

# Illinois Energy Efficient Affordable Housing Construction Program

Illinois Department of Commerce  
and Economic Opportunity

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## A. Executive Summary

The Illinois Department of Commerce and Economic Opportunity (DCEO) believes that affordable housing must be energy efficient to be truly affordable. DCEO has led this effort through the *Illinois Energy Efficient Affordable Housing Construction Program* initiated in 1988. Under this Program, grants are provided to Illinois based non-profit housing developers to include energy efficient building practices in the rehab or new construction of affordable housing units. Average energy savings range from 50% to 75%. Additional funding has been made to include “green” building products in selected projects.

Benefits of the Program include:

- \$12,000,000 dollar energy savings since Program inception
- \$1,584,000 annual dollar energy savings
- 1,907,275 annual therm savings
- 3,713,635 annual kWh savings
- 3,595 units of housing funded under Program
- 10,774 low and moderate income people served
- 68 non-profit housing developers assisted

The Program takes an all encompassing view of housing and does not fund standard energy efficient practices. Energy efficient building practices required by DCEO under the Program are:

- R21 (about 5-1/2”) blown insulation in sidewalls
- R43 (about 12”) attic insulation
- R10 (about 2”) foundation insulation
- High efficiency, sealed combustion furnace or boiler
- Sealed combustion water heater
- Exhaust ventilation in bathrooms and kitchens

Goals of the Program include:

- demonstrate the impact that energy efficiency has on **creating** and **maintaining** affordable housing
- show that lower housing costs can be achieved with energy efficiency
- treat the house as a system, focusing on energy efficiency, indoor air quality and occupant comfort
- identify and maximize cost effective energy efficiency opportunities present in rehab and new construction
- educate developers, architects and builders of the various energy efficient building measures and “green” building products such that they can begin using these measures and products on other non-funded DCEO projects



## **B. Benefits**

Benefits for all projects funded under the *Energy Efficient Affordable Housing Construction Program* are shown first. Benefits are then categorized by project type.

### **Energy Efficient Affordable Housing Program (all projects)**

- \$12,000,000 dollar energy savings since Program inception
- \$1,584,000 annual dollar energy savings
- 1,907,275 annual therm savings
- 3,713,635 annual kWh savings
- 3,595 units of housing funded under Program
- 10,774 low and moderate income people served
- 68 non-profit housing developers assisted

#### *Rehab*

- \$8,223,000 dollar savings since Program inception
- \$1,015,000 annual dollar savings
- \$525 annual dollar savings/unit
- 649 annual therm savings/unit
- 1,033 annual kWh savings/unit
- 1,993 units (96 buildings) rehabbed

#### *New Multi-Family Construction*

- \$1,873,000 dollar savings since Program inception
- \$348,000 annual dollar savings
- \$342 annual dollar savings/unit
- 367 annual therm savings/unit
- 1,033 annual kWh savings/unit
- 1,018 units (23 buildings) of new multi-family construction

#### *New Single Family Construction*

- \$1,905,000 dollar savings since Program inception
- \$222,000 annual dollar savings
- \$345 annual dollar savings/unit
- 373 annual therm savings/unit
- 1,033 annual kWh savings/unit
- 644 new single family homes (35 projects)



## C. Program Description

The US Department of Housing and Urban Development defines housing to be affordable if housing cost is no more than 30% of a household's income. Housing cost is defined as rent, or mortgage, plus energy costs. Typically, affordable rents and mortgages are achieved by minimizing construction costs. However, if affordable housing has affordable rents and mortgages but the households cannot afford the energy bills, is the housing truly affordable?

The Illinois Department of Commerce and Economic Opportunity (DCEO) believes that affordable housing must be energy efficient to be truly affordable. DCEO has led this effort through the *Energy Efficient Affordable Housing Construction Program* initiated in 1988. Under this Program, grants are provided to non-profit housing developers to include energy efficient building practices in the rehab or new construction of affordable housing units to achieve a level of energy efficiency not typically found in affordable housing projects. The Program takes an all encompassing view of housing and does not fund standard energy efficient practices. Goals of the Program include:

- demonstrate the impact that energy efficiency has on **creating** and **maintaining** affordable housing
- show that lower housing costs can be achieved with energy efficiency
- treat the house as a system, focusing on energy efficiency, indoor air quality and occupant comfort
- identify and maximize cost effective energy efficiency opportunities present in rehab and new construction
- educate developers, architects and builders of the various energy efficient building measures and "green" building products such that they can begin using these measures and products on other non-funded DCEO projects

Key to the Program's success is identifying opportunities for incorporating energy efficiency in the building process. As a result, construction costs are increased by \$2.00/ft<sup>2</sup> to \$3.00/ft<sup>2</sup> to include energy efficient building practices. However, total construction costs range between \$50.00/ft<sup>2</sup> to \$100/ft<sup>2</sup>. Thus, for only a 2% to 6% increase in construction costs, energy costs can be reduced by 50% to 75%.

A non-profit wishing to obtain an energy grant completes a Program application and forwards to the Program Manager. Project drawings are submitted and reviewed with respect to meeting the energy standards (Appendix B). A meeting is held with the non-profit, architect and contractor to review the energy standards. A set of energy specifications is prepared for the project and submitted to the non-profit and architect. The energy specifications must be part of the construction documents before an energy grant is provided by DCEO. Periodic visits to the site are made during construction to assure conformance to the energy standards. Air leakage tests (blower door tests) are conducted near project completion. Provisions are made to monitor actual energy consumption with the non-profit following project completion.

Energy grants are provided in the following amounts.

- Rehab
  - Multi and Single Family: \$2,500/unit
  - Single Room Occupancy, < 80 units: \$2.75/ft<sup>2</sup> of living space
  - Single Room Occupancy, > 80 units: \$2.50/ft<sup>2</sup> of living space
  
- New Multi-Family
  - 80 units or less: \$2.50/ft<sup>2</sup> of living space
  - Greater than 80 units: \$2.25/ft<sup>2</sup> of living space
  
- New Single Family
  - Single family: \$2,000/unit
  - Duplex: \$3,500/duplex
  - 3-flat: \$4,500/building

Energy grants are designed to pay for the incremental cost of upgrading to the DCEO energy standards. The grants are not designed to cover the entire cost of the energy measure. For example, all homes are built with furnaces. The cost of the furnace is part of the original construction budget. The DCEO grant is used to pay the cost difference for upgrading to a 90% furnace from a standard furnace.



## D. Program Measures

Grantees must incorporate the energy standards established by DCEO (Appendix B). A comparison of “standard energy practice” and DCEO energy standards is shown in Table 1.

**Comparison of “Standard Energy Practice” and “DCEO Energy Standards”**

Table 1

Measure	Standard Practice	DCEO Standards
Wall Insulation	Rehab – None to R13 New Construction – R19	R21 blown insulation (no batts)
Attic Insulation	R30	R43
Foundation Insulation	R10	R10
Air Sealing	no specification	1100 CFM50 <sup>1</sup> as measured with a blower door
Furnace	80% AFUE <sup>2</sup>	90% AFUE & direct vent sealed combustion
Water Heater	Natural draft	Direct vent sealed combustion
Bathroom Exhaust Fan	not required if bathroom window is present	70 CFM <sup>3</sup> , low sone <sup>4</sup> , vented to the outside
Kitchen Exhaust Fan	No requirements	150 CFM vented to the outside
Lighting	No requirements	Minimum of 3 fluorescent fixtures/unit (all common area light must be fluorescent in MF buildings)
Refrigerators	No requirements	ENERGY STAR®
Air Conditioning	No requirements	Minimum SEER 14 (when air conditioning is provided)

<sup>1</sup> – cubic feet of air at a 50 Pascal pressure difference between the house and outside – equivalent to a 20 mph wind on all sides of the home

<sup>2</sup> – Annual Fuel Utilization Efficiency

<sup>3</sup> – cubic feet of air per minute

<sup>4</sup> – sone is a sound rating; DCEO requires quiet fans with a sone rating no higher than 1.5

Highlights of the Program energy measures are discussed next.

### *Wall Insulation*

R21 blown insulation is required. Blown insulation includes cellulose (made from recycled newspaper), rock wool (made from rocks), glass fiber or foam. Batt insulation in walls is not allowed under the Program for two reasons. First, it is “standard practice” and the goal of the Program is not to fund standard practice. Secondly, the stated R-value for batt insulation is not achieved unless the insulation is installed without air space in the wall cavity. Although achievable, it is difficult to



obtain.

Blown insulation is installed in an open wall cavity. A small amount of water is mixed with cellulose and rock wool so the insulation remains in the wall cavity. Excess insulation is removed with a “stud scrubber”. Blown insulation achieves the goal of wall insulation - air space in the wall has been eliminated, the desired R-value has been obtained and a clean surface for the interior drywall is provided.



Glass fiber is applied dry behind netting. Foam can be applied to an open cavity or sprayed into a closed wall cavity.

### *Foundation Insulation*

The insulation value of an uninsulated foundation wall, including slabs-on-grade, is equivalent to a double pane window. Though no one would build a home with nothing but double pane windows, which is essentially what is done from a thermal standpoint if foundation walls and slabs are not insulated. Adding R10 foundation insulation increases the insulation value of foundations and slabs by a factor of 5.



### *Air Sealing*

Air sealing a building saves energy and eliminates drafts making the home more comfortable for the occupants. Yet, making a building too tight can create indoor air quality problems. No specific air sealing measures are included as part of “standard practice”. Specific air sealing measures are listed in the DCEO standards. The air measures are designed to save energy without creating indoor air quality problems. Principally, the interior drywall is used as the air barrier. Standard caulk and low expanding foam are used to air seal the drywall to the framing, windows, junction boxes and other penetrations.



A “blower door” is used by DCEO to measure the air tightness and check for air leaks and to assure that the unit is not too tight. The blower door is a large fan that is placed in an exterior door opening. The fan is turned-on and the house is depressurized (air is sucked out of the home). The amount of air being moved by the fan is measured. Completed homes must have air leakage rates no higher than 1100 CFM50 (cubic feet of air per minute at a 50 Pascal pressure difference). Standard new homes are approximately twice as leaky. If the air leakage rate is not achieved, air leakage sites can be found for additional air sealing work.



### *Direct Vent Sealed Combustion (DVSC) Furnaces and Water Heaters*

Furnaces and water heaters must be direct vent sealed combustion (DVSC) under the DCEO Program. No indoor air is used for combustion on DVSC appliances. All combustion air is drawn from the outside and ducted directly to the combustion chamber. DVSC appliances eliminate combustion gas backdrafting that can occur in a well sealed house. Backdrafting appliances can cause indoor air quality problems such as carbon monoxide poisoning and mold growth due to excess moisture. Furthermore, furnaces must be high efficiency and have a minimum seasonal efficiency of 90%.



Standard practice includes 80% furnaces and natural draft water heaters.

### *Exhaust Fans*

Too much moisture in a home is the number one indoor air pollutant. Excess moisture can cause mold growth, cause building materials to rot and generally promote unhealthy living conditions. Bathrooms and kitchens are natural moisture sources simply by the nature of their function. DCEO requires exhaust fans in these spaces, even though the building code may not. The fans must be vented to the outside to remove moisture from the home. Additionally, bathroom exhaust fans must be low sone, or quiet, fans. Kitchen exhaust fans must be vented to the outside – recirculating fans are not permitted as they do not remove moisture.



### *Electrical*

A minimum of three hard-wired fluorescent fixtures must be provided in every unit (exceptions are made for single room occupancy units). All common area and exterior lighting in multi-family buildings must be fluorescent.

When refrigerators are provided, they must be ENERGY STAR® rated. Similarly, when air conditioning is provided, the system must have a minimum SEER rating of 14.0.

## E. “Green” Building

“Green” building products began appearing in the early 1990’s to help promote resource efficient building. “Green” building products are those products that:

- contain recycled material
- use primary resources in an efficient manner
- promote good indoor air quality

The Program expanded in 1994 to address the feasibility of using “green” products in affordable housing. It was discovered that by selectively including “green” building products that promote good indoor air quality adds only **2% to 3%** to the construction costs.

Four projects have been completed where the use of “green” building products was combined with energy efficient building practices. Photovoltaic systems were also included on the Kimbark, Vision House and Bethel buildings.

- 3300 W. LeMoyne, 2 units, completed in 1995
- 6224-26 S. Kimbark, 10 units, completed in 2000
- Vision House Family Care Center (for children infected with AIDS), 514 E. 50<sup>th</sup> Pl., 2003
- Bethel Commercial Center

Building product manufacturers have started using waste materials in the production of building supplies and products. Waste material used in this fashion reduces the amount of waste that is disposed of in landfills. DCEO wishes to encourage this waste diversion by providing grants to include recycled building products in affordable housing projects. As funding for recycled building products is limited, applicants are encouraged to first speak with the Program Manager before submitting their request. Amount of a recycled building product grant will be at the discretion of the Program Manager. Maximum grants will be limited to either \$2.50/ft<sup>2</sup> or 3% of the construction cost, whichever is less.



## F. Program History

Abandoned inner city Chicago buildings were being purchased and rehabbed by non-profit housing developers in the late 1980's. These 3 and 4 story masonry buildings were structurally sound, but in need of everything else: new roofs, electrical, plumbing, and heating systems; windows; and interior walls. In an effort to keep construction costs low so as to provide affordable rents, energy efficient building practices were not part of the rehab work scopes. Despite the fact that the high energy costs of the 1970's were partially responsible for these buildings being abandoned in the first place, energy efficiency opportunities available during this type of rehab were being ignored by affordable housing developers. The buildings were being set-up for financial stress should energy price shocks be experienced once again.

At the same time, "Super Insulation" (SI) building practices were being applied to new market rate single family housing with guaranteed annual bills no higher than \$200. Why couldn't the procedures and practices being utilized in these homes be modified for multi-family building rehab? Could the same energy efficiency success being enjoyed in these market rate homes be repeated in multi-family buildings being rehabbed as affordable housing? With these goals in mind, the *Illinois Energy Efficient Affordable Housing Construction Program* was initiated in 1988 with the first three buildings (56 units) completed in 1990.

The City of Chicago initiated the *New Homes for Chicago Program* in 1990 in response to affordable housing needs. Joint ventures were formed between non-profit housing developers and for-profit builders to provide single family housing on vacant lots in selected Chicago neighborhoods. As with multi-family building rehab, energy efficient building practices were excluded from the designs in an effort to keep construction costs low. A set of energy standards was developed by DCEO for this housing type and the *Energy Efficient Affordable Housing Construction Program* was expanded to include new single family housing.

Non-profit housing developers expanded their activities in 1993 to include new multi-family housing. As with the previous housing types, energy efficiency was being ignored in these projects. DCEO expanded the Program once again in 1993 to address the lack of energy efficient building practices in this building type.



## **G. Summary**

Based on the premise that affordable housing must be energy efficient to be truly affordable, the *Illinois Energy Efficient Affordable Housing Construction Program* was initiated in 1988. The *Program* has gradually evolved over the past 18 years to address all aspects of affordable housing development – from single family rehab to the construction of new single room occupancy multi-family buildings to the inclusion of “green” building products.

As a result of DCEO’s efforts, the low income community residing in these buildings is saving almost \$1,600,000 a year in gas and electric costs. Furthermore, architect, engineers and builders who participated in these projects now understand that energy efficient practices are not high-tech and can be used on all residential projects in a cost effective manner. Occupant comfort and good indoor air quality are additional benefits to people residing in these buildings.

DCEO has worked to identify opportunities for integrating energy efficient building practices in affordable housing. As a result, 96 buildings (1,933 units) have been rehabbed and 23 multi-family buildings (1,018 units) and 664 new single family homes have been built.

Status of current projects as of July 2006 is as follows:

- 4 buildings (106 units) currently under rehab
- 4 buildings (152 units) awaiting rehab
- 6 new multi-family building under construction (456 units)
- 13 new multi-family buildings awaiting construction (792 units)
- 10 new single family housing projects under construction (264 units)
- 9 new single family housing projects awaiting construction (157 units)

The idea of applying energy efficient building practices to multi-family building rehab was greeted with a fair amount of skepticism by affordable housing practitioners in 1988 when DCEO initiated its Program. Could energy efficiency be integrated into work scopes without significantly raising costs? Would architects, engineers and builders accept the concepts? Would the expected energy savings be achieved? The success and breath of the Program since 1988 confirms that energy efficiency and affordable housing can indeed be combined. The concepts embodied in DCEO’s Program have been embraced by the Illinois affordable housing community. What once was considered a demonstration of energy efficient building practices is now becoming the new paradigm for affordable housing developments in Illinois as a result of DCEO’s efforts.

*Appendix A - Non-Profit Housing Developers Assisted with DCEO Energy Grants*

***In Chicago***

1. Neighborhood Housing Services
2. Covenant Development
3. Voice of the People
4. JP Development
5. Kenwood-Oakland Development
6. Southeast Dev. Commission
7. Lakefront SRO
8. Isaiah Community Dev.
9. PRIDE
10. Lawndale Christian Com. Dev.
11. Uptown Habitat for Humanity
12. Vision House
13. The Resurrection Project
14. Thresholds
15. Hispanic Housing
16. Woodlawn Development
17. WECAN
18. Deborah's Place
19. Rodgers Park Community Dev.
20. The Renaissance Corporation
21. West Side HFH
22. Acorn Housing
23. Catholic Charities
24. AFC Community Development
25. Near Northwest Arts Council
26. Bethel New Life
27. Christian Vision Center
28. Chicago Christian Indust. League
29. St. Andrew's Court
30. Progressive Square
31. Woodlawn Community Dev.
32. Claretian Associates
33. Near West Side Community Dev.
34. Interfaith Organizing Project
35. The Night Ministry
36. La Casa Norte
37. Windy City HFH
38. Turnstone Pacesetter
39. AidsCare
40. Safer Foundation
41. Chicago Metropolitan  
Development Association

***Outside Chicago***

1. Lake County Community Action  
Agency (Waukegan)
2. Project NOW (Rock Island)
3. Rockford Neighborhood  
Redevelopment (Rockford)
4. Mid-Central Community Action  
Association (Bloomington)
5. Center for Women in Transition  
(Champaign)
6. Zion Development (Rockford)
7. Proviso Habitat for Humanity  
(Maywood)
8. Champaign County Mental  
Health (Urbana)
9. Youthbuild (Rockford)
10. Neighborhood Housing Services  
(Elgin)
11. Interfaith Housing (Evanston)
12. St. Teresa's Family Living  
Center (East St. Louis)
13. Western Egyptian (Sparta)
14. Carver Community Action  
Agency (Galesburg)
15. Rock Island Economic Growth  
(Rock Island)
16. Tri-County Opportunities  
Council (Rock Falls)
17. Integrated Community Services  
(Pana)
18. Prairie Partners (Athens)
19. Shoal Creek Limited Partnership  
(Hillsboro)
20. Affordable Housing Continuum
21. Affordable Housing Preservation  
Foundation
22. Illinois Community Action  
Association
23. Dove, Inc. (Decatur)
24. Springfield HFH
25. Shelby County HFH
26. New Hope Housing  
Development
27. Trinity Services

## **Appendix B**

### **Illinois Department of Commerce and Economic Opportunity Minimum Energy Standards**

#### **Multi-Family Building Rehab**

##### **I. Insulation**

- Sidewalls R-19 full cavity blown insulation
- Attic R-43
- Basements R-19 full ceiling insulation over unconditioned basement;  
Walls insulated like sidewalls if units are located in basement

##### **II. Windows**

- Double glazed with low-E coating (maximum U-value of 0.35 for window unit)

##### **III. Air Sealing**

- Foil backed drywall on exterior walls and top floor ceiling (not required if cellulose of rock wool insulation is used)
- Exterior drywall installed to subfloor of unit above
- Top of drywall caulked to subfloor and framing members
- Base of drywall caulked to subfloor
- All penetrations through exterior drywall sealed with caulk or foam
- Seal drywall to framing members on exterior walls
- Completed units not to exceed 0.5 air changes/hour as measured with blower door

##### **IV. Mechanical**

- Furnace Sealed combustion/direct vent; minimum 90% AFUE or sealed combustion/direct vent 88% AFUE for boiler
- Water Heater Sealed combustion/direct vent; minimum 60% EF or sealed combustion/direct vent 88% for central water heater
- Air Conditioner Minimum SEER of 14
- Ventilation Minimum 75 CFM at 0.25 inches of static pressure exhaust fans in all bathroom with some rating no higher than 1.5  
Minimum 150 CFM exhaust fan in kitchen  
All fans vented directly to the outside
- Duct Sealing All duct joints (supply & return) sealed with duct mastic  
All ducts & pipes located in conditioned areas

##### **V. Refrigerators**

- *Energy Star*

##### **VI. Lighting**

- Minimum of 3 fluorescent fixtures/unit
- All common area and exterior lights to be fluorescent or approved equal

##### **VII. Water**

- 1.6 gallon toilet, low flow showerheads, aerators

# Illinois Department of Commerce and Economic Opportunity

## Minimum Energy Standards

### New Residential Construction

#### I. Insulation

- Sidewalls R-21 full cavity blown insulation
- Attic R-43
- Foundations
  - Slab-on-Grade R-10 full slab insulation & perimeter
  - Crawl Space R-10 exterior or R-19 interior
  - Basement R-10 exterior or R-19 interior
  - Floor above Crawl Space R-21

#### II. Windows

- Double glazed with low-E coating (maximum U-value of 0.35 for window unit)

#### III. Air Sealing

- All penetrations through shell sealed with caulk or foam
- Seal drywall to framing members on exterior walls
- Caulk base of drywall to subfloor
- Completed units not to exceed 0.5 air changes/hour as measured with blower door

#### IV. Mechanical

- Furnace Sealed combustion/direct vent; minimum 90% AFUE or sealed combustion/direct vent 88% AFUE for boiler
- Water Heater Sealed combustion/direct vent; minimum 60% EF or sealed combustion/direct vent 88% for central water heater
- Air Conditioner Minimum SEER of 14
- Ventilation Minimum 75 CFM at 0.25 inches of static pressure exhaust fans in all bathrooms with sone rating no higher than 1.5  
Minimum 150 CFM exhaust fan in kitchen  
All fans vented directly to the outside
- Duct Sealing All duct joints (supply & return) sealed with duct mastic  
All ducts & pipes located in conditioned spaces

#### V. Refrigerators

- Energy Star

#### VI. Lighting

- Minimum of 3 fluorescent fixtures
- All common area and exterior lights to be fluorescent or approved equal

#### VII. Water

- 1.6 gallon toilet, low flow showerheads, aerators