

ORDINANCE NO. 5512

AN ORDINANCE TO AMEND §173.08 **ARKANSAS ENERGY CODE** OF THE BUILDING REGULATIONS CHAPTER OF THE U.D.C. TO ADOPT THE 2009 INTERNATIONAL ENERGY CONSERVATION CODE, FOR RESIDENTIAL STRUCTURES, WITH AMENDMENTS HEREIN.

WHEREAS, Fayetteville customers spend over \$50 million annually for electricity and natural gas services; and

WHEREAS, more efficient buildings can conserve energy, reduce stress on our electricity grid and natural gas supplies while saving money and resources for our citizens; and

WHEREAS, improved building codes emphasizing energy conservation can reduce future energy consumption and the costs associated with energy production; and

WHEREAS, the existing State adopted and amended 2003 International Energy Conservation Code is inferior in comparison with the 2009 International Energy Conservation Code; and

WHEREAS, pursuant to A.C.A §14-55-206 and 207, the City of Fayetteville has published notice in the Northwest Arkansas Times that the City Council will consider enacting an ordinance to adopt and require all new residential construction and renovations to comply with the 2009 International Energy Conservation Code, three copies of which are available for public inspection and review in the Fayetteville City Clerk's Office.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF FAYETTEVILLE, ARKANSAS:

Section 1. That the City Council of the City of Fayetteville, Arkansas hereby repeals §173.08 **Arkansas Energy Code** of the Unified Development Code and enacts a replacement §173.08 **Energy Conservation Code** as shown below:

“§173.08 **Energy Conservation Code**

(A) *Commercial.* The Arkansas Energy Code, its Rules and Regulations as adopted and promulgated by the Arkansas Energy Office, and as from time to time

hereafter may be amended, is hereby adopted by reference pursuant to A.C.A. § 14-55-206 and § 14-55-207.

- (B) *Residential.* The 2009 International Energy Conservation Code (IECC) is hereby adopted by reference for all new residential structures with the exception of §107 **Fees** and §109 **Board of Appeals**.

(1) *New residential construction.*

The 2009 IECC is hereby amended by adding a provision requiring a Home Energy Rating System (HERS) Index rating for new residential construction. The City of Fayetteville requires that all new residential construction have a Home Energy Rating System (HERS) Index rating completed by an independent RESNET certified home energy rater, or equivalent, prior to the issuance of a Certificate of Occupancy. Residential developments that utilize the exact same floor plan multiple times are required to have a HERS Index rating completed on a minimum of 20% of the residential units.

(2) *Sticker.*

A sticker provided by the city shall be posted in a very visible location near the front entrance to the residential structure indicating the estimated monthly utility cost as derived from the HERS Index rating until the structure is sold, or for at least 90 days, whichever is less.

(3) *Additions, Alteration and renovations.*

All additions, alterations and renovations to existing residential structures shall comply with the standards of the 2009 IECC, but shall not be required to provide a HERS Index rating or post a sticker. Where it is shown to be impractical to meet the 2009 IECC, the Building Official may permit additions to comply with the Arkansas Energy Code, its Rules and Regulations as adopted and promulgated by the Arkansas Energy Office, and as from time to time hereafter may be amended.”

(4) *Repairs.*

All repairs to existing residential structures and mechanical systems need only be constructed to at least the same energy conservation standard as the damaged structure or mechanical system which needed repair unless a higher standard is required by the Arkansas Energy Code.

(5) *Fees.*

§107 **Fees** of the IECC is removed to reflect that only the City Council can set required fees and any refund policy, the "code official" cannot set fees nor a refund policy. All fees shall be as prescribed in the Unified Development Code.

(6) *Appeals.*

§109 **Board of Appeals** shall be removed from the IECC and have no force or application. Appeals of the Building Official's interpretation of this International Energy Conservation Code shall be heard by the existing Board of Construction Appeals and no new Board of Appeals for interpreting the International Energy Conservation Code shall be created by this Code.

Section 2. That in order to adequately prepare the residential construction industry for the 2009 International Energy Conservation Code (IECC) and the related new testing requirements, the effective date of the new code shall be implemented in stages as follows:

- (1) All provisions of the adopted 2009 IECC, as amended, shall become effective on September 03, 2012, with the exception that a Certificate of Occupancy may be issued even if a residential structure does not pass the air sealing/infiltration or duct sealing testing requirements.
- (2) The HERS Index rating and associated sticker requirements shall become effective on September 03, 2012.
- (3) All provisions of the adopted 2009 IECC, as amended, shall be effective on March 06, 2013.

PASSED and **APPROVED** this 17th day of July, 2012.

APPROVED:

ATTEST:

By: 
LIONELD JORDAN, Mayor

By: 
SONDRA E. SMITH, City Clerk/Treasurer



Analysis of Residential Energy Codes

Residential Building Code Task Force
City of Fayetteville Sustainability and Strategic Planning Department
2012

Background: On July 5, 2011 the City Council passed Resolution 117-11 directing City Staff to examine Fayetteville's current building codes and recommend possible changes to encourage energy efficiency improvements for City Council consideration. A Residential Building Code Task Force was formed comprised of local home builders, architects and energy performance consultants tasked with researching, modeling and developing a recommendation for the adoption of energy code changes.

Process: The Residential Building Code Task Force met a total of four times in 2011 and 2012. The Task Force utilized the expertise of its members to model the energy efficiency of a "typical" 1,824 sq. ft. home according to four different sets of building codes; the 2003, 2009 and 2012 International Energy Efficiency Codes (IECC) and the Energy Star Code. The results of this modeling exercise are included in the attached spreadsheets.

Comparison between the 2003, 2006, 2009 and 2012 International Energy Conservation Code (IECC) Building Envelope Requirements:

The IECC is typically published every three years. Each edition has some changes from the previous one. The residential portion of the code was heavily revised in 2004 and climate zones and building envelope requirements were restructured into a different format. This makes the post 2004 IECC codes much more concise and easier to use. However, these changes also complicate comparisons of pre-2004 codes to the newer versions. The changes between the 2006, 2009 and 2012 IECC were mainly to improve energy efficiency and make the code more stringent.

The major building thermal envelope updates to the 2003 IECC are the U-factor and Solar Heat Gain Coefficient (SHGC) requirements for fenestrations (windows) and the insulation R-factors for foundations and walls.

The Building Thermal Envelope is defined as what separates the building from unconditioned space. Windows are measured in terms of their thermal transmission, or U-factor. U-factor measures the rate of heat transfer through a product. The lower the U-factor, the lower the amount of heat loss, and the better a product is insulating a building. Solar Heat Gain refers to the increase in temperature in a space, object or structure that results from solar radiation. The amount of solar gain changes with the strength of the sun, and with the ability of any intervening material to transmit or resist the radiation.

The thermal building envelope changes between the 2003, 2006 and 2009 versions of the IECC are shown below:

	2003 IECC adopted by State with amendments	2006 IECC	2009 IECC
Ceiling	R-38	R-38	R-38
Skylight U-factor	N/A	0.60	0.60
Fenestration U-factor	0.41	0.40	0.35
Fenestration SHGC	N/A	N/A	0.45
Wood Frame Wall	R-13	R-13	R-13
Mass Wall	R-8.1	R-5	R-5/10*
Floor	R-19	R-19	R-19
Basement Wall	R-10/13**	R-10/13**	R-10/13**
Slab	R-4	R-10,2 ft depth	R-10,2 ft depth
Crawlspace Wall	R-10/13**	R-10/13**	R-10/13**

* The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

** The first *R*-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.

Additional revisions to the 2009 IECC to improve energy efficiency included:

- The 2009 IECC requires that all sealed ducts located outside of the building's thermal envelope be verified by conducting a duct tightness test. The 2003 and 2006 IECC requires ducts to be sealed but not to a specific leakage rate verified by testing.
- 50% of the lighting lamps in a building have to be high efficiency in the 2009 IECC. The 2006 IECC has no lighting requirement.
- Trade off credit can no longer be obtained for high-efficiency heating, ventilation, and air conditioning (HVAC) equipment in the 2009 IECC. For example, if a high efficiency furnace is used, no reduction in wall insulation is allowed.
- A permanent sticker shall be posted on or in the electrical distribution panel that lists the predominant *R*-values of the insulation in the ceiling/roof, walls, foundation and ducts outside conditioned space. Also, the certificate shall list U-factors for window, the types and efficiencies of heating, cooling, and water heating equipment.

The 2012 IECC continues this trend, with all of the 2009 requirements and heightened requirements for efficiency within the thermal building envelope. Wood frame walls go from R-13 insulation to 20; 75% of lighting fixtures are required to be high-efficiency; and the infiltration standards are much more stringent. Importantly, the mechanical systems within a residence begin to get much more scrutiny. In comparison, the 2003 IECC has no duct infiltration standards, the 2009 has 8 CFM per 100sf standard, and the 2012 IECC allows no more than 4 CFM per 100 sf of infiltration. As noted in the following cost-benefit analysis, the 2012 IECC significantly increases the cost of construction when compared to the current 2003 energy code, therefore the committee chose not to pursue this option further.

Overview of the 2009 IECC with Anticipated Energy Cost/Benefit Analysis

The 2009 IECC is designed to save the consumer in utility costs because the building's thermal envelope and duct system will be tighter allowing for less air infiltration and the solar heat gain will be reduced with the improved window U-factor ratings. The efficient lighting requirements require less energy thereby increasing efficiency. The 2009 IECC scope includes residential single-family housing and multifamily housing three stories or less above-grade, intended for permanent living. The code is intended to apply to new buildings and additions/alterations/renovations/repairs.

Ceiling	R-38
Skylight U-factor	U-0.60
Window U-factor	U-0.35
Wood Frame Wall	R-13
Fenestration Solar Heat Gain Coefficient (SHGC)	0.45
Mass Wall	R-5/10*
Floor	R-19
Basement Wall	R-10/13*
Slab	R-10, 2 ft depth
Crawlspace Wall	R-10/13*

* The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.

Additional requirements of the 2009 IECC include:

- Building envelope must be caulked and sealed.
- Supply ducts in attics must be insulated to R-8. Return ducts in attics and all ducts in crawlspaces, unheated basements, garages, or otherwise outside the building envelope must be insulated to R-6.
- All ducts must be sealed and either:
 1. Verified by pressure testing. The duct system is tested and the air leakage out of ducts must be kept to an acceptable maximum level.
 2. All ductwork must be installed entirely within the building envelope. Testing is not required if all ducts are inside the building thermal envelope.
- Less insulation is allowed for mass walls and more insulation is required for steel framing.
- 50% of the lighting in a building must be high efficacy.
- Standard administrative requirements apply (inspections, documentation).
- A certificate must be posted near the electrical panel listing insulation levels and other energy-efficiency measures.

Exemptions/allowances from prescriptive measures:

- One door and 15 square feet of window area are exempt.

Mandatory requirements:

Windows can never exceed an area-weighted average solar heat gain coefficient (SHGC) of 0.50.

Compliance Paths:

The 2003, 2006 and 2009 IECC all effectively contain three alternative compliance paths.

1. Prescriptive Measures. This is considered the simplest path. These requirements do not vary by building size, shape, window area or other features. The 2009 IECC has a single table of requirements for insulation R-values and window and door U-factors and SHGC.
2. Total building envelope UA (U-factor multiplied by area). This is the path predominantly used by the REScheck software. Based on the prescriptive U-factor table, it allows trade-offs whereby some energy efficiency measure can fall below code requirements if balanced by other measures that exceed code requirements.
3. Simulated performance path. This path allows compliance if the home has calculated annual energy consumption equal to or less than that of a standard reference design that meets the code's prescriptive requirements. This path allows for crediting energy efficiency measures not accounted for in other paths, such as renewable energy measures. The 2009 performance path differs from previous editions of the IECC in that it allows no trade-off credit for the use of high efficiency space heating, space cooling or water heating equipment.

Cost/Savings Analysis:

The Residential Building Code Task Force performed an analysis comparing the same 1,824 sq. ft. home constructed under both the 2003 IECC and the 2009 IECC and modeled with either gas or electric heat. The resulting analysis estimated an annual energy cost savings of \$267 for the gas home and \$344 for the electric home. The additional cost for building to the higher efficiency standards of the 2009 IECC was \$2,049, or amortized over a 30 year loan, \$132 annually. This represents a **net average annual energy savings for the home built to 2009 IECC standards of \$135 for the gas heated home and \$209 for the electric heated home.**

Overview of the Energy Star Version 3 Code with Cost/Benefit Analysis

The Energy Star Qualified Homes Version 3 goes beyond the requirements of the 2009 IECC. The Energy Star V3 code may be viewed as a stretch code to the 2009 IECC in that it requires higher efficiencies in some of the thermal building envelope requirements, and it promotes higher efficiency HVAC systems and appliances. The primary examples of this are; greater efficiencies for window U-factors, tighter building envelope requirements, tighter duct sealing requirements and increased foundation insulation installation requirements. Additionally, the Energy Star V3 code requires the installation of Energy Star certified appliances.

	2009 IECC	Energy Star Version 3
Ceiling	R-38	R-38
Skylight U-factor	U-0.60	N/A
Fenestration U-factor	U-0.35	U-0.32
Fenestration SHGC	0.45	0.40
Wood Frame Wall	R-13	R-13
Floor	R-19	R-19
Basement Wall	R-10/13*	R-19
Slab	R-10, 2 ft depth	R-19
Crawlspace Wall	R-10/13	R-13

Some additional significant features of the Energy Star Qualified Homes, Version 3 that differentiate it from the 2009 IECC include:

	2009 IECC	Energy Star V-3
HVAC	7.7 HSPF / 13 SEER / 11 EER ASHP – electric backup	8.5 HSPF / 14.5 SEER / 12 EER ASHP – electric backup
Ceiling Insulation Installation	Grade II Installation	Grade I Installation
AG Wall Insulation Installation	Grade III Installation	Grade I Installation
Foundation Insulation Installation	Grade II Installation	Grade I Installation
Infiltration	7.0 ACH50	5.0 ACH50
Water Heater	0.90 EF Electric DHW, 52 Gallons	0.92 EF Electric DHW, 52 Gallons
Dishwasher	Standard Efficiency	Energy Star
Refrigerator	Standard Efficiency	Energy Star
Lighting	50 % Fluorescent	80 % Energy Star Fluorescent
Bathroom Exhaust Fans	Standard Efficiency	Energy Star Exhaust Fans

Energy Star Cost/Saving Analysis:

Energy Star estimates that for a 2,200 sq. ft. all electric home with an unconditioned basement, located in Climate Zone 4 the improved efficiency standards would increase the annual mortgage cost by \$264. **The estimated monthly utility savings would be \$420, for a net cash flow increase of \$156/year for the homeowner.**

Conclusion

The 2003 IECC adopted and amended by the State of Arkansas has been improved on by subsequent code updates in recent years. The 2009 IECC has significantly higher thermal building envelope requirements than the 2003 IECC achieved primarily through higher efficiency windows and doors, better slab insulation, ductwork insulation and sealing requirements to reduce infiltration. The Energy Star V3 code has even higher efficiency requirements than the 2009 IECC and could be considered a stretch code. Both the 2009 IECC and the Energy Star V3 code have been shown to achieve a demonstrable net return on investment for the homeowner.

Recommendation

Based on the analysis performed calculating the cost of implementing the new energy code with the energy savings a homeowner could realize, the Residential Building Code Task Force and Staff recommends that the City adopt the 2009 IECC with the additional requirement for a Home Energy Rating (HERS) for all new residential construction. The HERS would provide a common denominator for all homebuilders and contractors to measure performance and will ensure that the construction techniques for all of these systems are sound. Staff would also recommend that the City require a Home Performance Sticker be placed in a prominent location near the front door showing the estimated monthly utility cost until the home is sold. This provides homebuyers the information needed to make an informed decision when making one of the largest investments a family can make, The Home Performance Sticker can also be a marketing tool for the homebuilders that wish to excel in this area.