

Evaluation of  
Low Income Residential Retrofit Program  
June 2013 through May 2014

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Prepared for:  
Illinois Department of Commerce and Economic Opportunity

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## Executive Summary

This report presents the results of the impact and process evaluations for electric program year six and natural gas program year three (EPY6/GPY3) of the Low Income Residential Retrofit Program offered by the Illinois Department of Commerce and Economic Opportunity (DCEO). EPY6/GPY3 is defined as the period June 2013 through May 2014.

The main features of the approach used for the evaluation are as follows:

- Data for the study were collected through review of program materials and interviews with DCEO staff members and participants.
- An engineering desk review was performed on program measures to verify gross and net savings estimates.

The gross and net ex post kWh savings of the Residential Retrofit Program during the period June 2013 through May 2014 are summarized by program component in Table ES-1 and by utility in Table ES-2. Because the Residential Retrofit Program targets energy efficiency improvements in low income resident housing, the net ex post savings are assumed to equal the gross ex post savings. Net ex post electricity savings total 5,803,322 kWh for the period. The program net-to-gross ratio is 100% because the program targets low income residents.

*Table ES-1 Summary of kWh Savings for Residential Retrofit Program by Program Component*

Program Component	Utility	TRM-Calculated		TRM-Calculated (Errata Corrected)		ADM-Calculated		Net-to-Gross Ratio
		Gross Ex Post kWh Savings	Net Ex Post kWh Savings	Gross Ex Post kWh Savings	Net Ex Post kWh Savings	Gross Ex Post kWh Savings	Net Ex Post kWh Savings	
Weatherization	Ameren	1,646,196	1,646,196	1,642,710	1,642,710	1,856,640	1,856,640	100%
	ComEd	1,761,487	1,761,487	1,760,494	1,760,494	2,068,650	2,068,650	100%
	Subtotal	3,407,684	3,407,684	3,403,204	3,403,204	3,925,291	3,925,291	100%
Program Grantees	Ameren	198,130	198,130	190,244	190,244	190,463	190,463	100%
	ComEd	1,449,723	1,449,723	1,356,515	1,356,515	1,539,875	1,539,875	100%
	Subtotal	1,647,853	1,647,853	1,546,759	1,546,759	1,730,338	1,730,338	100%
CDAP	Ameren	117,651	117,651	117,346	117,346	147,693	147,693	100%
	ComEd	-	-	-	-	-	-	-
	Subtotal	117,651	117,651	117,346	117,346	147,693	147,693	100%
Total		5,173,188	5,173,188	5,067,308	5,067,308	5,803,322	5,803,322	100%

Table ES-2 Summary of kWh Savings for Residential Retrofit Program by Utility

<i>Gas Utility</i>	<i>Realized Net kWh Savings*</i>
Ameren	2,194,797
ComEd	3,608,526
Total	5,803,322

\*To avoid duplication, gross savings are not presented because they are equal to net savings.

The gross and net ex post natural gas savings of the Residential Retrofit Program during the period June 2013 through May 2014 are summarized by program component in Table ES-3 and by utility in Table ES-4. Net natural gas savings total 844,231 therms for the period.

Table ES-3 Summary of Therm Savings for Residential Retrofit Program by Program Component

<i>Program Component</i>	<i>Utility</i>	<i>TRM-Calculated</i>		<i>TRM-Calculated (Errata Corrected)</i>		<i>ADM-Calculated</i>		<i>Net-to-Gross Ratio</i>
		<i>Gross Ex Post Therm Savings</i>	<i>Net Ex Post Therm Savings</i>	<i>Gross Ex Post Therm Savings</i>	<i>Net Ex Post Therm Savings</i>	<i>Gross Ex Post Therm Savings</i>	<i>Net Ex Post Therm Savings</i>	
Weatherization	Ameren	131,896	131,896	126,413	126,413	126,413	126,413	100%
	Nicor	81,320	81,320	77,849	77,849	77,849	77,849	100%
	North Shore	16,076	16,076	14,420	14,420	14,420	14,420	100%
	Peoples	112,193	112,193	109,816	109,816	109,816	109,816	100%
	Subtotal	341,485	341,485	328,498	328,498	328,498	328,498	100%
Program Grantees	Ameren	57,856	57,856	54,129	54,129	54,129	54,129	100%
	Nicor	198,735	198,735	168,672	168,672	168,672	168,672	100%
	North Shore	6,399	6,399	4,761	4,761	4,761	4,761	100%
	Peoples	380,675	380,675	288,171	288,171	288,171	288,171	100%
	Subtotal	643,665	643,665	515,733	515,733	515,733	515,733	100%
Total		985,149	985,149	844,231	844,231	844,231	844,231	100%

*Table ES-4 Summary of Therm Savings for Residential Retrofit Program by Utility*

<i>Gas Utility</i>	<i>Realized Net Therms Savings*</i>
Ameren	180,541
Nicor	246,521
North Shore	19,181
Peoples	397,987
Total	844,231

*\*To avoid duplication, gross savings are not presented because they are equal to net savings.*

The gross and net ex post peak kW reductions of the Residential Retrofit Program during the period June 2013 through May 2014 are summarized by program component in Table ES-5 and by utility in Table ES-6. Net ex post peak kW reductions total 3,514.81 kW for the period.

*Table ES-5 Summary of kW Savings for Residential Retrofit Program by Program Component*

<i>Program Component</i>	<i>Utility</i>	<i>TRM-Calculated</i>		<i>TRM-Calculated (Errata Corrected)</i>		<i>ADM-Calculated</i>		<i>Net-to-Gross Ratio</i>
		<i>Gross Ex Post kW Savings</i>	<i>Net Ex Post kW Savings</i>	<i>Gross Ex Post kW Savings</i>	<i>Net Ex Post kW Savings</i>	<i>Gross Ex Post kW Savings</i>	<i>Net Ex Post kW Savings</i>	
Weatherization	Ameren	1,289.87	1,289.87	1,267.28	1,267.28	1,299.80	1,299.80	100%
	ComEd	1,499.18	1,499.18	1,483.76	1,483.76	1,530.48	1,530.48	100%
	Subtotal	2,789.05	2,789.05	2,751.05	2,751.05	2,830.27	2,830.27	100%
Program Grantees	Ameren	118.00	118.00	100.38	100.38	100.35	100.35	100%
	ComEd	596.44	596.44	487.22	487.22	516.12	516.12	100%
	Subtotal	714.44	714.44	587.60	587.60	616.47	616.47	100%
CDAP	Ameren	63.27	63.27	63.23	63.23	68.07	68.07	100%
	ComEd	-	-	-	-	-	-	-
	Subtotal	63.27	63.27	63.23	63.23	68.07	68.07	100%
Total		3,566.76	3,566.76	3,401.88	3,401.88	3,514.81	3,514.81	100%

*Table ES-6 Summary of kW Savings for Residential Retrofit Program by Utility*

<i>Gas Utility</i>	<i>Realized Net kW Savings*</i>
Ameren	1,468.21
ComEd	2,046.60
Total	3,514.81

*\*To avoid duplication, gross savings are not presented because they are equal to net savings.*

Interviews were conducted with grant recipients and residents to better understand the effectiveness of program delivery. From the participant perspective, the program is generally effective and operating smoothly. However, review of program documentation and in-depth interviews with program staff indicate that there are aspects of the program that could be improved in order to increase awareness, improve administration and project tracking, and better align reporting requirements with the informational needs for assessing savings.

The following presents a selection of key conclusions from EPY6/GPY3:

- **Electricity Natural Gas Savings Increased from the Prior Program Year:** The program kWh savings for EPY6/GPY3 were 5,803,322 which is an increase from 4,025,972 kWh savings in the last program year. The program therm savings for EPY6/GPY3 were 844,231 which is an increase from 672,618 therm savings in the last program year.

ADM was unable to calculate savings for one program grantee project. ADM contacted the grantee to request project documentation but was supplied general construction documents that did not provide specific information about the characteristics of the energy saving measure implemented. The program has implemented new procedures to collect additional measure information that should prevent this in the future.

- **Verifications of Measures:** Program staff has begun verification visits for all projects completed through the program. This change should mitigate the risk of verification failures in future program years.

The following recommendations are offered in the interest of improving the program:

- **Consider Additional Measure Types:** There are several TRM measures not currently offered with a standard incentive through the program. These measures include outdoor lighting, lighting controls, LED exit signs, low-flow showerheads, faucet aerators, boiler replacements, LED omnidirectional bulbs and downlights.
- **Notify Technical Consultant when Projects Initiated:** Program staff should establish procedures to notify the program technical consultant when projects are initiated so that verification visits can include inspection earlier in the building retrofit process. For example, advance notification will allow for inspection of insulation levels in open walls prior to finishing.

# 1. Introduction

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This report presents the results of the impact and process evaluations of the Illinois Department of Commerce and Economic Opportunity (DCEO) Low Income Residential Retrofit Program during EPY6/GPY3, defined as the period June 2013 through May 2014.

## 1.1 Description of Program

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The Residential Retrofit Program offers grants to state agencies, local governments, and other entities that administer low income home improvements. Funds used for weatherization must be targeted at households at or below 200% of the federal poverty level. Low income home improvements must be targeted at households at or below 80% of the area Average Median Income (AMI).

During EPY6/GPY3, grants were awarded to (1) other programs that are operated by the DCEO, referred to as intra-agency grants; and (2) to external applicants engaged in low income construction projects.

Intra-agency grants were awarded to:

- The Community Development Assistance Program; and
- The Illinois Home Weatherization Assistance Program.

Additionally, program grants were awarded to the following external organizations:

- Elevate Energy;
- Hispanic Housing;
- The Community Builders, Inc.;
- Historic Chicago Bungalow Association;
- The Black United Fund;
- Residential Options.

Grant funds for most participants are prescriptive and based on the measures that are outlined in the program application. Applicants may propose additional measures provided that they include estimates of the energy savings from these measures. Decisions regarding the funding of proposed measures are based on staff reviews of estimated savings. Grantees receive funds for expected electric and gas energy savings.

Total grant funds cannot exceed \$750,000 and may not exceed 100 percent of the installed cost. However, the DCEO Director reserves the right to waive funding limitations and other program parameters.

## 1.2 Overview of Evaluation Approach

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The overall objective for the impact evaluation of the Residential Retrofit Program was to determine the net electric and natural gas energy savings and peak demand (kW) reductions resulting from program projects implemented during EPY6/GPY3.

The approach for the impact evaluation included the following main features:

- Available project documentation (e.g., invoices, savings calculations) was reviewed, with particular attention given to the calculation procedures and documentation for savings estimates.
- Gross savings were verified via analytical desk review.

The process evaluation approach involved the following:

- Review of program documentation and prior evaluation reports;
- Interviews with program staff members discussing program operations, successes, challenges, and future plans; and
- Interviews with grant recipients to gather information on their organization and their experience with the program.

### 1.3 Organization of Report

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The evaluation report for the Residential Retrofit Program is organized as follows:

- Chapter 2 presents and discusses the analytical methods and results of estimating program savings.
- Chapter 3 presents and discusses the analytical methods and results of the process evaluation of the program.
- Appendix A provides profiles of grant recipient organizations.

## 2. Impact Evaluation

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This chapter presents the results of the impact evaluation of the Low Income Residential Retrofit Program offered by the Illinois Department of Commerce and Economic Opportunity (DCEO). The overall objective of the impact evaluation was to determine the net electric and natural gas savings, as well as peak demand (kW) reductions resulting from program projects during the period June 2013 through May 2014. Section 2.1 describes the methodology used for estimating gross savings. Section 2.2 presents the results from the effort to estimate savings for the Residential Retrofit Program.

### 2.1 Methodology for Calculating Program Savings

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The methodology used for calculating program savings is described in this section. The overall objective for the impact evaluation of the Residential Retrofit Program was to determine the net electric and natural gas savings, as well as peak demand (kW) reductions resulting from projects completed during EPY6/GPY3. When applicable, the measure-level algorithms from the Illinois Statewide Technical Reference Manual (TRM) Version 2.0 (Illinois TRM) were used to estimate savings (see Table 2-1).

Depending on the measure type, savings were calculated using up to three different approaches. These approaches were as follows:

- TRM-Calculated: Savings calculated as per Illinois's Statewide TRM Version 2.0.
- TRM-Calculated (Errata Corrected): Savings calculated as per an erratum, in Version 3.0 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 that particular measure.

Table 2-1 Illinois TRM Sections by Measure Type

Measure	Section in Illinois TRM	Other Resources	TRM	Errata Corrected	ADM
Air Sealing	5.6.1	-	●		
Attic / Wall Insulation	5.6.4	-	●	●	
Bathroom Exhaust Fan	5.3.9	-	●		
Boiler	5.3.6	-	●		
Boiler - Commercial	4.4.10	-	●	●	
Boiler Lockout/Reset Controls	4.4.4	-	●	●	
Ceiling Fan	N/A	ES Calculator			●
Central AC w/ PT	5.3.3	-	●		
CFLs	5.5.1	-	●		
Dishwasher	5.1.4	-	●	●	
Exit Signs	5.5.7	-	●		
Furnace	5.3.7	-	●		
Furnace – Commercial	4.4.11	-	●	●	
LED Bulbs and Fixtures	4.5.4	-	●		
Programmable Thermostat	5.3.11	-	●		
Refrigerator	5.1.6	-	●		●
Room AC	5.1.7	-	●		●
Smart Pump	N/A	Engineering Review			●
T8 Fixtures and Lamps	4.5.3	-	●		
Vending Controls	4.6.2	-	●		
Water Heater – Electric	N/A	Engineering Review			●
Water Heater – Gas	5.4.2	-	●		

2.1.1 Air Sealing

To develop ex post savings for air sealing, ADM applied the following savings algorithm from section 5.6.1 of the Illinois TRM:

$$\Delta kWh = \Delta kWh_{cooling} + \Delta kWh_{heating}$$

$$\Delta Therms = (((CFM50_{existing} - CFM50_{new})/N_{heat}) * 60 * 24 * HDD * 0.018) / (\eta_{Heat} * 100,000)$$

Where,

$\Delta kWh_{cooling}$  = If central cooling, reduction in annual cooling requirement due to air sealing:

$$[(((CFM50_{existing} - CFM50_{new})/N_{cool}) * 60 * 24 * CDD * DUA * 0.018) / (1000 * \eta_{Cool})] * LM$$

$\Delta kWh_{heating}$  = If electric heat (resistance or heat pump), reduction in annual electric heating due to air sealing:

$$(((CFM50_{existing} - CFM50_{new})/N_{heat}) * 60 * 24 * HDD * 0.018) /$$

$$(\eta_{Heat} * 3,412)$$

If gas furnace heat, kWh savings for reduction in fan run time:

$$\Delta Therms * Fe * 29.3$$

*CFM50\_existing* = Infiltration at 50 Pascals as measured by blower door before air sealing.

*CFM50\_new* = Infiltration at 50 Pascals as measured by blower door after air sealing.

*N\_cool* = Conversion factor from leakage at 50 Pascal to leakage at natural conditions

*N\_heat* = Conversion factor from leakage at 50 Pascal to leakage at natural conditions

*CDD* = Cooling Degree Days

*HDD* = Heating Degree Days

*DUA* = Discretionary Use Adjustment (reflects the fact that people do not always operate their AC when conditions may call for it).

*ηCool* = Efficiency (SEER) of Air Conditioning equipment (kBtu/kWh)

*ηHeat* = Efficiency of heating system

*LM* = Latent multiplier to account for latent cooling demand

*Fe* = Furnace Fan energy consumption as a percentage of annual fuel consumption

### 2.1.2 Attic/Wall Insulation

To develop ex post savings for attic and wall insulation, ADM applied the following savings algorithm from section 5.6.4 of the Illinois TRM:

$$\Delta kWh = (\Delta kWh_{cooling} + \Delta kWh_{heating}) * ADJ$$

$$\Delta Therms = (((1/R_{old} - 1/R_{wall}) * A_{wall} * (1-Framing\_factor)) + (1/R_{old} - 1/R_{attic}) * A_{attic} * (1-Framing\_factor/2)) * 24 * HDD) / (\eta_{Heat} * 100,067 \text{ Btu/therm}) * ADJ$$

Where,

*ΔkWh\_cooling* = If central cooling, reduction in annual cooling requirement due to insulation:

$$(((1/R_{old} - 1/R_{wall}) * A_{wall} * (1-Framing\_factor)) + (1/R_{old} - 1/R_{attic}) * A_{attic} * (1-Framing\_factor/2)) * 24 * CDD * DUA] / (1000 * \eta_{Cool})$$

*ΔkWh\_heating* = If electric heat (resistance or heat pump), reduction in annual electric heating due to insulation:

$$((1/R_{old} - 1/R_{wall}) * A_{wall} * (1-Framing\_factor)) + (1/R_{old} -$$

$$1/R_{attic}) * A_{attic} * (1-Framing\_factor/2)) * 24 * HDD] / (\eta_{Heat} * 3412)$$

If gas furnace heat, kWh savings for reduction in fan run time:

$$\Delta Therms * Fe * 29.3$$

*ADJ* = Adjustment to account for prescriptive engineering algorithms overclaiming savings; TBD.

*R<sub>wall</sub>* = R-value of new wall assembly (including all layers between inside air and outside air).

*R<sub>attic</sub>* = R-value of new attic assembly (including all layers between inside air and outside air).

*R<sub>old</sub>* = R-value value of existing assemble and any existing insulation. (Minimum of R-5 for uninsulated assemblies).

*A<sub>wall</sub>* = Total area of insulated wall (ft<sup>2</sup>)

*A<sub>attic</sub>* = Total area of insulated ceiling/attic (ft<sup>2</sup>)

*Framing\_factor* = Adjustment to account for area of framing

*CDD* = Cooling Degree Days

*HDD* = Heating Degree Days

*DUA* = Discretionary Use Adjustment (reflects the fact that people do not always operate their AC when conditions may call for it).

*$\eta_{Cool}$*  = Seasonal Energy Efficiency Ratio of cooling system (kBtu/kWh)

*$\eta_{Heat}$*  = Efficiency of heating system

*Fe* = Furnace Fan energy consumption as a percentage of annual fuel consumption

### 2.1.3 Bathroom Exhaust Fan

To develop ex post savings for bathroom exhaust fans, ADM applied the following savings algorithm from section 5.3.9 of the Illinois TRM:

$$\Delta kWh = (CFM * (1/\eta_{Baseline} - 1/\eta_{Efficient})/1,000) * Hours$$

Where,

*CFM* = Nominal capacity of exhaust fan.

*$\eta_{Baseline}$*  = The efficiency of the baseline unit.

*$\eta_{Efficient}$*  = The efficiency of the baseline unit.

*Hours* = Annual hours of operation.

#### 2.1.4 Beverage and Snack Machine Controls

To develop ex post savings for gas furnaces, ADM applied the following savings algorithm from section 4.6.2 of the Illinois TRM:

$$\Delta kWh = WattsBase / 1000 * Hours * ESF$$

Where,

*WattsBase* = Watts for baseline fixture.

*Hours* = Annual hours of operation.

*ESF* = Energy savings factor.

#### 2.1.5 Boiler Lockout/Reset Controls

To develop ex post savings for gas furnaces, ADM applied the following savings algorithm from section 4.4.4 of the Illinois TRM:

$$\Delta Therms = Binput * SF * EFLH / (Effpre * 100)$$

Where,

*Binput* = Boiler Input Capacity (kBTU).

*SF* = Savings factor.

*EFLH* = Equivalent Full Load Hours for heating.

*Effpre* = Boiler Efficiency or custom.

*Tout* = Tank temperature.

*Tin* = Temperature of the incoming supply water.

#### 2.1.6 Boiler

To develop ex post savings for gas high efficiency boilers, ADM applied the following savings algorithm from section 5.3.6 of the Illinois TRM:

$$\Delta Therms = Gas\_Boiler\_Load * (1/AFUE(base) - 1/AFUE(eff))$$

Where,

*Gas\_Boiler\_Load* = Estimate of annual household load for gas boiler heated single family home.

*AFUE(base)* = Baseline boiler annual fuel utilization rating.

*AFUE(eff)* = Efficient boiler annual fuel utilization efficiency rating.

#### 2.1.7 Boiler – Commercial

To develop ex post savings for gas high efficiency boilers, ADM applied the following savings algorithm from section 4.4.10 of the Illinois TRM:

$$\Delta Therms = EFLH * Capacity * (1/Efficiency Rating (base) - 1/Efficiency Rating (eff))/100,000$$

Where,

- $EFLH$  = Equivalent Full Load Hours of heating.  
 $Capacity$  = Nominal Heating Capacity Boiler Size.  
 $Efficiency\ Rating\ (base)$  = Baseline boiler efficiency rating.  
 $Efficiency\ Rating\ (eff)$  = Efficient boiler efficiency rating

### 2.1.8 Ceiling Fan

To develop ex post savings for ceiling fans, ADM referenced the most recent ENERGY STAR® savings calculator, which recommends annual savings of 115 kWh for the replacement of a ceiling fan with lighting. This value assumes that conventional ceiling fan have 120 watt bulbs, while ENERGY STAR® rated ceiling fan have 25 watt bulbs.

### 2.1.9 Central Air Conditioner: SEER 14 with Programmable Thermostat

To develop ex post savings for central air conditioning, ADM applied the following savings algorithm from section 5.3.3 of the Illinois TRM:

$$\Delta kWh\ for\ remaining\ life\ of\ existing\ unit\ (1st\ 6\ years) = ((FLH_{cool} * Capacity * (1/SEER_{exist} - 1/SEER_{ee}))/1000)$$

Where,

$$\Delta kWh = \%ElectricHeat * Elec\_Heating\_Consumption * Heating\_Reduction * HF * Eff\_ISR + (\Delta Therms * Fe * 29.3)$$

$$\Delta Therms = \%FossilHeat * Gas\_Heating\_Consumption * Heating\_Reduction * HF * Eff\_ISR$$

Where,

- $\%ElectricHeat$  = Percentage of heating savings assumed to be electric.  
 $\%FossilHeat$  = Percentage of heating savings assumed to be Natural Gas.  
 $Elec\_Heating\_Consumption$  = Estimate of annual household heating consumption for electrically heated single-family homes.  
 $Gas\_Heating\_Consumption$  = Estimate of annual household heating consumption for gas heated single-family homes. If location is unknown, assume the average below.  
 $Heating\_Reduction$  = Assumed percentage reduction in heating energy consumption due to programmable thermostat.  
 $HF$  = Household factor, to adjust heating consumption for non-single-family households.  
 $Eff\_ISR$  = Effective In-Service Rate, the percentage of thermostats installed and programmed effectively.

$Fe$  = Furnace Fan energy consumption as a percentage of annual fuel consumption.

#### 2.1.10 Compact Fluorescent Lamp / Lighting

To develop ex post savings for compact fluorescent lamps CFLs, ADM applied the following savings algorithm from section 5.4.2 of the Illinois TRM:

$$\Delta kWh = ((WattsBase - WattsEE) / 1000) * ISR * Hours * WHFe$$

Where,

$WattsBase$  = Watts for baseline fixture.

$WattsEE$  = Watts for energy efficient fixture.

$ISR$  = In-service rate.

$Hours$  = Annual hours of operation.

$WHFe$  = Waste heat factor.

#### 2.1.11 Dishwasher

To develop ex post savings for ENERGY STAR<sup>®</sup> dishwashers, ADM applied the following savings algorithm from section 5.1.4 of the Illinois TRM:

$$\Delta kWh = (kWh_{base} - kWh_{estar}) * [\%kWh_{op} + (\%kWh_{heat} * \%Electric_{DWH})]$$

Where,

$kWh_{base}$  = Baseline kWh consumption per year.

$kWh_{estar}$  = ENERGY STAR<sup>®</sup> kWh annual consumption.

$\%kWh_{op}$  = Percentage of dishwasher energy consumption used for unit *operation*.

$\%kWh_{heat}$  = Percentage of dishwasher energy consumptions used for water *heating*.

$\%Electric_{DHW}$  = Percentage of DHW Savings assumed to be electric.

#### 2.1.12 Furnace

To develop ex post savings for gas furnaces, ADM applied the following savings algorithm from section 5.3.7 of the Illinois TRM:

$$\Delta Therms = Gas\_Furnace\_Heating\_Load * (1/AFUE(base) - 1/AFUE(eff))$$

Where,

$Gas\_Furnace\_Heating\_Load$  = Estimate of annual household heating load for gas furnace heated single family home.

$AFUE(base)$  = Baseline furnace annual fuel utilization rating.

$AFUE(eff)$  = Efficient furnace annual fuel utilization efficiency rating

## 2.1.13 Furnace – Commercial

$$\Delta kWh = \text{Heating Savings} + \text{Cooling Savings} + \text{Shoulder Season Savings}$$

Where,

*Heating Savings* = ECM savings during cooling season.

*Cooling Savings* = ECM savings during heating season.

*Shoulder Season Savings* = ECM savings during shoulder season.

$$\Delta Therms = EFLH * Capacity * (1/\text{Efficiency Rating (base)} - 1/\text{Efficiency Rating (eff)})/100,000$$

Where,

*EFLH* = Equivalent Full Load Hours of heating.

*Capacity* = Nominal Heating Capacity Boiler Size.

*Efficiency Rating (base)* = Baseline furnace annual fuel utilization efficiency rating.

*Efficiency Rating (eff)* = Efficient furnace annual fuel utilization efficiency rating.

## 2.1.14 LED Bulbs and Fixtures

To develop ex post savings for room air conditioner, ADM applied the following savings algorithm from section 4.5.4 of the Illinois TRM:

$$\Delta kWh = ((\text{WattsBase} - \text{WattsEE}) / 1000) * \text{ISR} * \text{Hours} * \text{WHFe}$$

Where,

*WattsBase* = Watts for baseline fixture.

*WattsEE* = Watts for energy efficient fixture.

*Hours* = Annual hours of operation.

*WHFe* = Waste heat factor.

## 2.1.15 LED Exit Signs

To develop ex post savings for ENERGY STAR<sup>®</sup> dishwashers, ADM applied the following savings algorithm from section 5.1.4 of the Illinois TRM:

$$\Delta kWh = ((\text{WattsBase} - \text{WattsEE}) / 1000) * \text{ISR} * \text{Hours} * \text{WHFe}$$

Where,

*WattsBase* = Watts for baseline fixture.

*WattsEE* = Watts for energy efficient fixture.

$Hours =$  Annual hours of operation.

$WHFe =$  Waste heat factor.

#### 2.1.16 Programmable Thermostat

To develop ex post savings for ENERGY STAR<sup>®</sup> dishwashers, ADM applied the following savings algorithm from section 5.1.4 of the Illinois TRM:

$$\Delta kWh = \%ElectricHeat * Elec\_Heating\_Consumption * Heating\_Reduction * HF * Eff\_ISR + (\Delta Therms * Fe * 29.3)$$

$$\Delta Therms = \%FossilHeat * Gas\_Heating\_Consumption * Heating\_Reduction * HF * Eff\_ISR$$

Where,

$\%ElectricHeat =$  Percentage of heating savings assumed to be electric.

$\%FossilHeat =$  Percentage of heating savings assumed to be Natural Gas.

$Elec\_Heating\_Consumption =$  Estimate of annual household heating consumption for electrically heated single-family homes.

$Gas\_Heating\_Consumption =$  Estimate of annual household heating consumption for gas heated single-family homes. If location is unknown, assume the average below.

$Heating\_Reduction =$  Assumed percentage reduction in heating energy consumption due to programmable thermostat.

$HF =$  Household factor, to adjust heating consumption for non-single-family households.

$Eff\_ISR =$  Effective In-Service Rate, the percentage of thermostats installed and programmed effectively.

$Fe =$  Furnace Fan energy consumption as a percentage of annual fuel consumption.

#### 2.1.17 Refrigerator

To develop ex post savings for ENERGY STAR<sup>®</sup> Refrigerators, ADM applied the following savings algorithm from section 5.1.6 of the Illinois TRM:

$$\Delta kWh = UEC_{BASE} - UEC_{EE}$$

Where,

$UEC_{BASE} =$  Annual Unit Energy Consumption of baseline unit as calculated in algorithm provided in table above.

$UEC_{EE} =$  Annual Unit Energy Consumption of ENERGY STAR unit as calculated in algorithm provided in table above.

Unit energy consumption can be determined by using the algorithms specified in the following table:

*Table 2-2 Unit Energy Consumption of Refrigerators*

<i>Product Category</i>	<i>NAECA as of July 1, 2001 Maximum Energy Usage in kWh/year</i>	<i>Current ENERGY STAR level Maximum Energy Usage in kWh/year</i>
1. Refrigerators and Refrigerator-freezers with manual defrost	8.82*AV+248.4	7.056*AV+198.72
2. Refrigerator-Freezer--partial automatic defrost	8.82*AV+248.4	7.056*AV+198.72
3. Refrigerator-Freezers--automatic defrost with top-mounted freezer without through-the-door ice service and all-refrigerators--automatic defrost	9.80*AV+276	7.84*AV+220.8
4. Refrigerator-Freezers--automatic defrost with side-mounted freezer without through-the-door ice service	4.91*AV+507.5	3.928*AV+406
5. Refrigerator-Freezers--automatic defrost with bottom-mounted freezer without through-the-door ice service	4.60*AV+459	3.68*AV+367.2
6. Refrigerator-Freezers--automatic defrost with top-mounted freezer with through-the-door ice service	10.20*AV+356	8.16*AV+284.8
7. Refrigerator-Freezers--automatic defrost with side-mounted freezer with through-the-door ice service	10.10*AV+406	8.08*AV+324.8

Where,

$$AV = Adjusted\_volume = Fresh\_volume + (1.63 * Freezer\_volume)$$

2.1.18 Room Air Conditioner

To develop ex post savings for room air conditioner, ADM applied the following savings algorithm from section 5.1.7 of the Illinois TRM:

$$\Delta kWh = ((FLH_{RoomAC} * BtuH * (1/EER_{base} - 1/EER_{ee}))/1000)$$

Where,

$FLH_{RoomAC}$  = Full Load Hours of room air conditioning unit

$Btu/H$  = Size of retired unit

$EER_{base}$  = Efficiency of baseline unit

$EER_{ee}$  = Efficiency of CEE Tier 1 (or ENERGY STAR Version 3.0) unit

2.1.19 Water Duplex Booster Pump

The Illinois TRM does not include a savings calculation methodology for energy efficient water duplex booster pump. Based on an engineering review of the measure, the ex post electric savings can be calculated using the following algorithm:

Where:  $\Delta P$  = Pressure Head, psi

Q = Flow, gpm  
 1714 = Horsepower conversion factor

$$\text{Brake Pump Power}_{base} = \frac{\text{hydraulic power}}{\eta_{p,base}}$$

Where:  $\eta_{p,base}$  = efficiency of baseline pump

$$\text{Brake Pump Power}_{as-built} = \frac{\text{hydraulic power}}{\eta_{p,as-built}}$$

Where:  $\eta_{p,as-built}$  = efficiency of as-built pump

$$\text{Motor Input Power}_{kW} \text{ Savings} = \frac{\Delta \text{break pump power}}{\eta_m}$$

Where:  $\eta_m$  = efficiency of pump motor

$$\Delta \text{break pump power} = \text{Brake Pump Power}_{base} - \text{Brake Pump Power}_{as-built}$$

$$\text{kWh Savings} = \text{motor input power savings} \times 8766$$

Where: 8766 = annual hours of operation

### 2.1.20 T8 Fixtures and Lamps

To develop ex post savings for room air conditioner, ADM applied the following savings algorithm from section 5.1.7 of the Illinois TRM:

$$\Delta kWh = ((\text{WattsBase} - \text{WattsEE}) / 1000) * \text{ISR} * \text{Hours} * \text{WHFe}$$

Where,

$\text{WattsBase}$  = Watts for baseline fixture.

$\text{WattsEE}$  = Watts for energy efficient fixture.

$\text{Hours}$  = Annual hours of operation.

$\text{WHFe}$  = Waste heat factor.

### 2.1.21 Water Heater - Electric

To develop ex post savings for electric water heaters, ADM applied the following savings algorithm (with some modifications to the algorithm) from section 5.4.3 of the Illinois TRM:

$$\Delta kWh = (1/EF_{base} - 1/EF_{efficient}) * (\text{GPD} * 365.25 * \gamma_{Water} * (\text{Tout} - \text{Tin}) * 1.0) / 3412$$

Where,

$EF_{base}$  = Efficiency of the baseline equipment.

$EF_{efficient}$  = Efficiency of the new equipment.

$\text{GPD}$  = Gallons of water used per day.

$\gamma_{Water}$  = Specific weight of water.

$T_{out}$  = Tank temperature.

$T_{in}$  = Temperature of the incoming supply water.

### 2.1.22 Water Heater - Gas

To develop ex post savings for gas water heaters, ADM applied the following savings algorithm from section 5.4.2 of the Illinois TRM:

$$\Delta Therms = (1/EF_{base} - 1/EF_{efficient}) * (GPD * 365.25 * \gamma_{Water} * (T_{out} - T_{in}) * 1.0) / 100,000$$

Where,

$EF_{base}$  = Efficiency of the baseline equipment.

$EF_{efficient}$  = Efficiency of the new equipment.

$GPD$  = Gallons of water used per day.

$\gamma_{Water}$  = Specific weight of water.

$T_{out}$  = Tank temperature.

$T_{in}$  = Temperature of the incoming supply water.

## 2.2 Results of Impact Evaluation

This section presents the results of the impact evaluation for the Residential Retrofit Program during the period of June 2013 through May 2014.

### 2.2.1 Program-Level Savings Results

This subsection presents the gross and net savings for the Residential Retrofit Program. A net-to-gross factor of 100% was used because the Residential Retrofit Program targets low income residents.

The gross and net ex post kWh and kW savings for the Residential Retrofit Program during the period June 2013 through May 2014 are summarized by program component in Table 2-3 and Table 2-5, by utility in Table 2-4 and Table 2-6, and by measure in Table 2-7. Net ex post electricity savings energy savings total 5,803,322 kWh and net peak demand reductions total 3,514.81 kW for the period.

Table 2-3 Summary of kWh Savings by Program Component

Program Component	Utility	TRM-Calculated		TRM-Calculated (Errata Corrected)		ADM-Calculated		Net-to-Gross Ratio
		Gross Ex Post kWh Savings	Net Ex Post kWh Savings	Gross Ex Post kWh Savings	Net Ex Post kWh Savings	Gross Ex Post kWh Savings	Net Ex Post kWh Savings	
Weatherization <sup>1</sup>	Ameren	1,646,196	1,646,196	1,642,710	1,642,710	1,856,640	1,856,640	100%
	ComEd	1,761,487	1,761,487	1,760,494	1,760,494	2,068,650	2,068,650	100%
	Subtotal	3,407,684	3,407,684	3,403,204	3,403,204	3,925,291	3,925,291	100%
Program Grantees	Ameren	198,130	198,130	190,244	190,244	190,463	190,463	100%
	ComEd	1,449,723	1,449,723	1,356,515	1,356,515	1,539,875	1,539,875	100%
	Subtotal	1,647,853	1,647,853	1,546,759	1,546,759	1,730,338	1,730,338	100%
CDAP <sup>2</sup>	Ameren	117,651	117,651	117,346	117,346	147,693	147,693	100%
	ComEd	-	-	-	-	-	-	-
	Subtotal	117,651	117,651	117,346	117,346	147,693	147,693	100%
Total		5,173,188	5,173,188	5,067,308	5,067,308	5,803,322	5,803,322	100%

Table 2-4 Summary of kWh Savings by Utility

Gas Utility	Realized Net kWh Savings*
Ameren	2,194,797
ComEd	3,608,526
Total	5,803,322

\*To avoid duplication, gross savings are not presented because they are equal to net savings.

<sup>1</sup> For the weatherization component, a database containing information about measures installed and equipment specifications was provided. Energy savings were calculated using this information.

<sup>2</sup> For the Community Development Assistance Program component, a desk review was conducted in order to estimate electric savings. Documentation for forty homes was requested from program administrators but not all documentation was received. Savings were calculated for any measures that were present in the documentation; however, several assumptions were made for key characteristics for some of the measures.

*Table 2-5 Summary of kW Savings by Program Component*

Program Component	Utility	TRM-Calculated		TRM-Calculated (Errata Corrected)		ADM-Calculated		Net-to-Gross Ratio
		Gross Ex Post kW Savings	Net Ex Post kW Savings	Gross Ex Post kW Savings	Net Ex Post kW Savings	Gross Ex Post kW Savings	Net Ex Post kW Savings	
Weatherization	Ameren	1,289.87	1,289.87	1,267.28	1,267.28	1,299.80	1,299.80	100%
	ComEd	1,499.18	1,499.18	1,483.76	1,483.76	1,530.48	1,530.48	100%
	Subtotal	2,789.05	2,789.05	2,751.05	2,751.05	2,830.27	2,830.27	100%
Program Grantees	Ameren	118.00	118.00	100.38	100.38	100.35	100.35	100%
	ComEd	596.44	596.44	487.22	487.22	516.12	516.12	100%
	Subtotal	714.44	714.44	587.60	587.60	616.47	616.47	100%
CDAP	Ameren	63.27	63.27	63.23	63.23	68.07	68.07	100%
	ComEd	-	-	-	-	-	-	-
	Subtotal	63.27	63.27	63.23	63.23	68.07	68.07	100%
Total		3,566.76	3,566.76	3,401.88	3,401.88	3,514.81	3,514.81	100%

*Table 2-6 Summary of kW Savings by Utility*

Gas Utility	Realized Net kW Savings*
Ameren	1,468.21
ComEd	2,046.60
Total	3,514.81

*\*To avoid duplication, gross savings are not presented because they are equal to net savings.*

Table 2-7 Summary of kWh Savings by Measure

Measure	TRM-Calculated		TRM-Calculated (Errata Corrected)		ADM-Calculated		Net-to-Gross Ratio
	Gross Ex Post KWh Savings	Net Ex Post KWh Savings	Gross Ex Post KWh Savings	Net Ex Post KWh Savings	Gross Ex Post KWh Savings	Net Ex Post KWh Savings	
Air Sealing	1,980,160	1,980,160	1,980,160	1,980,160	1,980,160	1,980,160	100%
Attic Insulation	522,808	522,808	459,227	459,227	459,227	459,227	100%
Bathroom Exhaust Fan	11,781	11,781	11,781	11,781	11,781	11,781	100%
Ceiling Fan	-	-	-	-	2,442	2,442	100%
Central AC w/ PT	90,284	90,284	90,284	90,284	90,284	90,284	100%
CFL	1,392,522	1,392,522	1,392,522	1,392,522	1,392,522	1,392,522	100%
Dishwasher	731	731	146	146	146	146	100%
Electric Water Heater	-	-	-	-	553	553	100%
LED Bulbs and Fixtures	223,720	223,720	223,720	223,720	223,720	223,720	100%
LED Exit Signs	24,369	24,369	24,369	24,369	24,369	24,369	100%
Furnace Blower Motor	501,825	501,825	501,825	501,825	501,825	501,825	100%
Lighting Fixtures	47,442	47,442	47,442	47,442	47,442	47,442	100%
Refrigerator	104,137	104,137	104,137	104,137	658,455	658,455	100%
Room AC	59	59	59	59	6,376	6,376	100%
Wall Insulation	271,736	271,736	230,022	230,022	230,022	230,022	100%
Smart Pump	-	0	-	-	172,384	172,384	100%
Vending Controls	1,613	1,613	1,613	1,613	1,613	1,613	100%
Total	5,173,188	5,173,188	5,067,308	5,067,308	5,803,322	5,803,322	100%

The gross and net ex post natural gas savings of the Residential Retrofit Program during the period June 2013 through May 2014 are summarized by program component in Table 2-8 by utility in Table 2-9, and by measure in Table 2-10. Net ex post natural gas savings total 844,231 therms for the period.

*Table 2-8 Summary of Net Natural Gas Savings by Program Component*

Program Component	Utility	TRM-Calculated		TRM-Calculated (Errata Corrected)		ADM-Calculated		Net-to-Gross Ratio
		Gross Ex Post Therm Savings	Net Ex Post Therm Savings	Gross Ex Post Therm Savings	Net Ex Post Therm Savings	Gross Ex Post Therm Savings	Net Ex Post Therm Savings	
Weatherization	Ameren	131,896	131,896	126,413	126,413	126,413	126,413	100%
	Nicor	81,320	81,320	77,849	77,849	77,849	77,849	100%
	North Shore	16,076	16,076	14,420	14,420	14,420	14,420	100%
	Peoples	112,193	112,193	109,816	109,816	109,816	109,816	100%
	Subtotal	341,485	341,485	328,498	328,498	328,498	328,498	100%
Program Grantees	Ameren	57,856	57,856	54,129	54,129	54,129	54,129	100%
	Nicor	198,735	198,735	168,672	168,672	168,672	168,672	100%
	North Shore	6,399	6,399	4,761	4,761	4,761	4,761	100%
	Peoples	380,675	380,675	288,171	288,171	288,171	288,171	100%
	Subtotal	643,665	643,665	515,733	515,733	515,733	515,733	100%
Total		985,149	985,149	844,231	844,231	844,231	844,231	100%

*Table 2-9 Summary of Net Natural Gas Savings by Utility*

Gas Utility	Realized Net Therms Savings*
Ameren	180,541
Nicor	246,521
North Shore	19,181
Peoples	397,987
Total	844,231

*\*To avoid duplication, gross savings are not presented because they are equal to net savings.*

Table 2-10 Summary of Therm Savings by Measure

Utility	TRM-Calculated		TRM-Calculated (Errata Corrected)		ADM-Calculated		Net-to-Gross Ratio
	Gross Ex Post Therm Savings	Net Ex Post Therm Savings	Gross Ex Post Therm Savings	Net Ex Post Therm Savings	Gross Ex Post Therm Savings	Net Ex Post Therm Savings	
Air Sealing	310,082	310,082	310,082	310,082	310,082	310,082	100%
Attic Insulation	304,565	304,565	226,597	226,597	226,597	226,597	100%
Boiler	596	596	596	596	596	596	100%
Boiler - Commercial	50,803	50,803	19,154	19,154	19,154	19,154	100%
Boiler Lockout/Reset Controls	3,024	3,024	878	878	878	878	100%
Furnace	105,962	105,962	105,962	105,962	105,962	105,962	100%
Furnace - Commercial	108,180	108,180	103,188	103,188	103,188	103,188	100%
Programmable Thermostat	12,900	12,900	12,900	12,900	12,900	12,900	100%
Wall Insulation	85,757	85,757	61,594	61,594	61,594	61,594	100%
Water Heater - Gas	3,281	3,281	3,281	3,281	3,281	3,281	100%
Total	985,149	985,149	844,231	844,231	844,231	844,231	100%

## 3. Process Evaluation

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This chapter presents the results of the process evaluation for the DCEO Low Income Residential Retrofit Program. The process evaluation focuses on the effectiveness of program policies and organization, as well as the program delivery framework. The purpose of the process evaluation is to assess the design and recent results of the program in order to determine how effectively it is achieving its intended outcomes.

The chapter begins with a discussion of the overall progress of the program. This is followed by an examination of certain issues that are critical to the future success of the program. This chapter also presents strategic planning and process recommendations, and highlights key findings from the interviews of grant recipients and residents. Conclusions, recommendations, and other findings from the process evaluation may be useful in comparing program years over time, and in conducting planning efforts for future program years.

### 3.1 Evaluation Objectives

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The purpose of this process evaluation is to examine program operations and results, and to identify potential program improvements that may prospectively increase program efficiency or effectiveness in terms of levels of participation and program satisfaction.

Key research questions to be addressed by this evaluation of EPY6/GPY3:

- What were the primary changes that occurred during EPY6/GPY3?
- Are there any planned changes for EPY7/GPY4?
- What were the program's greatest successes and challenges?

During the evaluation, data and information from numerous sources were analyzed to achieve the stated research objectives. Insight into the participant experience was developed through in-depth interviews with program grantees, while the program operations perspective is developed through in-depth interviews with program staff.

### 3.2 Summary of Primary Data Collection

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The primary data collection activities completed for the program evaluation effort were as follows:

- **Program Staff Interviews:** At various times during the evaluation effort, program staff were interviewed about the program operations. Interviews with program staff covered topics such as program operations, success and challenges, and changes that occurred during EPY6/GPY3 and changes that are planned for next year.
- **Participant Interviews:** Participant interviews were a key data source for many components of this process evaluation, and serve as the foundation for understanding the grant recipients' perspective. The participant interviews provided grant recipient feedback and insight

regarding their experiences with the Residential Retrofit Program. Respondents reported on their satisfaction with the program, discussed their organizations and their motivations for making the efficiency improvements, and provided recommendations related to improving the program.

### 3.3 Low Income Residential Retrofit Program Description

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The Residential Retrofit Program offers grants to state agencies, local governments, and other non-profit entities that administer low-income home improvements. Similar to previous program years, grants were awarded to other programs that are operated by DCEO, referred to as intra-agency grants, and to external applicants engaged in low-income housing projects. Intra-agency grants were awarded to the Community Development Assistance Program and the Illinois Home Weatherization Assistance Program. Additionally, seven grants were awarded to external applicants.

#### 3.3.1 Participant and Measure Eligibility Requirements

Projects funded through the Residential Retrofit Program must be targeted at households at or below 80% of the area Average Median Income (AMI). Funds used for weatherization must be targeted at households at or below the 200% of the federal poverty level. Furthermore, the projects cannot have applied or received funds for the same measures from other DCEO programs or programs operated by ComEd or Ameren.

The program includes a list of eligible measures that applicants select, including ENERGY STAR<sup>®</sup> appliances, compact fluorescent lamps, and energy efficient heating and cooling equipment. Applicants may also propose additional measures to be approved by program staff.

#### 3.3.2 Program Incentives

The Residential Retrofit Program offers standard incentives for a list of prescribed measures. Table 3-1 displays the incentive amounts for the measures included in the program. The incentive amounts listed are the maximum funds available for the measures. The amount of the incentive cannot exceed the total installed cost of the measures. Total grant funds cannot exceed \$750,000. However, the DCEO Director reserves the right to waive funding limitations and other program parameters.

*Table 3-1 Measure Incentive Levels*

<i>Energy Saving Measure</i>	<i>Maximum Amount</i>
ENERGY STAR rated refrigerator	\$700
ENERGY STAR rated fluorescent light fixtures	\$95/fixture
CFL Installation	\$5/lamp
ENERGY STAR rated bathroom exhaust fan	\$450
ENERGY STAR rated dishwasher	\$550
SEER 14.5 central air conditioner w/ programmable thermostat	\$3,100
ENERGY STAR rated ceiling fan	\$250
ENERGY STAR rated room air conditioner (per window AC unit)	\$400
ENERGY STAR rated heat pump	\$2,500
Replace existing PSC motor with electronically commutated motor or equivalent advanced air handler	\$600
Attic insulation and bypass air sealing	\$1,200
Wall insulation	\$1,300
Air leakage reduction of 30% with blower door guided sealing work	\$400
New electric water heater (minimum EFF 0.93), if all electric	\$600
ENERGY STAR rated natural gas water heater	\$600
High efficiency furnace with 92% AFUE or greater with electronically commutated motor or equivalent advanced air handler	\$1,500
Boiler controls (for multi-family housing)	*
Steam system balancing (for multi-family housing)	*
Steam/hot water pipe insulation (for multi-family housing)	\$250
Reflective Roof Coating (for multi-family housing)	\$150
ENERGY STAR Clothes Washers (for multi-family housing)	\$550

3.4 Residential Retrofit Energy Efficiency Program Grant Recipient Profile

Table 3-2 presents the grant amounts received by external organizations and the intra-agency grants distributed to the Bureau of Community Development for CDAP projects and the Bureau of Energy Assistance for IHWAP projects. Profiles of the different grantee organizations can be found in Appendix A.

*Table 3-2 EPY6/GPY3 Electricity Savings and Grants Distributed*

<i>Program Component</i>	<i>Ex Post kWh</i>	<i>Electric Grant Amount</i>	<i>Dollars per Ex Post kWh Saved</i>
Weatherization	3,925,291	\$3,000,000	\$0.76
Program Grantees	1,730,338	\$6,057,660	\$3.50
CDAP	147,693	\$649,000	\$4.39

*Table 3-3 EPY6/GPY3 Therms Savings and Grants Distributed*

<i>Program Component</i>	<i>Ex Post Therms</i>	<i>Gas Grant Amount</i>	<i>Dollars per Ex Post Therm Saved</i>
Weatherization	328,498	\$2,000,000	\$6.09
Program Grantees	515,733	\$3,184,613	\$6.17
CDAP	na	na	na

### 3.5 Grant Recipient Perspectives

Interviews were conducted with three program grant recipients. Grantees were asked to comment on their experiences with the program and provide feedback on the program's greatest strengths and challenges. Below is a summary of the key findings from those conversations.

#### 3.5.1 Program Strengths

The program guidelines provide a list of eligible measures that grantees use to define their project parameters. The variety of eligible measures available is one of the greatest strengths of the program. Specifically, grantees stated that thermal envelope improvements are measures rarely covered by other programs, but often provide significant energy savings.

Another noted strength of the program was the flexibility of the grant terms. Grantees stated that projects often change mid-year due to unforeseen circumstances, and measure quantities and equipment types can vary. When this occurs, the grantee communicates the change to DCEO program staff for a grant modification. The modification is generally approved if the newly proposed measure exceeds the standard efficiency level of what would have otherwise been installed. Grantees said this flexibility allows them to complete more projects and utilize the maximum amount of grant dollars.

#### 3.5.2 Program Challenges

As indicated in previous program years and evaluation reports, the timeline for releasing grant funds is one of the most challenging aspects of completing work for the Residential Retrofit Program. Grantees are unable to schedule work or order equipment until a grant award letter is received. The long timeline between applying for and receiving funds often limits the time available to complete the project.

EPY6/GPY3 was the second year the Illinois Technical Reference Manual (TRM) was in effect. A workbook was developed to facilitate data collection and savings calculations savings. The workbook included the fields necessary for grantees to calculate savings using the Illinois TRM algorithm. Three grantees piloted the use of the workbook in EPY6/GPY3. In response, the grantees stated that the additional reporting increased the administrative burden, and suggested increasing funds available for grant administration.

One grantee made specific comments about the prevailing wage requirement for the grant agreement. The grantee stated that the required wages exceed industry standard for some trades

because of assigned labor categories. For example, there is no specific category for labor involving thermal envelope improvements. The grantee instead uses carpenter, the labor category which most closely aligns with the required skills. However, the assigned labor rate differs from what contractors pay their employees to complete thermal envelope improvements. The wage requirements apply to the whole project, not just the DCEO funded measure resulting in increases projects costs and reduced potential energy savings. The grantee suggested that DCEO reassess the labor categories to ensure they align more closely with trades associated with program funded measures.

Another observation made was that recent trends in energy efficiency are excluded from the list of eligible measures. The list of measures has not been updated in several years and excludes measures that could provide significant savings, such as outdoor lighting. The grantee suggested comparing the program offerings to the programs operated by Illinois utilities to ensure the programs are comparable.

ADM Staff conducted a high-level review of energy efficiency programs administered by ComEd and Ameren Illinois. Table 3-4 below provides a summary of the measures offered through the utility programs compared to those offered through DCEO's Residential Retrofit Program.

Table 3-4 Program Comparison

<i>Program Offering</i>	<i>DCEO Residential Retrofit</i>	<i>ComEd (Commercial &amp; Residential)</i>	<i>Ameren Illinois (Commercial &amp; Residential)</i>
ENERGY STAR rated refrigerator	x	x	x
Low-flow showerheads and faucet aerators		x	x
ENERGY STAR rated fluorescent light fixtures	x	x	x
CFL Installation	x	x	x
ENERGY STAR rated bathroom exhaust fan	x		
ENERGY STAR rated dishwasher	x		
SEER 14.5 central air conditioner w/ programmable thermostat	x	x	
SEER 16 central air conditioner w/ programmable thermostat		x	x
ENERGY STAR rated ceiling fan	x		
ENERGY STAR rated room air conditioner (per window AC unit)	x		
ENERGY STAR rated heat pump	x	x	x
Replace existing PSC motor with electronically commutated motor or equivalent advanced air handler	x	x	
Attic insulation and bypass air sealing	x	x	x
Wall insulation	x	x	x
Air leakage reduction of 30% with blower door guided sealing work	x	x	x
New electric water heater (minimum EFF 0.93), if all electric	x	x	x
ENERGY STAR rated natural gas water heater	x		x
High efficiency furnace with 92% AFUE or greater with electronically commutated motor or equivalent advanced air handler	x	x	x
Boiler controls (for multi-family housing)	x		
Steam system balancing (for multi-family housing)	x		
Boiler Replacement		x	x
Steam/hot water pipe insulation (for multi-family housing)	x	x	x
Steam traps		x	x
Reflective Roof Coating (for multi-family housing)	x		
HVAC Tune Up - water and air cooled chillers		x	x
HVAC Tune Up - Variable Speed Drives (VSD)		x	x
Lighting controls		x	x
Outdoor Lighting		x	x
LED Exit Signs			x

As shown, there are several measures offered by ComEd and Ameren that are not included as standard measures in the Residential Retrofit Program. These measures include outdoor lighting, lighting controls, LED exit signs, low-flow showerheads, faucet aerators, and boiler replacements.

### 3.6 Program Operations Perspective

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Interviews were conducted with two DCEO Low Income Program staff, and one contractor. The interviews focused on program changes that occurred during EPY6/GPY3 and upcoming changes that are planned for EPY7/GPY4. Interviewees asked to comment on successes and challenges that arose throughout the program year. Each interview was approximately sixty minutes in length and took place at DCEO offices in Springfield Illinois.

#### 3.6.1 EPY6/GPY3 Program Changes

The EPY6/GPY3 program year expanded the program by including three new grant recipients: The Black United Fund, The Community Builders, and Residential Options. Continuing the trend of the last two years of the program cycle, two intra-agency grants were awarded to the Bureau of Community Development and the Bureau of Energy Assistance, which administer the Community Development Assistance Project (CDAP) and Weatherization Program, respectively.

Program staff members were asked about significant changes that occurred during the EPY6/GPY3 program year. Most notable was the loss of two program staff, one senior staff member and one intern. Two other staff members were transitioned from the DCEO recycling programs to the two low income programs, Residential Retrofit and Affordable Housing New Construction. The roles of the new staff included support to program administration and oversight functions. The new staff members split their time between the recycling programs and the two low income programs. Approximately 15% of their time is dedicated to Recycling and the other 85% is split between Residential Retrofit and Affordable Housing New Construction Programs.

Interviews indicated that the low income programs face staffing issues, and are insufficiently staffed to implement and administer the programs. Staffing issues are in part a function of department hiring policies, which prevented hiring their intern full-time despite the intern's previous contributions.

Another significant change to the program was the completion of site verification visits by program staff during the program year. The technical consultant, Domus Plus, conducted site visits at several of the grantee project sites, but not all of them. Site visit procedures include the following:

- Review of the initial application to record the location of the project and what measures were proposed.
- Review of blower door test results or request that one is completed.

- Photographs of installed measures and records other notes about installations are recorded.
- Notes are sent to DCEO program staff for review.

The consultant indicated that the verification effort was improved from last year, but that further enhancements to the verification procedures are needed. One suggestion was for DCEO to notify the technical consultant when projects have begun, allowing the consultant to complete site visits before the project is complete.

### 3.6.2 Grantee Selection Process

Staff members were asked about the grantee selection process and criteria. Each grantee is evaluated by three separate staff members, who complete an evaluation form based on seven evaluation criteria outlined in the program guidelines. Each criterion is scored on a five point scale. The project energy savings and feasibility are the most heavily weighted criteria, followed by application quality, organizational capacity, project timeline, potential to encourage investment in energy efficiency, and job creation.

Discussions with program staff and review of evaluation documents suggested that scoring is a subjective process based on each evaluator's opinion of the grantee's ability to complete the project as defined in the application. Although the expected project savings are based on Illinois TRM based calculations, the scope of the implemented projects often differ significantly from the proposed projects. This difference makes evaluating projects on expected savings challenging.

### 3.6.3 The Future of the Residential Retrofit Program

Although the Residential Retrofit Program is not actively promoted by program staff, the number of applications received has increased from prior years. As a result, the number of grantees accepted has also increased and this growth has created unique opportunities and challenges.

The Residential Retrofit Program was originally designed to attract grantees with existing programs that serve low income communities in Illinois by making energy saving improvements to their residences. However, this restriction on participation has limited the capacity of the program to meet its energy saving goals. As a result, staff funded a more diverse group of grantees in EPY6/GPY3 than in prior years. Some of the new grantees work with the target population but do not have well established programs focused on energy savings. Additionally, other grantees include non-profit organizations that have ownership interests in multifamily housing buildings and some organizations work directly with home owners.

The increase in diversity in grantees created administrative challenges for program staff during EPY6/GPY3. Several new grantees had fewer administrative resources and organizational procedures to meet the program reporting requirements. As a result, these newer grantees required additional support from program staff. Interviews with program staff indicate that these challenges were taken into consideration when EPY7/GPY4 grant applications were assessed.

#### 3.6.4 Grantee Workbook Pilot

During EPY6/GPY3 ADM and DCEO worked together to develop grantee workbooks, which were designed to serve as a reporting tool for grantees to provide measures and site specifications, as well as project cost. Pilot participants provided feedback on the workbook, which was incorporated into a revised version that will be completed by all grant recipients during EPY7/GPY4.

## Appendix A: Grantee Profiles

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The Residential Retrofit program administers grants to organizations that are both internal and external to DCEO. Each grantee that participated in the Residential Retrofit Program in EEPY6/GPY3/GPY3 is profiled below.

### **Bureau of Community Development – Community Development Assistance Program**

A portion of the Residential Retrofit Program funds are awarded to the Community Development Assistance Program (CDAP) to encourage participants to install energy efficient equipment in low income residences. CDAP is administered through the Bureau of Community Development, an office internal to the Illinois DCEO.

CDAP staff work directly with grant administrators to deliver the program offerings, track project activity, and fulfill the reporting and verification requirements to DCEO. Grant administrators are local community action agencies or regional planning commissions that provide ancillary project management and administrative services to the participating municipal entity, township, or city office. Most of the Grant Administrators have a long-standing relationship with DCEO and have been receiving CDAP funds for years, sometimes decades.

The program is designed to aid in the economic development of Illinois communities; assisting local governments with public works projects and housing rehabilitation.<sup>3</sup> When a city decides to apply for the CDAP funds, the grant administrator will work with the city to identify potential target areas with eligible households. Eligibility is limited to low-income or very low-income housings. Low-income families are defined as families whose incomes do not exceed 80 percent of the median family income for the area. Very low-income families are defined as families whose incomes do not exceed 50 percent of the median family income for the area.

The grant administrator completes the application and waits for notification of award. Once the grant amount is determined, the grant administrator hosts a meeting with the homeowners and interested parties apply to the program. The applications are reviewed and ranked according to need. A SOW is developed and the grant administrator releases a Request for Bid. The lowest bidder will usually win the job. Total redevelopment expenditures on a single house are limited to \$40,000.

### **Bureau of Energy Assistance – Illinois Home Weatherization Assistance Program**

Residential Retrofit Program funds are also used to fund a portion of the Illinois Home Weatherization Assistance Program (IHWAP) activity. IHWAP is administered through the Bureau of Energy Assistance, an office internal to DCEO. Like CDAP, IHWAP works with Local Action Agencies (LAA) to deliver the program offerings and track activity. While the measures are similar to those of CDAP, the guidelines are different. A maximum of \$7,500 is allotted to each household. Additionally income requirements are slightly different as well,

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<sup>3</sup> [http://www.illinoisbiz.biz/dceo/Bureaus/Community\\_Development/Grants/CDAP.htm](http://www.illinoisbiz.biz/dceo/Bureaus/Community_Development/Grants/CDAP.htm)

depending on the participant's family size and if the household's annual income is at or below 150% of the federal poverty level, the participant is eligible to receive IHWAP assistance.

EEPS funds are allocated to the agencies based on a formula that includes poverty level, population, index of need, and utility prices. Because the Bureau of Energy Assistance receives funding from a variety of sources, the Energy Efficiency Portfolio Standard (EEPS) dollars are pooled with other funds and are distributed once the work is completed. All projects are tracked and managed using a software tool called Weather Works. The Weather Works program develops an energy model of the building and proposes measures; those measures with a savings-to-investment ration (SIR) of one or greater become part of the work order. Then the agency then generates a work order from the list of recommended measures for measures within a specific budget. Once measures are completed, they are invoiced, inspected by the agency and approved. The agency must use a final inspector that goes through the work order to verify that the work was installed.

The LAAs hire contractors approximately 90% of the time, while some have crews that complete the work. The community action agencies maintain invoices and supporting documentation in customer files after the project specific documentation is uploaded to Weather Works. They also are responsible for vouchering the state office to request payments for work that has been completed.

### **Elevate Energy**

Elevate Energy, formally known as CNT Energy, is division of the Center for Neighborhood Technology, is a non-profit think-and-do tank whose main mission is to promote urban sustainability. Specifically, the organization seeks to promote effective use of existing resources and community assets to improve the health of natural systems and the wealth of people, today and in the future. The organization, with its 70 employees, helps consumers and communities obtain the information and services they need to control energy costs and become energy efficient.

Awareness of the DCEO's Residential Retrofit program arose from Elevate Energy's long-standing relationship with DCEO. They have participated in the program for over five years and have continued to receive funding annually. Elevate Energy felt that their goals align nicely with what DCEO is trying to achieve. DCEO is dedicated to economic development in lower income neighborhoods, the same neighborhoods that Elevate Energy serves. Elevate Energy believes that they are efficient in cost-effectively allocating DCEO funds for projects that are aligned with both organizations' goals.

Elevate Energy offers a variety of services for multi-family building owners free of charge. They conduct upfront energy audits composed of onsite inspection and utility bill analysis and provide reports of the results to their customers. Elevate Energy will also help to solicit and review bids for the work if the customer requests such services. The organization maintains a network of certified contractors. In fact, they are very active in the contractor certification process. Elevate also has its own construction team that works alongside contractors to verify completion of the

work. In terms of long-term oversight, Elevate Energy conducts ongoing utility bill and savings analysis at one and two years after completion of the project.

### **The Community Builders**

The Community Builders is a non-profit development organization with approximately 800 employees. The main mission of the organization is to build and sustain strong communities where people of all incomes can achieve their full potential. They partake in various activities to achieve this mission including: (1) planning, financing, developing and operating high-quality affordable housing, (2) coordinating access to support services and asset-building activities, (3) collaborating with neighborhood groups, residents, public and private agencies, and philanthropic interests to shape community and economic initiatives, (4) transforming large-scale distressed housing projects into anchors for revitalization efforts, (5) serving as a long-term stakeholder in the neighborhoods they help transform, and (6) creating local implementation teams that combine neighborhoods' understanding, technical skills, and managerial ability.

The EPY5/GPY2 program year was the first time that the Community Builders participated in the Residential Retrofit Program.

The role of the Community Builders is to serve as a liaison and essentially manage the funds transferred from DCEO to the building owners (i.e., the Community Builders subsidiaries and/or limited partners). In addition, the Community Builders work with general contractors and their own construction management team to watch changes as they happen. In addition, they conduct on-site inspections using their own inspection team, who are typically on site at least three days a week. The Community Builders also have their own legal staff that assist in delivering the program.

In terms of the program process, a project manager handles the initial application. To participate in the Residential Retrofit Program, the process requires that the Community Builders report to DCEO quarterly. They typically receive funds within 18 to 20 months of the initial application.

Outside of DCEO funds, the Community Builders seeks funds from various sources. They look for soft funds from municipalities, the state, tax credit programs and an array of smaller funding sources. Other funding sources include: the U.S. Department of the Treasury's 1603 Program, Federal Home Loan Bank loans, and they often receive rental subsidies from the Public Housing Authority.

### **Historic Chicago Bungalow Association**

The primary mission of the Historic Chicago Bungalow Association (HCBA) is to aid in the preservation of one and one-half story homes in the Chicago area. The organization assists homeowners who are looking to modernize, repair and adapt their bungalows to fit their needs and lifestyles. Collaborating with other non-profit groups and neighborhood organizations, HCBA strives to help bungalow owners make their homes more energy efficient and sustainable. They provide: seminars and workshops, design guidelines, local expos, awards and recognition, and more to their members.

To carry out the delivery of the Residential Retrofit program, HCBA works in tandem with several organizations. DNR Construction, Inc. handles the highest volume of work; they are HCBA's primary contractor. However, they have also worked closely with J. L. Contractor Services. HCBA also partners frequently with Franklin Energy and People's Gas for available rebates.

CNT Energy is one of HCBA's primary partners. HCBA is a heavily customer service-oriented organization. They partner with CNT Energy to ensure that bungalow owners are getting the best possible service. Since HCBA does not conduct in-house savings calculations, they rely on CNT Energy for this service. CNT Energy calculates savings for measures, which entail examining pre- and post- utility bill analysis. Recently, CNT Energy has received Energy Impact Illinois funding, which enables them to conduct post-work energy audits for HCBA.

### **Hispanic Housing Development Corporation**

Hispanic Housing Development Corporation (HHDC) is a non-profit organization, established in 1975, whose primary mission is to help create affordable housing in Latino communities throughout a 250 mile radius of Chicago. In addition to housing, they aim to revitalize neighborhoods and become a catalyst for economic prosperity. To foster socio-economic growth, they provide employment and business opportunities.

In addition, the organization has a sub-sector, the Affordable Community Energy (ACE) division. ACE's mission is to deliver energy efficient and renewable energy solutions to underserved low-income populations. They focus on energy efficient retrofit measures and renewable power.

The organization has one corporate office, several satellite offices and offices at approximately 40 properties. There are 200 employees on staff to manage approximately 5000 buildings in the greater Chicago area. In addition to what they own and operate, they also provide property management and development services to third party properties. In the future, they hope to provide energy services to other affordable housing developers in the area.

HHDC has worked with the Illinois Department of Commerce & Economic Opportunity (DCEO) on various projects for over a decade. However, they are only in their third year of participation in the Residential Retrofit Program. HHDC begins mobilizing to implement the measures shortly after signing the grant agreement with DCEO. They had not incurred any costs prior to securing the DCEO funding. Unlike previous years in which they applied in October, they applied early in June for EPY5/GPY2. Doing so allowed them to get an early start on the process.

After the installation of measures, HHDC conducts internal verification. The verification process is specific to the type of measure. The value of savings and installation typically drives the verification process. In other words, more verification is required for measures that are more costly or those that are predicted to have more savings.

HHDC works with various partners throughout the program process. They seek out assistance from auditors and engineering firms for feasibility and design commissioning. They also partner

with CNT Energy through CNT Energy's Energy Savings Program. CNT provides various services to HHDC including the identification of potential measures, construction management expertise (particularly with air ceiling and insulation), and inspection of all properties to verify the scope of work being installed from a third party standpoint.

### **Black United Fund**

The Black United Fund of Illinois (BUFI) is a non-profit organization that is located in Cook County Illinois and serves communities in the southeast lakefront region of Downton Chicago. The mission of the organization is to improve the quality of life for African Americans through reliance on self-help at the local community level.<sup>44</sup> The Residential Energy Efficiency Project (REEP) was developed to motivate sustainable practices by educating target communities on the benefits of energy efficiency and the utility cost savings that are possible.

The REEP delivery structure begins by identifying qualified residential units in the target area. To do this BUFI works with two primary community-based organizations, the Neighborhood Recovery Initiative and a group of five Sage Passage workers. Local certified energy auditors and energy efficient contractors are hired to perform home audits and install the efficient equipment.

The BUFI provided information on the grantee application regarding its marketing plan for REEP. The organization's marketing plan included indoor posters and flyers within the community, as well as on the internet with email and social media campaigns. The funds will be utilized to hire one internal staff member, conduct residential audits, install the efficiency measures, and verify project completion.

### **Residential Options**

Residential Options, Inc is a non-profit organization located in Madison County Illinois. The organization provides housing and support services to individuals with disabilities and mental illness. The residents are placed in one of twelve homes owned and managed by Residential Options, Inc. These group homes, like many residential homes, are in need of energy efficiency upgrades. Grant funds were used to fund ES refrigerators, lighting upgrades, bathroom exhaust fans, ES dishwashers, AC units, and ceiling fans. The requested grant funds were substantially less than other program grantees.

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<sup>44</sup> [http://www.bufi.org/cms/index.php?option=com\\_content&view=article&id=3&Itemid=5](http://www.bufi.org/cms/index.php?option=com_content&view=article&id=3&Itemid=5)