Evaluation of Energy Efficient Affordable Housing Construction Program

June 2013 through May 2014

Prepared for:
Illinois Department of Commerce Economic Opportunity

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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 (Affordable Housing Construction Program) offered by the Illinois Department of Commerce and Economic Opportunity (DCEO). The report presents results for electric program year six and natural gas program year three (EPY6/GPY3), the period June 2013 through May 2014.

The main features of the evaluation approach include:

- Data collection through review of program materials, interviews with DCEO 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 Affordable Housing Construction Program during EPY6/GPY3 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 EPY6/GPY3, net ex post electricity savings total 1,886,351 kWh. The gross realization rate is 126%.

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

Utility	*Ex Ante kWh Savings*	*TRM-Calculated*		*TRM-Calculated (Errata Corrected)*		*ADM-Calculated*			
		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*	*Gross Realization Rate*	*Net Ex Post kWh Savings*	*Net-to-Gross Ratio*
Ameren	227,069	265,898	265,898	263,066	263,066	326,738	144%	326,738	100%
ComEd	1,272,949	1,463,717	1,463,717	1,463,093	1,463,093	1,559,613	123%	1,559,613	100%
Total	1,500,018	1,729,615	1,729,615	1,726,159	1,726,159	1,886,351	126%	1,886,351	100%

Gross and net ex post natural gas savings are shown in Table ES-2. Net ex posts natural gas savings total 76,382 therms. The gross realization rate is 38% for natural gas savings.

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

Utility	*Ex Ante Therm Savings*	*TRM-Calculated*		*TRM-Calculated (Errata Corrected)*		*ADM-Calculated*			
		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*	*Gross Realization Rate*	*Net Ex Post Therm Savings*	*Net-to-Gross Ratio*
Ameren	14,234	-	-	-	-	-	-	-	-
Nicor	10,506	22,470	22,470	18,669	18,669	19,820	189%	19,820	100%
North Shore	-	-	-	-	-	-	-	-	-
Peoples	175,288	52,001	52,001	50,612	50,612	56,563	32%	56,563	100%
Total	200,028	74,472	74,472	69,281	69,281	76,382	38%	76,382	100%

The gross and net ex post peak kW reductions of the Affordable Housing Construction Program during the period June 2013 through May 2014 are summarized in Table ES-3.

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

Utility	*TRM-Calculated*		*TRM-Calculated (Errata-Corrected)*		*ADM-Calculated*	
	Ex Post Gross kW Savings	*Ex Post Net kW Savings*	*Ex Post Gross kW Savings*	*Ex Post Net kW Savings*	*Realized Gross kW Savings*	*Realized Net kW Savings*
Ameren	28.69	28.69	28.40	28.40	30.86	30.86
ComEd	226.78	226.78	226.71	226.71	231.21	231.21
Total	255.46	255.46	255.11	255.11	262.07	262.07

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

- **Ex Ante Savings Estimates High for Some Measures:** Ex ante savings provided were high for some measure types. For example, ex ante therms saved for dishwashers averaged 6.24 therms per unit, but the TRM calculated savings resulted in an average of 1.44 therms saved per unit. Furthermore, TRM errata-corrected savings have reduced the savings from 1.44 therms per unit to .29 therms per unit.
- **Improved Project Documentation:** Supporting documentation for program year EPY6/GPY3 was more complete and better organized than in prior years.
- **Incentive Changes Implemented for EPY7/GPY4:** Two changes were made to the program incentive for EPY7/GPY4. First, incentives were increased to cover the cost of

blower door testing, a process completed by a third party contractor. Second, grantees were given the option of receiving a performance-based incentive rather than a prescriptive incentive. The performance incentive offers a bonus payment for exceeding minimum efficiency levels. Specifically, if the participant's project exceeds the minimum efficiency requirements by 15% they are eligible for a 10% increase to the base incentive.

The following recommendations are offered for consideration:

- **Institute an Expiration Date for Grant Offers**: Approved grantees receive a letter notifying them that they have been awarded a grant through the program. By instituting an expiration date for these funds, projects that are stalled will be removed from the program, decreasing backlog. The program may consider a grant renewal process for expired grants.
- **Continue to Improve Project Documentation and Measure Level Information:** 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, etc.
  - **Measure Unit:** Number of units, square feet, liner 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.

1. Introduction

This report presents the results of the impact and process evaluations of the Illinois Department of Commerce and Economic Opportunity (DCEO) Affordable Housing Construction Program. The report presents evaluation results pertaining to program activity during electric program year six and natural gas program year three (EPY6/GPY3), the period from June 2013 through May 2014.

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. Table 1-1 displays the number of units that received efficiency improvements through the program during EPY6/GPY3.

Table 1-1 Number of Residential Units Receiving Efficiency Improvements

Type of Project	*EPY6/GPY3 Number of Residential Units*
Single Family Rehab	4
Multi-Family Building Rehab	212
New Multi-Family Building Construction	340
New Single Family Construction	123
Total	679

1.2 Overview of Evaluation 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 EPY6/GPY3.

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.
- Chapter 3 presents and discusses the analytical methods and results of the process evaluation of the program.

2. Impact Evaluation

This chapter presents the results of the impact evaluation of the Affordable Housing Construction Program offered by the Illinois Department of Commerce and Economic Opportunity (DCEO). 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 2013 through May 2014. 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 Calculating Program 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.

ADM performed (1) a tracking system review and (2) an engineering review to determine the appropriate ex post savings estimates.

2.1.1 Engineering 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 2.0. 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 2.0.
- TRM-Calculated (Errata Corrected): Savings calculated per an erratum correction 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 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

Measure	*Section in Illinois TRM*	*Other Resources*	*TRM*	*Errata Corrected*	*ADM*
Air Sealing	5.6.1	Engineering review	●		●
Bathroom Exhaust Fan	5.3.9	-	●		
Boiler	5.3.6, 4.4.10	-	●	●	
Ceiling Fan	-	ES Calculator			●
Central Air Conditioner	5.3.3	-	●		
Clothes Washer	5.1.2	-	●		
Dishwasher	5.1.4	-	●	●	
Fluorescent and Common Area Lighting	5.5.1, 5.5.6, 4.5.12, 4.5.3	-	●		
Furnace w/ Advanced Blower	5.3.5, 5.3.7	-	●	●	
Heat Pump	5.3.1, 5.3.8, 4.4.9	-	●		
Refrigerator	5.1.6	-	●		
Room Air Conditioner	5.1.7		●		
Wall and Ceiling / Attic Insulation	5.6.4	Engineering review	●	●	●
Water Heater	4.3.1, 5.4.2	-	●		●
Windows	-	Engineering review			●

2.1.1.1. Air Sealing

For new construction air sealing, energy savings were developed using the following algorithms:

$$\Delta kWh = \Delta kWh\_cooling + \Delta kWh\_heating$$

Where,

$\Delta kWh\_cooling$ = If central cooling, the reduction in annual cooling requirement due to air sealing

$$= (((CFM50\_exist - CFM50\_new)/N\_cool) * 60 * 24 * CDD * DUA * .018) / (1000 * \eta Cool) * LM$$

And,

ΔkWh_heating = If electric heat (resistance or heat pump), reduction in annual electric heating due to air sealing

= *(((CFM50_exist – CFM50_new)/N_heat) * 60 * 24 * HDD * .018) / (3,412 * ηHeat)*

Where,

CFM50_exist = Infiltration at 50 Pascals as measured by blower door before sealing

CFM50_new = Infiltration at 50 Pascals as measured by blower door after sealing

N_cool = Conversion factor from leakage at 50 Pascal to leakage at natural conditions

CDD = Cooling Degree Days

DUA = Discretionary Use Adjustment

*60*24* = Conversion factor from cubic feet per minute to cub feet per day

0.018 = Specific Heat Capacity of Air

1000 = Converts Btu to kBtu

ηCool = Seasonal Energy Efficiency Ratio of the cooling system.

LM = Latent multiplier to account for latent cooling demand

N_heat = Conversion factor from leakage at 50 Pascal to leakage at natural conditions

HDD = Heating Degree Days

nHeat = Efficiency of heating system

3412 = Converts Btu to kWh

For units with a natural gas furnace, the following algorithm was used to develop first year therm savings:

*ΔTherms= (((CFM50_exist – CFM50_new)/N_heat) * 60 * 24 * HDD * .018) / (100,000 * ηHeat)*

Units with a natural gas furnace also realized kWh savings due to a reduction in fan run time. These savings were calculated using the following Illinois Statewide TRM algorithm:

$$\Delta kWh\_heating = \Delta Therms * Fe * 29.3$$

Where,

Fe = Furnace fan energy consumption as a percentage of annual fuel consumption

= 3.14%

The Illinois Statewide TRM provides the following assumptions:

- The full load hours for cooling and heating, and latent multiplier are dependent on climate zone.
- N_cool is based on building exposure and climate zone
- CFM50_exist and CFM50_new are based on actual tested values
- The discretionary use adjustment factor is 0.75
- N_heat is based on the number of stories of the building, the exposure, and the climate zone

The TRM calculation for air sealing was developed for a retrofit program delivery type. The measure algorithm specifies that existing CFM50 (air leakage tests) of the space should be measured before the installation of air sealing. This calculation is not appropriate for a new construction application. ADM calculated savings using the building code allowable air leakage at the time the project was permitted.

2.1.1.2. Bathroom Exhaust Fan

ADM applied the following savings algorithm for bathroom exhaust fans from the Illinois Statewide Technical Reference Manual (TRM), to determine ex post savings.

$$\Delta kWh = (CFM * (1/\eta,Baseline - 1/\eta Efficient)/1000) * Hours$$

Where,

CFM = Nominal capacity of exhaust fan.

η,Baseline = The efficiency of the baseline unit.

η,Efficient = The efficiency of the efficient unit.

Hours = Annual hours of operation.

The Illinois Statewide TRM provides the following assumptions:

- The nominal capacity of exhaust fan is 50.

- The efficiency of the baseline fan is 8.3 CFM per Watt.
- The efficiency of the efficient fan is 3.1 CFM per Watt.
- The annual hours of use are 8,766.

Using these values, ex post calculations resulted in 88.58 kWh savings per fan.

2.1.1.3. Boiler

Ex post savings for commercial sized boilers were developed using the following Illinois TRM algorithm:

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

Where,

EFLH	=	Equivalent Full Load Hours for boiler heating
AFUE(base)	=	Estimate of baseline boiler annual fuel utilization efficiency rating.
AFUE(eff)	=	Efficient boiler annual fuel utilization rating.
Capacity	=	Nominal Heating Capacity Boiler size (btuh)

The Illinois Statewide TRM provides the following assumptions:

- EFLH for a multifamily area installation is dependent on the zone, averaging 1,792.
- The AFUE(base) is 80%.

Ex post savings for residential sized boilers were developed using the following Illinois TRM algorithm:

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

Where,

Gas_Boiler_Load	=	Estimate of annual household load for gas boiler heating
AFUE(base)	=	Estimate of baseline boiler annual fuel utilization efficiency rating.
AFUE(eff)	=	Efficient boiler annual fuel utilization rating.

The Illinois Statewide TRM provides the following assumptions:

- Gas_Boiler_Load is dependent on the zone, averaging 1,158.
- The AFUE(base) is 80%.

2.1.1.4. Ceiling Fan

The most recent ENERGY STAR® calculator was used to determine the savings from energy efficient ceiling fans. Dependent on the information available for each site, the calculator recommends 118 kWh for the replacement of a ceiling fan with lighting. Sites with 118 kWh per ceiling fan were assumed to have bulbs in a conventional ceiling fan that are 120 Watts, while bulbs in an ENERGY STAR® rated ceiling fan are 22 Watts. One site had documentation that showed no lights on the ceiling fans. For fans only, the ENERGY STAR® calculator recommends 11 kWh per ceiling fan.

2.1.1.5. Central Air Conditioning

For the new construction central air conditioning measure, the first year kWh savings are based on the following Illinois Statewide TRM algorithm:

$$\Delta kWh = (FLHcool * BtuH * (1/SEERbase - 1/SEERee))/1000$$

Where,

FLHcool = Full Load Hours for cooling.

BtuH = The size of the new unit.

SEERbase = Seasonal Energy Efficiency Ratio of the baseline equipment.

SEERee = Seasonal Energy Efficiency Ratio of the efficient equipment.

The Illinois Statewide TRM provides the following assumptions:

- The full load hours for cooling are dependent on climate zone and building type.
- The size of the new unit is 33,600 if unknown.
- The SEER for the baseline equipment is 13.
- The SEER for the efficient equipment is based on new equipment specifications or 14.5 if unknown.

2.1.1.6. Clothes Washer

Ex post savings were developed using the following Illinois TRM algorithms. For electric savings,

$$\Delta kWh = [(Capacity * 1/MEFbase * Ncycles)*(\%CWbase + (\%DHWbase * \%Elect\_DHW) + (\%Dryerbase * \%Elect\_Dryer)] - [(Capacity * 1/MEFeff * Ncycles) * (\%CWeff + (\%DHWeff * \% Elect\_DHW) + (\%Dryereff * \%Elect\_Dryer)]$$

For natural gas savings,

$$\Delta Therm = [(Capacity * 1/MEFbase * Ncycles) * ((\%DHWbase * \%NG\_DHW * R\_eff) + (\%Dryerbase * \%Gas\_Dryer)] - [(Capacity * 1/MEFeff * Ncycles) * ((\%DHWeff * \%NG\_DHW * R\_eff) + (\%Dryereff * \%Gas\_Dryer)] * Therm\_convt$$

Where,

MEFbase	=	Modified Energy Factor of baseline unit
MEFeff	=	Modified Energy Factor of efficient unit
Ncycles	=	Number of cycles per year
Capacity	=	Clothes Washer capacity of the new unit
%CW	=	Percentage of energy consumption for Clothes Washer
%DHW	=	Percentage of energy consumption for water heating
%Dryer	=	Percentage of energy consumption for dryer operation
%Elect_DHW	=	Percentage of DHW savings assume to be electric
%Elect_Dryer	=	Percentage of dryer savings assume to be electric
%NG_DHW	=	Percentage of DHW savings assume to be Natural Gas
%Gas_Dryer	=	Percentage of dryer savings assume to be Natural Gas
R_eff	=	Recovery efficiency factor
Therm_convt	=	Conversion factor from kWh to Therms

Savings calculations utilized the following Illinois TRM specified inputs:

- The Modified Energy Factor for baseline equipment was 1.64.
- The number of annual wash cycles was 295 for residential units and 950 for commercial units.
- Baseline clothes washer energy usage was 7%.
- Baseline water heater usage for clothes washers was 33%.
- Baseline dryer usage for clothes washers was 59%.
- The recovery energy factor was 1.26.
- The conversion factor from kWh to Therm was 0.03413

The equation inputs for the percentage of total energy consumption for clothes washer operation, percentage of total energy consumption used for water heating, and the percentage of total energy consumption for dryer operation were determined based on an Illinois TRM table, which differentiates inputs by the efficiency of the newly installed clothes washer. Tier 3 efficient clothes washers were most often installed, for which the Illinois TRM specifies the percentage of

energy consumption for the clothes washer, water heating, and the dryers as 10%, 16%, and 74%, respectively.

2.1.1.7. Dishwasher

For the new construction ENERGY STAR® dishwasher measure, the first year kWh savings are based on the following Illinois Statewide TRM algorithm:

$$\Delta kWh = (kWh\_base - kWh\_estar) * [\%kWh\_op + (\%kWh\_heat * \%Electric\_DWH)]$$

Where,

kWh_base = Baseline kWh consumption per year.

kWh_estar = ENERGY STAR® 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.

The Illinois Statewide TRM provides the following assumptions:

- Baseline annual kWh consumption for a standard sized dishwasher is 355 kWh.
- ENERGY STAR® annual kWh consumption for a standard sized dishwasher is 295 kWh.
- 44% of the dishwasher energy consumption is used for unit operation.
- 56% of the dishwasher energy consumption is used for water heating.
- 100% of the DWH savings will be assumed electric savings for an electric ENERGY STAR® dishwasher.

Using the aforementioned algorithm and assumptions, the average first year savings for the new construction of an ENERGY STAR® dishwasher is 60kWh per unit.

$$\Delta kWh = (355kWh - 295kWh) * [0.44 + (0.56 * 1.00)] = 60.0\ kWh$$

For the new construction ENERGY STAR® dishwasher measure, the first year therm savings are based on the following Illinois Statewide TRM algorithm:

$$\Delta Therms = (kWh\_base - kWh\_estar) * \%kWh\_heat * \%Natural\_Gas\_DHW * Reff * Conversion\_Factor$$

Where,

kWh_base = Baseline kWh consumption per year

kWh_estar	=	ENERGY STAR® kWh annual consumption
%kWh_heat	=	Percentage of dishwasher energy consumptions used for water heating
%Natural_Gas_DHW	=	Percentage of DHW Savings assumed to be natural gas
Reff	=	recovery efficiency factor
Conversion_Factor	=	factor to convert from kWh to therms

The Illinois Statewide TRM provides the following assumptions:

- Baseline annual kWh consumption for a standard sized dishwasher is 355 kWh.
- ENERGY STAR® annual kWh consumption for a standard sized dishwasher is 295 kWh.
- 56% of the dishwasher energy consumption is used for water heating.
- 100% of the DWH savings will be assumed natural gas savings for an ENERGY STAR® dishwasher.
- The recovery efficiency factor is 1.26.
- A conversion factor of 0.03413 Therms per kWh.

Using the aforementioned algorithm and assumptions, the average first year savings for a new construction ENERGY STAR® dishwasher is 1.44 Therms per unit.

$$\Delta Therms = (355 kWh - 295 kWh) * 0.56 * 1.0 * 1.26 * 0.03413 Therms/kWh = 1.44\ Therms$$

2.1.1.8. Fluorescent Lighting and Common Area Fluorescent Lighting

ADM applied the following savings algorithm from the Illinois Statewide Technical Reference Manual (TRM), to determine ex post savings.

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

Where,

WattsBase	=	Watts for baseline fixture.
WattsEE	=	Watts for energy efficient fixture.
ISR	=	In-service rate.
WHFe	=	Waste heat factor.
Hours	=	Annual hours of operation

The Illinois Statewide TRM provides the following assumptions:

- The in-service rate is 98%. For LED Downlights only, the in-service rate is 100%.
- If unknown, the baseline fixture wattage is 60W.
- If unknown, the efficient fixture wattage is 13W.
- The annual hours of use for residences are 938, exterior locations 4,903, and 5,950 for common areas. LED Downlights in a residential area have 1,010 annual hours of use.
- The waste heat factor for residences is 1.04, exterior locations 1.0, and 1.34 for common areas.

2.1.1.9. Furnace with Advanced Blower

Ex post savings were developed using the following TRM algorithm:

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

Savings calculations utilized the following inputs:

- Heating load for a gas furnace are from the residential furnace section of the Illinois Statewide TRM and average 766;
- Annual fuel utilization efficiency (AFUE) for baseline equipment is. 80;
- Furnace output capacity is based on installed unit capacity.

Ex post kWh savings for furnace motors were based on the Illinois TRM deemed values. Total kWh savings include deemed savings of 469 kWh for the furnace motor and 263 kWh for the air conditioner, if present.

2.1.1.10. Heat Pumps

Both ground source and air source heat pumps were found in the documentation for this program. Ex post savings for air source heat pumps were developed using the following algorithms:

$$\Delta kWh = Annual\ kWh\ Savings_{cool} + Annual\ kWh\ Savings_{heat}$$

With,

$$Annual\ kWh\ Savings_{cool} = (kBtu/hcool) * [(1/SEERbase) - (1/SEERee)] * EFLHcool$$

$$Annual\ kWh\ Savings_{heat} = (kBtu/hcool) * [(1/HSPFbase) - (1/HSPFee)] * EFLHheat$$

Where,

kBtu/hcool	=	Capacity of the cooling equipment in kBtu per hour.
EFLHcool	=	Cooling mode equivalent full load hours.
EFLHheat	=	Heating mode equivalent full load hours.
SEERbase	=	Seasonal Energy Efficiency Ratio of the baseline equipment.
SEERee	=	Seasonal Energy Efficiency Ratio of the energy efficient equipment.
HSPFbase	=	Heating Seasonal Performance Factor of the baseline equipment.
HSPFee	=	Heating Seasonal Performance Factor of the energy efficient equipment.

The Illinois TRM specifies the following assumptions:

- The full load heating and cooling hours vary by climate zone.
- The Seasonal Energy Efficiency Ratio of the baseline equipment is 13.
- The Heating Seasonal Performance Factor of the baseline equipment is 7.7.

Ex post savings for ground source heat pumps were developed using the following algorithms:

*ΔkWh = (FLHcool * Cap_cool * (1/SEERbase – (1/(EERee*1.02)))/1000)+ (FLHheat * Cap_heat * (1/HSPFbase – (1/COPee*3.412))/1,000)*

Where,

FLHcool	=	Full load cooling hours
Cap_cool	=	Cooling Capacity of the Ground Source Heat Pump
SEERbase	=	Seasonal Energy Efficiency Ratio of the baseline equipment.
EERee	=	EER Efficiency of efficient equipment
1.02	=	Constant used to estimate equivalent air conditioning SEER
FLHheat	=	Full load heating hours
Cap_heat	=	Heating capacity of Ground Source Heat Pump
HSPFbase	=	Heating Seasonal Performance Factor of the baseline equipment.
COPee	=	Coefficient of Performance of the energy efficient equipment.
3.412	=	Constant to convert the COP to HSPF

The Illinois TRM specifies the following assumptions:

- The full load heating and cooling hours vary by climate zone and installation type.

- The Seasonal Energy Efficiency Ratio of the baseline equipment is 13.
- The Heating Seasonal Performance Factor of the baseline equipment is 7.7.

2.1.1.11. Refrigerator

Ex post savings were developed using the Illinois Statewide TRM. Under this methodology,

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

Where,

UEC_{BASE} = Annual Unit Energy Consumption of baseline unit, and

UEC_{EE} = Annual Unit Energy Consumption of ENERGY STAR unit

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

Table 2-2 Unit Energy Consumption of Refrigerators

Product Category	*NAECA as of July 1, 2001 Maximum Energy Usage in kWh/year*	*Current ENERGY STAR level Maximum Energy Usage in kWh/year*
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,

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

2.1.1.12. Room Air Conditioner

ADM applied the following savings algorithm from the Illinois Statewide Technical Reference Manual (TRM), to determine ex post savings.

$\Delta kWh = (Btuh/1{,}000) * (1/EERexisting - 1/EERnew) * FLH_s$

Where,

FLH_s = Full load cooling hours

EERexisting = Energy efficiency ratio of baseline equipment

EERnew = Energy efficiency ratio of efficient equipment.

Btuh = Unit capacity

2.1.1.13. Wall and Attic Insulation

For the new construction building envelope improvements measure, energy savings were developed using the following algorithms:

$\Delta kWh = (\Delta kWh\_cooling + \Delta kWh\_heating) * ADJ$

Where,

ΔkWh_cooling = If central cooling, the reduction in annual cooling requirement due to insulation

ΔkWh_cooling = $[((1/R\_old - 1/R\_wall) * A\_wall * (1-Framing\_factor) + (1/R\_old - 1/R\_attic) * A\_attic * (1-Framing\_factor/2)) * 24 * CDD * DUA] / (1000 * \eta Cool)$

Where,

R_old = Baseline R-value.

R_wall = R-value of implemented wall assembly and insulation.

A_wall = Total area of insulated wall (ft^2)

Framing_factor= An adjustment to account for area of framing.

R_attic = R-value of implemented attic assembly and insulation.

A_attic = Total area of insulated ceiling/attic (ft^2)

CDD = Cooling degree days.

DUA = A discretionary use adjustment to reflect the fact that people do not always operate their air conditioner when conditions may call for it.

ηCool = Seasonal Energy Efficiency Ratio of the cooling system.

ΔkWh_heating= If electric heat (resistance or heat pump), reduction in annual electric heating.

*ΔkWh_heating= [(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] / (ηHeat * 3412)*

Where,

R_old = Baseline R-value.

R_wall = R-value of implemented wall assembly and insulation.

A_wall = Total area of insulated wall (ft^2)

Framing_factor= An adjustment to account for area of framing.

R_attic = R-value of implemented attic assembly and insulation.

A_attic = Total area of insulated ceiling/attic (ft^2)

HDD = Heating degree days.

ηHeat = Efficiency of the heating system.

For units with a natural gas furnace, the following algorithm was used to develop first year therm savings:

*ΔTherms = (((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) / (ηHeat * 100,067 Btu/therm) * ADJ*

Where,

R_old = Baseline R-value.

R_wall = R-value of implemented wall assembly and insulation.

A_wall = Total area of insulated wall (ft^2)

Framing_factor= An adjustment to account for area of framing.

R_attic = R-value of implemented attic assembly and insulation.

A_attic = Total area of insulated ceiling/attic (ft^2)

HDD = Heating degree days.

ηHeat = Efficiency of the heating system.

The Illinois Statewide TRM provides the following assumptions:

- Cooling and heating degree days are dependent on climate zone.
- The discretionary use adjustment is .75.
- The Seasonal Energy Efficiency Ratio of the cooling systems is based on equipment specifications or is 13 if unknown.
- The efficiency of the heating system is based on equipment specifications or is 1.92 for heat pumps and 1 for resistance heat.
- The efficiency of the natural gas furnace is based on equipment specifications or is 70%.
- The framing factor is 15%.

The TRM calculation for wall and attic insulation was developed for a retrofit program delivery type. The measure algorithm specifies that existing R-value of the insulation or an R-value of 5 should be used for un-insulated assemblies and is not appropriate for a new construction application. ADM calculated savings using the R-value required by the applicable building code at the time the project was permitted.

2.1.1.14. Water Heater

The Illinois TRM does not include a savings calculation methodology for Electric Water Heaters. An engineering review of the heat pump water heater algorithm was performed and the following modified algorithm was applied to calculate ex post electric savings:

*ΔkWh = ((1/EFbase – 1/EFproposed) * (GPD * 365.25 * 8.33lb/gal * (Thot-Tcold)) / 3412 BTU/kWh*

Where,

EFbase = Energy factor of baseline water heater.

EFproposed = Energy factor of proposed efficient water heater.

GPD = How water used per day in gallons.

Thot = Temperature of hot water.

Tcold = Temperature of cold water supply.

The PA TRM recommends the following assumptions:

- The energy factor of the baseline water heater is dependent on the water heater size.
- The hot water used per day in gallons is 50 gallons/day.
- The temperature of the hot water is 125ºF.
- The temperature of the cold water supply is 54ºF.

Therm savings for Residential Natural Gas Water Heaters were calculated using the following algorithm provided by the Illinois Statewide TRM:

*ΔTherms = (1/ EFbase - 1/EFefficient) * (GPD * 365.25 * γWater * (Tout– Tin) * 1.0)/100,000*

Where,

EFbase	=	Efficiency of the baseline equipment.
EF efficient	=	Efficiency of the new equipment.
GPD	=	Gallons of water used per day.
γWater	=	Specific weight of water.
Tout	=	Tank temperature.
Tin	=	Temperature of the incoming supply water.

The Illinois Statewide TRM provides the following assumptions:

- The efficiency of baseline equipment if unknown is 0.67.
- The efficiency for energy efficient unit was based on the efficiency for condensing gas storage units and is 0.80.
- The tank temperature is 125 °F.
- The incoming water temperature is 54 °F.
- The specific weight of water is 8.33 lb.
- The gallons of water used per day are 50.

Central water heaters were verified as large enough to use commercial water heater savings methodology from the Illinois Statewide TRM. The deemed Therms savings value for Commercial Natural Gas Water Heaters in a multifamily area is 119 Therms per water heater.

2.1.1.1. Windows

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

$$\Delta kWh = \frac{A * \left(SHGF * \left(SC_{pre} - SC_{post}\right) + U - Factor * (T_{out} - T_{in})\right)}{1{,}000 * EER}$$

Where,

A	=	Window Film Area
SHGF	=	Solar Heat Gain Factor
SC	=	Shading Coefficient
U-Factor	=	Windows resistance to heat flow
Tout	=	Temperature on the outside of the window
Tin	=	Temperature on the inside of the window
EER	=	Cooling Efficiency

Similarly, the algorithm used to calculate Therm savings for windows is:

$$\Delta Therm = \frac{A * \left(SHGF * \left(SC_{pre} - SC_{post}\right) + U - Factor * (T_{out} - T_{in})\right)}{100{,}000 * COP}$$

Where,

COP	=	Heating Efficiency

The window film area, U-Factor, shading coefficient, and heating and cooling efficiencies were based on site specific information. The inside air temperature and SHGF were based on the ASHRAE 1997 Fundamentals Handbook. The outside air temperature was based on TMY (Typical Meteorological Year) data for the specific geographic locations of installation.

2.2 Results of Impact Evaluation

This section presents the results of the impact evaluation for the Affordable Housing Construction Program during EPY6/GPY3.

2.2.1 Measure-Level Savings Results – Engineering Review

This section presents gross and net ex post savings by measure type. Gross and net ex post kWh savings are presented in Table 2-3 and natural gas savings are presented in Table 2-4.

Table 2-3 Summary of kWh Savings by Measure

Measure	*Ex Ante kWh Savings*	*TRM-Calculated*		*TRM-Calculated (Errata Corrected)*		*ADM-Calculated*			
		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*	*Gross Realization Rate*	*Net Ex Post kWh Savings*	*Net-to-Gross Ratio*
Air Sealing	n/a	-	-	-	-	23,583	-	23,583	100%
Bath Fan	49,573	58,020	58,020	58,020	58,020	58,020	117%	58,020	100%
Ceiling Fan	33,966	-	-	-	-	94,814	279%	94,814	100%
Clothes Washer (Gas Hot Water)	3,792	-	-	-	-	-	-	-	-
Clothes Washer (Electric Hot Water)	9,988	8,119	8,119	8,119	8,119	8,119	81%	8,119	100%
Common area Fluorescent Lighting - exterior	15,827	279,910	279,910	279,910	279,910	279,910	1769%	279,910	100%
Common area Fluorescent Lighting - interior	202,293	536,547	536,547	536,547	536,547	536,547	265%	536,547	100%
Dishwasher (Electric Hot Water)	7,945	4,320	4,320	864	864	864	11%	864	100%
Dishwasher (Gas Hot Water)	5,544	-	-	-	-	-	-	-	-
Efficient AC	43,804	48,744	48,744	48,744	48,744	48,744	111%	48,744	100%
Efficient Heat Pump	36,936	58,009	58,009	58,009	58,009	58,009	157%	58,009	100%
Efficient Windows	n/a	-	-	-	-	12,979		12,979	100%
Fluorescent Lighting	525,306	378,854	378,854	378,854	378,854	378,854	72%	378,854	100%
Furnace w/ Advanced Blower	154,400	296,460	296,460	296,460	296,460	296,460	192%	296,460	100%
Individual Electric Water Heater	14,550	-	-	-	-	16,855	116%	16,855	100%
Refrigerator	51,965	60,632	60,632	60,632	60,632	60,632	117%	60,632	100%
Wall and Attic Insulation	344,129	-	-	-	-	11,960	3%	11,960	100%
Total	1,500,018	1,729,615	1,729,615	1,726,159	1,726,159	1,886,351	126%	1,886,351	100%

Table 2-4 Summary of Therm Savings by Measure

Utility	*Ex Ante Therm Savings*	*TRM-Calculated*		*TRM-Calculated (Errata Corrected)*		*ADM-Calculated*			
		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*	*Gross Realization Rate*	*Net Ex Post Therm Savings*	*Net-to-Gross Ratio*
Air Sealing	n/a	-	-	-	-	3,292	-	3,292	100%
Central Gas Water Heater	9,719	7,413	7,413	7,413	7,413	7,413	76%	7,413	100%
Clothes Washer (Gas Hot Water)	1,422	1,342	1,342	1,342	1,342	1,342	94%	1,342	100%
Dishwasher (Gas Hot Water)	1,512	188	188	38	38	38	2%	38	100%
Efficient Boiler	3,566	8,664	8,664	3,625	3,625	3,625	102%	3,625	100%
Efficient Windows	n/a	-	-	-	-	1,289	-	1,289	100%
Furnace w/ Advanced Blower	21,408	55,812	55,812	55,812	55,812	55,812	261%	55,812	100%
Individual Gas Water Heater	903	1,052	1,052	1,052	1,052	1,052	117%	1,052	100%
Wall and Attic Insulation	161,498	-	-	-	-	2,520	2%	2,520	100%
Total	200,028	74,472	74,472	69,281	69,281	76,382	38%	76,382	100%

2.2.2 Program-Level Savings Results

This subsection presents the gross and net savings for the Affordable Housing Construction Program during the period of June 2013 through May 2014.

The gross and net kWh savings of the Affordable Housing Construction Program for the period June 2013 through May 2014 are summarized by utility in Table 2-5. During this period, net ex post kWh savings total 1,886,351 kWh. The gross realization rate for the program is 126%. A net-to-gross factor of 100% was used because the Affordable Housing Construction Program targets low income residents. The net ex post savings for the period are 1,886,351 kWh.

Gross and net ex post natural gas savings are shown by program component in Table 2-6. Net ex post natural gas savings are 76,382 therms and the gross realization rate is 38%.

Table 2-5 Summary of kWh Savings by Utility

Utility	Ex Ante kWh Savings	TRM-Calculated		TRM-Calculated (Errata Corrected)		ADM-Calculated			
		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	Gross Realization Rate	Net Ex Post kWh Savings	Net-to-Gross Ratio
Ameren	227,069	265,898	265,898	263,066	263,066	326,738	144%	326,738	100%
ComEd	1,272,949	1,463,717	1,463,717	1,463,093	1,463,093	1,559,613	123%	1,559,613	100%
Total	1,500,018	1,729,615	1,729,615	1,726,159	1,726,159	1,886,351	126%	1,886,351	100%

Table 2-6 Summary of Therm Savings by Utility

Utility	Ex Ante Therm Savings	TRM-Calculated		TRM-Calculated (Errata Corrected)		ADM-Calculated			
		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	Gross Realization Rate	Net Ex Post Therm Savings	Net-to-Gross Ratio
Ameren	14,234	0	0	0	0	0	0%	0	100%
Nicor	10,506	22,470	22,470	18,669	18,669	19,820	189%	19,820	100%
North Shore	-	-	-	-	-	-	-	-	-
Peoples	175,288	52,001	52,001	50,612	50,612	56,563	32%	56,563	100%
Total	200,028	74,472	74,472	69,281	69,281	76,382	38%	76,382	100%

The realized gross and net peak kW reductions of the Affordable Housing Construction Program during the period June 2013 through May 2014 are summarized in Table 2-7. The net ex post peak demand savings for the program total 262.07 kW.

Table 2-7 Summary of Peak kW Savings by Utility

Utility	*TRM-Calculated*		*TRM-Calculated (Errata-Corrected)*		*ADM-Calculated*	
	Ex Post Gross kW Savings	*Ex Post Net kW Savings*	*Ex Post Gross kW Savings*	*Ex Post Net kW Savings*	*Realized Gross kW Savings*	*Realized Net kW Savings*
Ameren	28.69	28.69	28.40	28.40	30.86	30.86
ComEd	226.78	226.78	226.71	226.71	231.21	231.21
Total	255.46	255.46	255.11	255.11	262.07	262.07

2.2.3 Impact Findings and Recommendations

Overall the impact analysis went smoothly and documentation has been improving from year to year. If clarification was needed, program staff was easily accessible and were able to provide further explanations when necessary. Below are several key findings from the Affordable Housing New Construction Program:

- **Supporting Documentation was Significantly Improved this Program Year:** Measure specifications were more accessible because more cut sheets and on-site photographs were included. For some projects, a checklist which listed the location of the measure specifications in the documentation was available.
- **Additional Details are Necessary to Track Project Details and Calculate Energy Savings per the IL TRM:** Currently the technical consultant develops project specification sheets that provide general descriptions of the measure and quantity. However, the descriptions are unclear and do not always match the measure categories and inputs in the IL TRM. For example, additional granularity for the number of fixtures and lamps is necessary. For lighting measures, the number and wattage of individual bulbs should also be recorded. For HVAC measures, unit size and efficiency ratings should be 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 should be considered to improve the program tracking data:

- **Develop more Robust Measure Level Data**: 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 the tracking data would 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, etc.
- **Measure Unit:** Number of units, square feet, liner 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.

3. Process Evaluation

This chapter presents the results of the process evaluation of the DCEO Energy Efficient Affordable Housing Construction Program (Affordable Housing Construction Program). The chapter begins with an overview of the process evaluation methodology, research objectives, summary of key conclusions, and recommendations. The program overview is followed by the program operations perspective, which is developed from interviews with key program staff.

The process analysis is meant to provide a qualitative understanding of how the program is progressing, what is working well, and what needs to be improved upon. In addition, it can identify issues that are critical to the future success of the program. Conclusions, recommendations, and other findings from the process evaluation may be useful in conducting planning efforts for future program years.

3.1 Evaluation Objectives

The purpose of the process evaluation is to examine program operations and results throughout the program operating year. The evaluation also seeks to identify potential program improvements that may prospectively improve program delivery, increase energy savings, and increase 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 coming up for EPY7/GPY4?
- What were the program's greatest successes and challenges?

3.2 Summary of Primary Data Collection

- **Review of Program Materials and Project Documentation**: ADM staff conducted a comprehensive review of all program materials in order to identify any changes to the incentive structure, program description, or delivery channels. Materials reviewed include the application, guidelines, and website. ADM also reviewed project documentation including application materials, calculated expected energy savings, project scope, payment requests, and documentation supporting the installation of energy efficient measures. Building drawings were also made available to be used in cases where technical specifications were questioned.

- **Program Staff Interviews:** At various points of the evaluation, program staff was interviewed about program operations. These interviews covered topics such as program administration, operations, data collection, and the participation process.

3.3 Energy Efficient Affordable Housing Construction Program Description

The Affordable Housing Construction Program was designed to help improve the energy efficiency of low-income housing in Illinois. Grant funds are available for energy efficiency measures at sites serviced by Ameren Illinois or ComEd. Grant funds are available for natural gas conservation measures for sites serviced by Ameren Illinois, Nicor, Peoples, or North Shore.

3.3.1 Participant and Measure Eligibility Requirements

The Affordable Housing Construction Program provides grants to non-profit and for-profit affordable housing developers to 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 as a result of living in energy efficient buildings. Eligible projects must be targeted at households that are at or below 80% of the Average Median Income (AMI) level.

To receive the grant funds, the new construction or rehabilitation project must meet the program guideline requirements and implement all required measures. There are different measures for each type of project:

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

3.3.2 Program Incentives

Grant amounts for projects are based on per living unit, building, or living space square footage. Rehab grant amounts are described below and reflect combined natural and electric incentives:

- Up to $4,500 per living unit for single-family homes;
- Up to $4.50/ft2 of gross living space or $4,500, whichever is less, for multi-family buildings with fewer than 80 units; and
- Up to $4.25/ft2 of gross living space or $4,250, whichever is less, for multi-family buildings with 80 or more units.

Grant amounts for new construction projects are described below and reflect combined natural and electric incentives:

- Up to $4,000 per living unit for new single-family homes;
- Up to $6,500 per building for new duplex construction;

- Up to $7,500 per building for new "3-flat" construction;
- Up to $8,500 per building for new "4-flat" construction;
- Up to $11,000 per building for new "6-flat" construction;
- Up to $4.25/ft2 of gross living space in new multi-family buildings with fewer than 80 units; and
- Up to $4.00/ft2 of gross living space in new multi-family buildings with 80 or more units.

3.4 Energy Efficient Affordable Housing Construction

Table 3-1 presents a summary of the total number of residential units constructed or rehabilitated by project type. In total, 679 units were constructed or rehabilitated through 18 program projects. The majority of units were new multi-family construction, followed by multi-family building rehab.

Table 3-1 Number of Residential Units Receiving Efficiency Improvements

Type of Project	*EPY6/GPY3 Number of Residential Units*
Single Family Rehab	4
Multi-Family Building Rehab	212
New Multi-Family Building Construction	340
New Single Family Construction	123
Total	679

3.5 Program Operations Perspective

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 were also asked to comment on some the successes and challenges that arose during the program year. Each interview was approximately sixty minutes in length and took place at DCEO offices in Springfield Illinois.

3.5.1 EPY6/GPY3 Program Changes

Program staff members were asked about significant changes that occurred during the EPY6/GPY3 program year. The most notable change described was the loss of two program staff, a senior staff member, and an intern. Two other staff members transitioned from the DCEO recycling programs to DCEO's two low income programs, Residential Retrofit and Affordable

Housing New Construction. The role of these new staff members was to spend part of their time supporting program administration and performing oversight functions. 15% of the new staff time was dedicated to Recycling and 85% is split between Residential Retrofit and Affordable Housing New Construction Programs.

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

3.5.2 The Future of the Affordable Housing New Construction Program

Staff was asked to comment on future changes planned for the Affordable Housing Program. Staff stated that there are plans for the program to offer a performance-based incentive on achieved energy savings in addition to the prescriptive incentive amount. There will also be a slight increase in the base incentive amount.

To receive the performance based incentive, participants provide a building energy use simulation model that demonstrates that the project(s) show a minimum 15% energy use improvement over the applicable energy code. Those that qualify are eligible for an additional 10% of the base grant amount as calculated per the standard incentive calculation. Grantees choosing the performance incentive approach must meet the following criteria:[1]

- Project sites is a multi-family building;
- Projects must seek ENERGY STAR® or LEED certification;
- Grantees must provide their modelling results to a third-party selected by DCEO for verification;
- Energy produced by solar or wind power cannot be included in the 15% energy use improvement.

Table 3-2 below provides a comparison of the EPY6/GPY3 and EPY7/GPY4 standard incentives and reflects the increase in the in the EPY7/GPY4 incentive.

[1]Illinois Energy Efficient Affordable Housing Construction Program Guidelines and Application, PY7. http://www.illinois.gov/dceo/whyillinois/KeyIndustries/Energy/Documents/EEAHCP20142015PY7GuidelinesFinal-PK_5-22-14.doc

Table 3-2 Base Incentive Comparison PY6 – PY7

Housing Type	*PY6*	*PY7*
Rehab		
Single Family	$4,500	$4,650
Multi-Family < 80 Units	$4.50/ft2 or $4,500	$4.60/ft2 or $4,650
Multi-Family > 80 Units	$4.25/ft2 or $4,250	$4.35/ft2 or $4,650
New Construction		
Single Family	$4,000	$4,150
Duplex	$6,500	$6,700
3-Flat	$7,500	$7,800
4-Flat	$8,500	$8,900
5-Flat	$11,000	$11,500
Multi-Family < 80 Units	$4.25/ft2	$4.35/ft2
Multi-Family > 80 Units	$4.00/ft2	$4.10/ft2

The increase in the base incentive amount is due to additional requirements for each grantee to procure a contractor to conduct blower door testing. In the past this was done by DCEO's independent consultant, Domus Plus. If the grantee receives a grant based on a per unit basis, every unit has to be tested. If the grant is based on building size, then the Res Net protocol goes into effect; if the first seven units pass, then not every following unit requires a blower door test; only a sample of the remaining units are tested.

3.5.3 Program successes

Staff were asked to comment on what they thought were the greatest program successes and challenges going into PY7. Staff indicated that the program participation and implementation processes are seamless and well executed. The Affordable Housing Construction Program celebrated its 25th year of operations in 2014 and said that they feel like that is a huge accomplishment.

Staff believes that grantees are very satisfied with their experiences and grateful for the program offerings. The contractor noted that one of the greatest program successes is that they have never had to turn down a participant. If a developer applies to the program with real energy savings opportunities, DCEO finds a way to fund them.

Staff also said that from an implementation perspective communication is consistent between DCEO, Domus Plus, and the grantees. Domus Plus provides the majority of the technical expertise, grantee oversight, and measure verification. DCEO staff handles the processing of payments and grantee reporting. DCEO staff and the contractor staff communicate about the progress of the various projects several times a week.

3.5.4 Program challenges

While the program is running smoothly some challenges do exist. One program staff member noted that there is often a significant amount of time between when they process a funding commitment letter and when the grantee plans to execute the grant agreement. Grantees often apply for funding well in advance of when it is needed. The commitment letter can allow for the grantee to secure other funding sources, so it is assumed that the grantee is waiting to secure these sources prior to the execution of the grant agreement. When grantees hold onto these commitment letters for months or even years, there is a greater chance that the project parameters will have changed. Staff indicated that this delay disrupts program continuity. A potential solution to the problem could be to assign an expiration date to each commitment letter, which would clearly set expectations for the timing of grant agreements.

Staff noted that the evolving nature of building codes in Illinois will increasingly impact the program savings potential. The more stringent code requirements raise the baseline efficiency that must be surpassed for applicants to qualify for incentives and increase the cost of above code energy savings. The consultant from Domus Plus referenced this challenge and indicated that the performance incentive approach was specifically designed to drive energy savings as codes increase. One suggestion that was made is to consider implementing a scaled version of the performance incentive. For example, if the grantee exceeds the code by 5% they will be eligible for a 5% increase in the base incentive amount, a 10% increase respectively, and so on. This scaled approach is similar to the incentives offered for energy efficient new construction in the public sector program.

Appendix A: Project Summaries

Grantee	*Project Name*	*Type*	*Number of Units*	*Gas Utility*	*Electric Utility*
Green HFH Action Group II		Rehab SF	4	Peoples	ComEd
Three Corners, LLC	Bronzeville Artist Lofts	Rehab MF	16	Peoples	ComEd
Bickerdike Redevelopment Corporation	Humboldt Building	Rehab MF	29	Peoples	ComEd
Affordable Housing Continuum	Woodlawn Six	Rehab MF	100	Peoples	ComEd
Interfaith Housing Development Corporation	Grove Ave. Apartments	Rehab MF	51	Nicor	ComEd
TCB Development Services	Low Rise Properties	New MF<80	18	Peoples	ComEd
Davis Lakefront	Lake Park Crescent	New MF<80	57	Peoples	ComEd
Bickerdike Redevelopment Corporation	Zapata Apartments	New MF<80	67	Peoples	ComEd
Preservation of Affordable Housing	Woodlawn Center North Phase II	New MF<80	29	Peoples	ComEd
Senior Suites Chicago Midway Village	Senior Suites of Midway Village	New MF>80	80	Peoples	ComEd
Glendale Heights Senior Apartments	Glendale Heights Senior Apartments	New MF>80	81	Nicor	ComEd
New Directions Housing Corporation	Greenleaf Manor	New SF	20	Nicor	ComEd
JRG Holdings - Belleville, LLC	Park Manor	Rehab MF	16	Ameren	Ameren
Southern Illinois Coalition for the Homeless	Phoenix Project	New MF<80	8	Ameren	Ameren
New Directions Housing Corporation	Buttonwood Trails	New SF	40	Non-EEPs	Ameren
Morgan County Civic Services	Gilmore Estates	New SF	22	Ameren	Ameren
McLean County HFH	Trailside	New SF	4	Nicor	Ameren
Plowfield Square LP	Plowfield Square Apartments	New SF	37	Ameren	Ameren