility</i>	<i>Ex Ante Therm Savings</i>	<i>Gross Ex Post Therm Savings</i>	<i>Gross Realization Rate</i>	<i>Net Ex Post Therm Savings</i>	<i>Net-to-Gross Ratio</i>
Ameren	11,034	11,703	106%	11,703	100%
Nicor	47,472	50,128	106%	50,128	100%
Peoples	89,108	125,867	141%	125,867	100%
Total	147,614	187,698	127%	187,698	100%

The gross and net ex post peak kW reductions of the Affordable Housing Construction Program during the period June 2015 through May 2016 are summarized in Table ES-3.

Table ES-3 Summary of Peak kW Savings for Affordable Housing Construction Program

<i>Utility</i>	<i>Realized Gross kW Savings</i>	<i>Ex Post Net kW Savings</i>	<i>Net-to-Gross Ratio</i>
Ameren	59.98	59.98	100%
ComEd	268.58	268.58	100%
Total	328.56	328.56	100%

The following presents a selection of key conclusions from the analysis of EPY8/GPY5:

Below are several key findings from the Affordable Housing New Construction Program:

- **Additional Details Would Benefit Tracking Projects and the Calculation of Energy Savings:** Currently the technical consultant develops project specification sheets that provide general descriptions of the measure and quantity. However, the descriptions do not always match the measure categories and inputs in the Illinois TRM. As an example, lighting measures should have the number fixtures, lamps, and wattages of individual bulbs recorded. These data should be developed in conjunction with the establishment of a standardized list of measures to ensure that the appropriate data for each measure are being collected.

The following recommendations based on the review of the program are offered for the Department of Commerce's consideration:

- **Have Grantees Complete a Supplementary Form to Improve Project Documentation and Measure-level Information:** ADM recommends that grantees fill out a supplementary form to provide more detail on the measures included in their project.

Each measure should include descriptors precise enough to account for differences in expected useful life (EUL), but general enough to be aggregated at a higher level. There may be a few custom measures that may not be easily categorized. Such measures should be assigned to an "Other" category and/or subcategory. Ideally tracking data should contain:

- **Measure Category:** Lighting, HVAC, building insulation, etc.
- **Measure Subcategory:** Linear Fluorescent, Lighting Occupancy Sensor, HVAC Packaged Unit, etc.
- **Measure Name:** 14W CFL, R-19 fiberglass insulation, 2 Ton SEER 14 central air conditioner, etc.
- **Measure Quantity:** Number of fixtures or lamps, appliances, square footage of insulation, etc.
- **Measure Unit:** Number of units, square feet, linear feet, etc.

- **Notes:** For custom measures this field would provide the description for those measures that do not correspond to any established category in the fields described above. These measures would be given a value of “Other” for the preceding fields.
- **Develop Measure-Level Ex Ante Savings Estimates:** Ex ante savings estimates were calculated using a savings per housing unit multiplier based on ADM’s EPY7/GPY4 evaluation of the AHC Program. Changes in building codes, updates to the Illinois TRM’s savings algorithms, and differences in the measures implemented at each project lead to this approach underestimating savings. To achieve a more accurate ex ante savings estimate and measure-level realization rates, ADM recommends developing measure-level TRM-based ex ante savings estimations.

1. Introduction

This report presents the results of the impact and process evaluations of the Illinois Department of Commerce & Economic Opportunity (hereinafter referred to as the “Department of Commerce”) Affordable Housing Construction (AHC) Program. The report presents evaluation results pertaining to program activity during electric program year seven and natural gas program year four (EPY8/GPY5), the period from June 2015 through May 2016.

1.1 Description of Program

The Affordable Housing Construction Program provides grants to non-profit and for-profit affordable housing developers to help offset the cost of incorporating energy efficient building practices in residential construction. The goal of the program is to promote the benefits of lower utility bills for low income households within energy efficient buildings. Eligible projects must be targeted at households that are at or below 80% of the Average Median Income (AMI) level.

Grant amounts for projects are calculated per living unit, building, or living space square footage. To receive grant funding, the new construction or rehab project must meet program guidelines and implement all specified measures. There are three sets of program guidelines applicable to different types of projects:

- New single-family and low-rise residential construction minimum energy standards;
- New multi-family building construction minimum energy standards; and
- Single and multi-family building rehab minimum energy standards.

These guidelines specify requirements for insulation, windows, air sealing, mechanical systems, ventilation, appliances, and lighting.

1.2 Overview of Evaluation Objectives and Approach

The primary objective of the impact evaluation of the Affordable Housing Construction Program was to determine the net electricity and natural gas energy savings and peak demand (kW) reductions resulting from program projects completed during EPY8/GPY5.

The impact evaluation included:

- Review of project documentation (e.g., invoices, savings calculation work papers, etc.), with particular attention given to calculation methods and documentation of savings estimates.
- Verification of gross savings via analytical desk review.

The process evaluation included:

- Review of program documentation and prior evaluation reports and;

- Interviews conducted with program staff members to discuss program operations, successes, challenges, and future plans.

1.3 Organization of Report

The evaluation report for the Affordable Housing Construction Program is organized as follows:

- Chapter 2 presents and discusses the analytical methods and results of estimating program energy savings.
- Appendix A provides a list of summaries for completed projects.

2. Estimation of Gross Savings

This chapter presents the results of the impact evaluation of the Affordable Housing Construction Program offered by the Department of Commerce. The main objective of the impact evaluation was to determine the electricity and natural gas energy savings, and peak demand (kW) reductions resulting from projects completed under the program during the period June 2015 through May 2016. Section 2.1 describes the methodology used for estimating savings. Section 2.2 presents the results of the effort to estimate program savings.

2.1 Methodology for Estimating Gross Savings

The methodology used for calculating program savings is described in this section.

The overall objective of the impact evaluation of the Affordable Housing Construction Program was to determine the net electric energy and natural gas energy savings, as well as peak demand (kW) reductions resulting from projects completed during the program year.

2.1.1 Review of Documentation

Available documentation (e.g., invoices, savings calculation work books, ECRM forms, etc.) was reviewed for projects, with particular attention given to the calculation procedures and documentation for savings estimates. In cases where project documentation was incomplete or unclear, evaluation staff contacted the technical consultant to seek further information. This ensured the development of accurate realized energy savings estimates.

2.1.2 Analytical Desk Review

Available documentation was reviewed to determine the number, and type of measures installed through the program. Through this process, ADM assessed the appropriate savings calculations for each measure, and if there was adequate documentation.

Energy savings for most measures were developed by applying the Illinois Statewide Technical Reference Manual Version 4.0. Depending on the measure type, savings were calculated using up to three different approaches. The approaches used are as follows:

- TRM-Calculated: Savings calculated per the Illinois's Statewide Technical Reference Manual Version 4.0.
- TRM-Calculated (Errata Corrected): Savings calculated per an erratum correction in Version 4.0 of the TRM.
- ADM-Calculated: Savings calculated using a non-TRM methodology. ADM-Calculated savings were performed when the measure was not in the TRM or when the methodology in the TRM was not applicable because the assumptions provided were not appropriate for a new construction application.

Table 2-1 displays which approach was used for each of the program measure types, the TRM section referenced, and other resources utilized to estimate gross ex post savings.

Table 2-1 Illinois TRM Sections by Measure Type

<i>Measure</i>	<i>Section in Illinois TRM Version 4</i>	<i>Other Resources</i>	<i>TRM</i>	<i>Errata Corrected</i>	<i>ADM</i>
Air Sealing	5.6.1	Applicable Building Code			•
Attic and Wall Insulation	5.6.4	Applicable Building Code			•
Bathroom Exhaust Fan	5.3.9	-	•		
Ceiling Fan	5.3.15	-	•		
Clothes Washer	5.1.2	-	•		
Dishwasher	5.1.4	-	•		
Efficient AC	5.3.3	-	•	•	
Efficient Boiler	5.3.6, 4.4.10	-	•	•	
Efficient Heat Pump	4.4.9, 5.3.1, 5.3.8	-	•	•	
Efficient Lighting	5.5.1, 5.5.6, 4.5.12, 4.5.3, 4.5.7	-	•	•	•
Efficient Refrigerator	5.1.6	-	•		
Efficient Window	-	Engineering Calculation			•
Furnace w/ Advanced Blower	5.3.5, 5.3.7	-	•	•	
Room Air Conditioner	5.1.7		•		
Water Heater	4.3.1, 4.3.5, 5.4.2		•	•	

2.1.3 Sampling Plan

A sample of projects was selected and an ex post savings calculation was performed for each measure within each project. A stratified random sampling approach was used. Samples of projects were developed with statistical precision levels sufficient enough to enable kWh and therm savings to be estimated with $\pm 10\%$ statistical precision at a 90% confidence level.

2.2 Results of Gross Savings Estimation

This section presents the results of the impact evaluation for the Affordable Housing Construction Program during EPY8/GPY5.

2.2.1 Sampling

Data used to estimate the gross savings of the Affordable Housing Construction Program were collected through samples of projects completed during the June 2015 through May 2016 period. Strata boundaries, realization rates, gross ex post savings, and relative precision for kWh savings are reported in Table 2-2. Gross ex post savings of the program totaled 3,561,902 kWh. The relative precision of the gross ex post savings is $\pm 9\%$ at the 90% confidence level.

Table 2-2 Stratum Level kWh Savings

<i>Stratum</i>	<i>Strata Boundaries (kWh)</i>	<i>Number of Projects</i>	<i>Number of Projects Sampled</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Stratum Level Realization Rate</i>	<i>Relative Precision at 90% Confidence Level</i>
4	>250,000	3	2	969,272	294,603	30%	11%
3	106,000 - 250,000	8	3	1,112,744	1,899,783	171%	20%
2	106,000-60,000	10	2	837,714	984,501	118%	16%
1	<60,000	8	2	332,578	383,015	115%	37%
Total	-	29	9	3,252,308	3,561,902	110%	9%

Strata boundaries, realization rates, gross ex post savings, and relative precision for therm savings are reported in Table 2-3. Gross ex post savings of the program totaled 187,698. The relative precision of the gross ex post savings is $\pm 10\%$ at the 90% confidence level.

Table 2-3 Stratum Level Therm Savings

<i>Stratum</i>	<i>Strata Boundaries (kWh)</i>	<i>Number of Projects</i>	<i>Number of Projects Sampled</i>	<i>Ex Ante Therm Savings</i>	<i>Ex Post Therm Savings</i>	<i>Stratum Level Realization Rate</i>	<i>Relative Precision at 90% Confidence Level</i>
4	>8,000	4	3	75,140	111,032	148%	30%
3	8,000-7,000	5	1	32,278	31,237	97%	7%
2	7,000-4,000	5	1	24,864	31,200	125%	15%
1	<4,000	6	3	15,332	14,228	93%	31%
Total	-	20	8	147,614	187,698	127%	10%

2.2.2 Program-Level Savings Results and Realization Rates

The gross and net kWh savings of the Affordable Housing Construction Program for the period June 2015 through May 2016 are summarized by utility in Table 2-4. During this period, net ex post kWh savings total 3,561,902 kWh. The gross realization rate for the program is 110%. A net-to-gross factor of 100% was used because the Affordable Housing Construction Program targets low income residents.

Gross and net ex post natural gas savings are shown by program component in Table 2-5. Net ex post natural gas savings are 187,698 therms and the gross realization rate is 127%.

Table 2-4 Summary of kWh Savings by Utility

Utility	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	Net Ex Post kWh Savings	Net-to-Gross Ratio
Ameren	778,610	474,552	61%	474,552	100%
ComEd	2,473,698	3,087,350	125%	3,087,350	100%
Total	3,252,308	3,561,902	110%	3,561,902	100%

Table 2-5 Summary of Therm Savings by Utility

Utility	Ex Ante Therm Savings	Gross Ex Post Therm Savings	Gross Realization Rate	Net Ex Post Therm Savings	Net-to-Gross Ratio
Ameren	11,034	11,703	106%	11,703	100%
Nicor	47,472	50,128	106%	50,128	100%
Peoples	89,108	125,867	141%	125,867	100%
Total	147,614	187,698	127%	187,698	100%

The gross and net ex post peak kW reductions of the Affordable Housing Construction Program during the period June 2015 through May 2016 are summarized in Table 2-6. The net ex post peak demand savings for the program total 328.56 kW.

Table 2-6 Summary of Peak kW Savings by Utility

Utility	Realized Gross kW Savings	Ex Post Net kW Savings	Net-to-Gross Ratio
Ameren	59.98	59.98	100%
ComEd	268.58	268.58	100%
Total	328.56	328.56	100%

2.2.3 Discussion of Gross Savings Analysis

Below are several key findings from the Affordable Housing New Construction Program:

- Additional Details Would Benefit Tracking Projects and the Calculation of Energy Savings:** Currently the technical consultant develops project specification sheets that provide general descriptions of the measure and quantity. However, the descriptions do not always match the measure categories and inputs in the Illinois TRM. As an example, lighting measures should have the number fixtures, lamps, and wattages of individual bulbs recorded. These data should be developed in conjunction with the establishment of a standardized list of measures to ensure that the appropriate data for each measure are being collected.

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Appendix A: Project Summaries

Table A-1 presents a summary of Affordable Housing Construction Program projects completed in EPY8/GPY5.

Table A-1 Project Summaries

<i>Grantee</i>	<i>Project Name</i>	<i>Number of Units</i>	<i>Sampled</i>	<i>Ex Post kWh</i>	<i>Ex Post Therms</i>
Patchwork	Bond County Homes	40	Yes	58,424	-
Metropolitan Housing Development Corp.	Delta Development of Downers Grove	120	Yes	156,974	-
Senior Suites Bellwood LLC	Senior Suites of Bellwood	89	No	79,205	-
Rosenwald Courts Apartments LP	Rosenwald Courts Apartments	225	Yes	548,644	86,611
Affordable Housing Continuum	Goldblatt's Senior Living	98	No	311,039	-
The Alden Foundation	Woodridge Horizons Senior Living Community	90	Yes	176,136	2,496
Hispanic Housing Development	Cicero & George Elderly Housing	70	No	209,861	6,503
Kennedy Jordan Manor	Kennedy Jordan Manor	65	No	194,871	6,039
Preservation of Affordable Housing III	Woodlawn Center Senior	65	No	194,871	6,039
Featherfist	Oswego Senior Apartments II	63	No	188,875	5,853
Laborer's Home Development Corp.	Maple Ridge Apartments II	37	Yes	75,488	6,803
Elgin Housing Authority	Central Park Towers	60	No	123,821	7,228
North West Housing Partnership	Sugar Grove Senior Living	54	Yes	139,752	6,505
Metropolitan Housing Development Corp	Cottages at Cathedral Square	32	No	110,114	-
G&A Construction & Development	G&A Senior Residences	50	No	103,185	6,023
Hispanic Housing Development	Veteran's Village @ Humboldt Park	49	No	101,121	5,903
Madison County Housing Authority	May Building	46	No	100,498	-
Turnstone Development	ThornCreek Senior Living	46	No	94,930	5,541
Madison County Housing Authority	May Building	24	No	82,585	-
Over the Rainbow Association	Southwick Apartments	39	Yes	52,171	2,290
GenCap Financial 2014, Inc.	Wildberry Village	72	No	76,324	20,215
St. Edmund's Redevelopment Corp.	St. Edmund's Tower Annex	34	No	68,758	3,029
Full Circle Communities	Milwaukee Ave. Apartments	32	No	64,714	2,851
Holsten Real Estate Development Corp	Historic Strand Hotel	53	Yes	81,393	1,711
Sertoma Centre, Inc.	Kimball Court Apartments	16	No	53,953	-
Access Peoria	Access Ridge	16	Yes	27,321	3,300
Bluestem Housing Partners	Finley Supportive Housing	12	No	40,465	-
Children's Place Housing Corp.	West Humboldt Place	13	No	26,290	1,158
McLean HFH	Six Scattered Sites	6	No	20,122	857

HFH of Sangamon County	Four Scattered Sites	4	Yes	-	742
Total	-	1,620	-	3,561,902	187,698