Mr. Robin Nicoson  
Chairman, Fire Prevention and Building Safety Commission  
Indiana Government Center South  
302 West Washington Street  
Indianapolis, IN 46204  

Re: Proposed Rule on Indiana Residential Code, LSA Document #19-330

Dear Chairman Nicoson,

We, the undersigned, all expressed strong stakeholder interest in the development of the energy efficiency requirements of the Indiana Residential Code in the attached letters dated August 22, 2018 and in numerous appearances before the Residential Code Committee last year.

As citizens groups and community members, we are concerned and disappointed that the Committee failed to acknowledge the potential life-safety and environmentally-friendly benefits of updating the residential energy code. As experts in the building trades, we know that the people of Indiana want better and that the builders of Indiana can do better. As manufacturers, we know a strong energy code will drive improvements in energy efficiency, conservation, public health and wellness that will create jobs and improve the statewide and local economies.

We urge you to reconsider the proposals submitted by the Responsible Energy Codes Alliance and the Midwest Energy Efficiency Alliance.

Further, we would also urge the Fire Prevention and Building Safety Commission to initiate a rulemaking to update Indiana’s commercial building code, which is still based on a 2010 model. An update of the commercial code is long overdue, and will reap benefits from business, environmental and safety standpoint.

Sincerely,

350.org - Indiana- Indianapolis  
American Institute of Architects- Indiana  
American Chemistry Council  
Ball State University Center for Energy Research & Education & Service  
Building Performance Institute  
Building Performance Association (formerly Efficiency First, the Home Energy Magazine, and the Home Performance Coalition)  
Citizens Action Coalition
Earth Charter Indiana
Energy Efficient Codes Coalition
Hoosier Environmental Council
The Indiana Chapters of ASHRAE: Central Indiana, Evansville, Ft Wayne and Northern Indiana
Kheprw Institute
Knauf Insulation
Midwest Energy Efficiency Alliance
North American Insulation Manufacturers Association
Owens Corning
Polyisocyanurate Insulation Manufacturers Association
Responsible Energy Codes Alliance
Sierra Club Hoosier Chapter
Mr. Gregory Furnish  
Commissioner and Chairman, Indiana Residential Code Committee  
Indiana Government Center South  
302 West Washington Street  
Indianapolis, IN 46204

Re: RECA/MEEA Proposals To Update Envelope Provisions of Indiana’s Energy Code

Dear Chairman Furnish,

The undersigned organizations recommend that the Indiana Residential Code Committee support the proposed updates to the energy code from the Responsible Energy Code Alliance and the Midwest Energy Efficiency Alliance.

As citizens groups and community members we are concerned that the Committee is ignoring the critical life-safety elements of the energy code.

Studies have shown that the adoption of the 2018 IRC (as embodied in the RECA/MEEA proposals) will result in healthier, more comfortable, and more resilient homes. Improvements to the building envelope improve occupant comfort and maintain temperatures, especially during events with severe weather. A study conducted after Superstorm Sandy found that homes built to newer energy codes enabled residents to safely stay in their homes longer after a power outage compared to similar buildings constructed under an older code.\(^1\) The ability to shelter in place longer saves lives and provides critical flexibility for deploying first responder resources.

The impact of monthly energy bills on those with low or fixed income, particularly the elderly, is far greater than you may assume. Hoosiers are making decisions to choose between paying a heating bill and buying medicine, staying cool in the summer or having enough to eat.

The Department of Energy recently surveyed Americans about their energy use.\(^2\) Three findings should alarm and motivate us all to do better in caring for our community:

- About one in five households reported reducing or forgoing basic necessities like food and medicine to pay an energy bill and 14% reported receiving a disconnection notice for energy service.
- Nearly one-third of U.S. households (31%) reported facing a challenge in paying energy bills or sustaining adequate heating and cooling in their home in 2015.

\(^1\) ACEEE. Leaks and Lives: How Better Building Envelopes Make Blackouts Less Dangerous  

\(^2\) Reference: October 31, 2017 analysis of DOE EIA’s Residential Energy Consumption Survey (RECS)  
https://www.eia.gov/consumption/residential/reports/2015/energybills/?src=%E2%80%B9%20Consumption%20%2020%20%20%20%20%20%20%20Residential%20Energy%20Consumption%20Survey%20(RECS)-f1
• 11% of households surveyed reported keeping their home at an unhealthy or unsafe temperature.

Considering that newly built homes will be around for 50 to 100 years, most homes built today could eventually be inhabited by low-income families. The RECA/MEEA proposals will help ensure that all new homes are constructed with a quality building envelope, locking in key efficiency and health improvements for years to come.

Thank you for considering our recommendation, and please contact us with any questions.

Sincerely,

350.org - Indiana- Indianapolis
Citizens Action Coalition
Earth Charter Indiana
Energy Efficient Codes Coalition
Energy Matters Community Coalition
Hoosier Environmental Council
Hoosier Interfaith Power and Light
Kheprw Institute
Responsible Energy Codes Alliance
Sierra Club Hoosier Chapter
August 22, 2018

Mr. Gregory Furnish  
Commissioner and Chairman, Indiana Residential Code Committee  
Indiana Government Center South  
302 West Washington Street  
Indianapolis, IN 46204

Re: Energy Efficiency Updates to the Indiana Residential Code

Dear Chairman Furnish,

We are writing in support of the RECA/MEEA proposals to bring the energy efficiency requirements of the Indiana Residential Code in line with the 2018 International Residential Code.

New home construction in Indiana has kept a steady pace since Indiana’s last energy code update to the 2009 IECC (effective 4/2/12). Approximately 80,000 new single-family homes have been constructed (or are under construction) during the period from April 2012 through April 2018 and the pace of construction is increasing.¹ Each of these homes can exist for 70 to 100 years. These homes benefit from construction with permanent thermal envelopes that are as energy efficient as cost-effectiveness can justify.

The model energy code sets a minimum building standard that builders can and often will go beyond in constructing safe, attractive homes. To put in perspective how far above this standard others can go, some states such as New York, provide alternate ‘stretch codes’ with extra requirements for efficiency. Other states adopt or incentivize numerous third party systems:

- The International Code Council’s International Green Construction Code
- American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) ANSI/ASHRAE/USGBC/IES Standard 189.1
- The National Association of Homebuilders’ ICC 700 National Green Building Standard

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¹ Building permit date for single-family homes in Indiana is posted on the Federal Reserve Economic Data (FRED) database. [https://research.stlouisfed.org/fred2/series/INBP1FHSAl](https://research.stlouisfed.org/fred2/series/INBP1FHSAl)
• The Green Building Initiative’s ANSI/GBI 01-210 Green Building Assessment Protocol for Commercial Buildings
• The US Green Building Council’s Leadership in Energy and Environmental Design
• The International Living Future Institute’s Living Building Challenge.

Builders can design to net-zero and in many places are building actual net-zero homes: the Net-Zero Energy Coalition reported a total of 8,203 single-family and multifamily units in 2016, up from the 6,177 in 2015. A June 2018 report from Parks Associates shows that construction of zero net energy (ZNE) homes increased another 75% from 2016 to 2017.

Indiana’s forward thinking builders are already miles ahead of the 2018 IRC. The US Department of Energy (DOE) “Zero Energy Ready Home” (ZERH) program has 127 partners in Indiana including 11 builders, 51 verifiers, 14 training partners, 14 architects and designers, and 37 innovation partners. This program provides resources for successfully building and selling zero-energy ready homes in today’s market. The US Green Building Council Indiana has 5 branches in the state. The universities and public institutions are committed to advancing sustainable green building design. In June 2018, 30 mayors of Indiana who participate in the US Conference of Mayors endorsed a resolution to “Accelerate Focus on the Economic and Climate Benefits of Boosting America’s Building Energy Efficiency”. The Mayors specifically support driving further improvement in the International Energy Conservation Code and to make steady progress toward net zero building construction by 2050.

Our neighbors have caught on to this movement. Over the past four years, most of the surrounding states have updated their residential building energy code to the 2012 IECC or better, and currently Illinois, Minnesota and Ohio are considering the 2018 IECC for adoption.

The point is this: there is a long way to go above the minimum standards of 2018 IRC, and many are achieving them in Indiana and elsewhere. Arguments suggesting that 2018 IRC energy chapter is too hard or that Indiana should stay at its current level of efficiency simply ignores the reality that the people of Indiana want better and that the builders of Indiana can do better.
Sincerely,

Larry Zarker, CEO, Building Performance Institute

Robert Koester, Director of the Center for Energy Research & Education & Service, Ball State University

J. Joseph Cullen, Director of Policy & State Outreach, The Home Performance Coalition

Douglas Fick, Region V Director, ASHRAE

Tom Carter, Executive Director, Efficiency First

Ian Blanding, Senior Building Policy Associate, Midwest Energy Efficiency Alliance
August 22, 2018

Mr. Gregory Furnish  
Commissioner and Chairman, Indiana Residential Code Committee 
Indiana Government Center South 
302 West Washington Street 
Indianapolis, IN 46204

Re: Energy Conservation Requirements of the 2018 International Residential Code

Dear Chairman Furnish,

We support the Committee’s efforts to review and update the current Indiana Residential Code to the 2018 IRC. In the current review process we believe further consideration needs to be given to the energy efficiency provisions in Chapter 11 of the IRC. The proposals from the Responsible Energy Code Alliance and the Midwest Energy Efficiency Alliance are aligned with the 2018 IRC, present a clear, data-based argument, and should be adopted by the Committee. These proposals will drive improvements in energy efficiency, conservation, public health and wellness that will create jobs and improve the statewide and local economies.

According to a 2016 report, the clean energy sector supports more than 47,720 jobs in Indiana. A large majority of those jobs - 81 percent - are in energy efficiency. All of these 38,453 energy efficiency jobs are interdependent with the building industry, whether it be HVAC, insulation, lighting or manufacturing. They are good, in-state jobs in a vital, growing sector of Indiana’s economy.¹ We have an opportunity to build on this investment, improve the livability and resiliency of new homes, reduce energy waste, continue to spur local construction and manufacturing jobs, and become a leader in strong building energy codes throughout the region.

The RECA/MEEA proposals restore the balance designed into the 2018 IRC. The 2018 IRC provides flexibility with numerous compliance paths including a prescriptive path that provides alternative approaches of minimum R-value requirements, maximum assembly U-factor requirements and an area weighted U-factor method, a performance path, and an Energy Rating Index path. A builder can benefit from this flexibility to find their lowest-cost path to achieving code. These options are internally balanced; a weakening amendment to one path will create a loophole in the energy code. An amendment that results in paths of varying efficiency defeats the purpose of a minimum standard and may deceive citizens and residents about the energy, air quality, moisture control, and general performance of their homes.

Representing the businesses of energy efficiency, we know a strong energy code with the flexibility of many equally strong compliance paths will unleash the power of competition without picking winners or losers. For example, the proposed cavity insulation and continuous insulation options are constructible with various products. For instance, multi-functional insulation materials can simplify construction. In contrast, state-specific amendments to the energy code can increase legal, contracting, design, and materials transaction costs.

Indiana builders are able to construct homes that meet the 2018 IRC Chapter 11. The 2018 IRC provides guidance for practical matters such as cladding attachments to support constructability and compliance. In addition, manufacturers provide installation instructions for use of their products. Various third-party resources are available to support code compliance with helpful practices for construction.

¹ See Clean Energy Trust, Clean Jobs Indiana. https://www.cleanjobsmidwest.com/state/indiana
Available resources provide a variety of actionable and code-compliant solutions to optimize moisture control, integrate various wall functions and components, and equip builders/designers with conventional or more advanced options for resilient, energy efficient performance. Thus, as with many forms of construction (including conventional framing, advanced wood framing, SIPs panels, ICF forms, etc.) there are significant resources available to support not just one but many reasonable options.

Sincerely,

George Phelps, Public Affairs Manager, **Knauf Insulation**

Jay Murdoch, Director, Government & Industry Affairs, **Owens Corning**

Curt Rich, President & CEO, **North American Insulation Manufacturers Association**

David Mann, Senior Director, Building & Construction, **American Chemistry Council**

Justin Koscher, President, **Polyisocyanurate Insulation Manufacturers Association**
Proposed Code Change

Revise Table N1102.1 as follows:

**TABLE N1102.1**

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>FENESTRATION U-FACTOR</th>
<th>SKY LIGHT U-FACTOR</th>
<th>GLAZED FENESTRATION SHGC</th>
<th>CEILING R-VALUE</th>
<th>WOOD FRAME WALL R-VALUE</th>
<th>MASS WALL R-VALUE</th>
<th>FLOOR R-VALUE</th>
<th>BASEMENT WALL R-VALUE</th>
<th>SLAB R-VALUE &amp; DEPTH</th>
<th>CRAWL SPACE WALL R-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4A</td>
<td>0.35 0.32</td>
<td>0.60 0.55</td>
<td>NR 0.40</td>
<td>20 or 13+5&quot;</td>
<td>5/00 8/13</td>
<td>19</td>
<td>10/13</td>
<td>10/13</td>
<td>10/13</td>
<td>10/13</td>
</tr>
<tr>
<td>5A</td>
<td>0.35 0.30</td>
<td>0.60 0.55</td>
<td>NR 0.40</td>
<td>20 or 13+5&quot;</td>
<td>13/17</td>
<td>30&quot;</td>
<td>10/13 15/19</td>
<td>10/13</td>
<td>10/13</td>
<td>15/19</td>
</tr>
</tbody>
</table>

Delete footnotes to Table N1102.1 and replace as follows:

- **R-values are minimums, U-factors and SHGC are maximums.** Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall not be less than the R-value specified in the table.
- **The fenestration U-factor column excludes skylights.** The SHGC column applies to all glazed fenestration.
- “10/13” means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall. “15/19” means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with “15/19” shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.
- R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
- **Reserved**
- **Reserved**
- Alternatively, insulation sufficient to fill the framing cavity and providing not less than an R-value of R-19.
h. The first value is cavity insulation, the second value is continuous insulation, so “13+5” means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section N1102.2.5. The second R-value applies when more than half the insulation is on the interior of the mass wall.

Revise Table N1102.1.2 and footnotes as follows:

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>FENESTRATION U-FACTOR</th>
<th>SKY-LIGHT U-FACTOR</th>
<th>CEILING U-FACTOR</th>
<th>FRAME WALL U-FACTOR</th>
<th>MASS WALL U-FACTOR b</th>
<th>FLOOR U-FACTOR</th>
<th>BASEMENT WALL U-FACTOR d</th>
<th>CRAWL SPACE WALL U-FACTOR c</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 except Marine</td>
<td>0.35 0.32</td>
<td>0.60 0.55</td>
<td>0.030 0.026</td>
<td>0.082 0.060</td>
<td>0.141 0.098</td>
<td>0.047</td>
<td>0.059</td>
<td>0.065</td>
</tr>
<tr>
<td>5 and Marine 4</td>
<td>0.35 0.30</td>
<td>0.60 0.55</td>
<td>0.030 0.026</td>
<td>0.060</td>
<td>0.082</td>
<td>0.033</td>
<td>0.059 0.050</td>
<td>0.066 0.055</td>
</tr>
</tbody>
</table>

a. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.

b. Mass walls shall be in accordance with Section N1102.2.5. Where more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, 0.10 in Zone 4 except Marine, and 0.065 in Zone 5 and the same as the frame wall U-factor in Marine Zone 4 and Zones 5 through 8.

c. Basement wall U-factor of 0.360 in warm humid locations as defined by Figure 301.1 and Table 301.2.

Delete Sections N1102.4.1 “Building thermal envelope” and N1102.4.2 “Air sealing and insulation” and replace with the following:

**N1102.4 Air leakage (Mandatory).** The building thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections N1102.4.1 through N1102.4.5.

**N1102.4.1 Building thermal envelope.** The building thermal envelope shall comply with Sections N1102.4.1.1 and N1102.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

**N1102.4.1.1 Installation.** The components of the building thermal envelope as listed in Table N1102.4.1.1 shall be installed in accordance with the manufacturer’s instructions and the criteria indicated in Table N1102.4.1.1, as applicable to the method of construction. Where required by the building official, an approved third party shall inspect all components and verify compliance.

**N1102.4.1.2 Testing.** The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding five air changes per hour in Climate Zones 1 and 2, and three air changes per hour in Climate Zones 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the building official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test.
and provided to the building official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

Delete Section N1103.2 “Ducts” and replace it with the following:

**N1103.3 Ducts.** Ducts and air handlers shall be in accordance with Sections N1103.3.1 through N1103.3.8.

**N1103.3.1 Insulation (Prescriptive).** Supply and return ducts in attics shall be insulated to a minimum of R-8 for ducts 3 inches (76 mm) in diameter and larger and a minimum of R-6 for ducts smaller than 3 inches (76 mm) in diameter. Supply and return ducts in other portions of the building shall be insulated to a minimum of R-6 for ducts 3 inches (76 mm) in diameter and a minimum of R-4.2 for ducts smaller than 3 inches (76 mm) in diameter.

**Exception:** Ducts or portions thereof located completely inside the building thermal envelope.

**N1103.3.2 Sealing (Mandatory).** Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the International Mechanical Code Section M1601.4.1 or the International Residential Code, as applicable.

**N1103.3.2.1 Sealed air handler.** Air handlers shall have a manufacturer’s designation for an air leakage of no more than 2 percent of the design air flow rate when tested in accordance with ASHRAE 193.

**N1103.3.3 Duct testing (Mandatory).** Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer’s air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer’s air handler enclosure. All registers shall be taped or otherwise sealed during the test.

**Exceptions:**

1. A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.
2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by the party conducting the test and provided to the building official.

N1103.3.4 Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section N1103.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

2. Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

N1103.3.5 Building cavities (Mandatory). Building framing cavities shall not be used as ducts or plenums.

Reason Statement and Fiscal Impact

Indiana’s current residential energy conservation requirements, which are based on Chapter 11 of the 2009 International Residential Code (IRC), have served Indiana homeowners well for several years, and we strongly support maintaining and, wherever possible, improving upon these requirements. Our understanding is that the Residential Code Committee will be considering adoption of the 2018 IRC Chapter 11 in its entirety. This would be the ideal outcome for Indiana homeowners: the improvements made in the 2018 IRC Chapter 11 have been thoroughly analyzed and demonstrated to be cash-flow positive and cost-effective to the homeowner over the useful life of the building. Moreover, a complete adoption of the 2018 IRC Chapter 11 will help create jobs and will help solve several Indiana energy policy issues going forward.

If, however, Indiana does not adopt the full 2018 IRC Chapter 11, we recommend the above “key amendments” package, which will yield a significant portion of the energy and cost savings by improving three important aspects of new homes:

- An improved permanent thermal envelope;
- Whole house air tightness and testing; and
- Duct sealing and testing.

We detail the benefits of adopting the 2018 IRC Chapter 11 below, with additional analysis and support for several “key amendments,” which we have included as a single package in this proposal.

First Principle: No Rollbacks to Current Residential Energy Conservation Standards

We are not aware of any efforts to roll back or eliminate the current energy conservation requirements for residential homes, but it is important to note that Indiana homeowners have benefited significantly from the adoption and implementation of the 2009 IRC Chapter 11, which contains energy conservation requirements for residential buildings. Since 2012, Indiana has been enforcing the 2009 IRC Chapter 11 as part of the Indiana Residential Code, and based on U.S. Census data, we estimate that over that period roughly 70,000 single-family homes have been built to that standard.1 In 2011, the Indiana

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1 See generally U.S. Census, Building Permits Survey, Table 2u, available at https://www.census.gov/construction/bps/.
Department of Homeland Security conducted a Fiscal Analysis on the 2009 IRC Chapter 11 and found that “the cost savings the proposed rule will implement outweigh the increased cost to comply with the proposed rule, by a cost savings in money paid for utility bills and the amount of natural resources that will be saved.”

The Department’s foresight and investment in the future have already saved 70,000 Indiana homeowners thousands of dollars in energy costs and prevented unnecessary waste of Indiana’s natural resources. No matter what changes the Department decides to make to the current Residential Code, we strongly urge the Department not to weaken any of the provisions of Chapter 11.

Benefits of Full 2018 IRC Chapter 11 Adoption

Just as the 2009 IRC served as the national model code for Indiana in 2011, the 2018 IRC represents the latest version of the national model code for residential construction. Although the U.S. Department of Energy has not yet released a complete analysis of the efficiency improvements in the 2018 IRC/IECC, the 2018 IRC/IECC largely improves upon the 2015 IRC/IECC, and by our estimates, will likely further improve cost-effective energy savings. Indiana homeowners will save substantial amounts of energy and money with the full adoption of the 2018 IRC Chapter 11. The U.S. Department of Energy found that owners of homes built to the 2015 IRC/IECC would save, on average, $5,826 over the first 30 years of the home’s useful lifetime, as compared to homes built to Indiana’s current energy code. We estimate that the 2018 IRC/IECC will be a moderate improvement, both in overall energy savings and in energy cost savings for homeowners. The value of this investment for homeowners is clear: these improvements are cash-flow positive in the first year of ownership, and simple payback for the improvements in the 2015 IRC/IECC is 3.8 years. Updating to either the 2015 IRC/IECC or the 2018 IRC/IECC would be a clear winner for Indiana homeowners.

Chapter 11 of the 2018 IRC improves building efficiency at multiple levels. A tighter, better-insulated thermal envelope is required, along with windows and doors that will improve the home’s performance. More efficient duct systems, lighting, and water heating systems will all contribute to a more comfortable, more resilient home. Adopting the 2018 IRC Chapter 11 will benefit Indiana building code officials and builders by allowing them to use the latest code materials and trainings available, including U.S. DOE’s free REScheck software, which is used in the vast majority of states to simplify compliance for builders and to help improve verification for building code officials.

Full adoption of the 2018 IRC Chapter 11 will provide a multitude of additional benefits that are not typically included in simple cost-effectiveness calculations. Homes are often one of the largest investments made by a family, and unlike any other investment, a family actually lives in this investment and experiences the incremental improvements (or lack of improvements) on a daily basis. High energy costs can have a drastic impact on the lives of homeowners: the U.S. Energy Information Administration recently found that nearly 1 in 5 Midwestern households reported having to reduce or forego food or medicine in order to pay home energy costs.

It is critical that decisions made now, such as the levels of insulation, the overall tightness of the building thermal envelope, and the efficiency of doors and windows, be made with an eye toward the homeowner’s lived experience in the home over the lifetime of the home—which could be 70-100 years. Many of these decisions will be made once, at construction, but will impact all future owners and occupants.

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3 See U.S. Department of Energy, Cost-Effectiveness Analysis of the Residential Provisions of the 2015 IECC for Indiana (Feb. 2016). In this document and elsewhere, we use the 2015 IECC and 2015 IRC Chapter 11 interchangeably because the residential energy conservation provisions of the two codes are identical.
4 Id.
5 For more information about REScheck, see https://www.energycodes.gov/rescheck.
for decades. Good energy codes also support good statewide energy policy. More efficient homes will help reduce electric peaks and will help reduce Indiana’s need to build and site additional power plants. These improvements will not only directly benefit the homeowners, but will also help keep electricity costs low for all Indiana ratepayers.

**Key Amendments Package**

If Indiana determines that it is not ready to adopt the complete 2018 IRC Chapter 11, we recommend at least adopting the three groups of amendments included in the proposal above: (1) an improved permanent thermal envelope, including improved insulation specifications and fenestration U-factors; (2) whole house air tightness and testing; and (3) duct sealing and testing. These improvements capture the largest share of long-term energy savings in the 2018 IRC, and they are all improvements that are best implemented at construction. In support of these improvements, we offer the following:

- **Improved Insulation Specifications**

  The most cost-effective time to properly insulate a home is when it is built. A small investment today in insulation will pay solid dividends over the entire useful life of a residential building. The 2018 IRC makes homes more affordable and more comfortable by improving insulation levels in floors, walls, ceilings, and basements in one or both of Indiana’s climate zones. These insulation upgrades are a critical first step toward building modern, affordable homes that will provide benefits to homeowners over the home’s useful life.

  The insulation levels of the 2018 IRC are well within the range of what the U.S. Department of Energy found to be cost-effective for Indiana’s climate zones. We conducted an additional simple analysis of the wall and ceiling insulation requirements in Indiana’s climate zones, using the DOE Residential Code Change Methodology for a single-family home, and confirmed that the 2018 IRC insulation requirements are indeed cost-effective to the consumer. Figure 1 shows the changes in wall insulation in climate zone 4 and ceiling insulation in climate zones 4 and 5 that would result from the adoption of the 2018 IRC.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Wall Cavity R-value</th>
<th>Ceiling R-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Upgrade</td>
</tr>
<tr>
<td>CZ 4</td>
<td>R-13</td>
<td>R-20 or 13+5</td>
</tr>
<tr>
<td>CZ 5</td>
<td>R-20 or 13+5</td>
<td>R-38</td>
</tr>
</tbody>
</table>

*Figure 1: 2015 IRC insulation upgrades for walls and ceilings in Climate Zones 4 and 5*

Using actual costs from retailers in these climate zones, we found that homeowners completely recoup the first costs of these improvements within a reasonable period. More importantly, over a 30-year period, homeowners stand to save $731 or $4,464, depending on climate zone. See Figure 2 below for a summary of the results of the analysis.

| Simple Payback Analysis | Life Cycle Analysis |

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8 For simplification, R-20 was specified for wall insulation in both climate zones in this analysis.
9 Assumptions for this analysis, which was performed using U.S. DOE EnergyPlus software, include Current EIA energy prices for Indiana: 0.1205 $/kWh and $15.98 MCF/gas.
Zone | Marginal Upgrade Cost | Measure Life | Annual Energy Savings | Simple Payback (Years) | Present Value Costs | Present Value Benefits | 30 Year Homeowner Savings
--- | --- | --- | --- | --- | --- | --- | ---
CZ 4 Evansville | $936 | 30 | $121 | 7.7 | $2,119 | $6,583 | $4,464
CZ 5 Indianapolis | $182 | 30 | $21 | 8.7 | $413 | $1,143 | $731

*Figure 2: Analysis of energy and cost savings for wall and ceiling insulation improvements in 2015 IRC*

We note that these assumptions are very conservative, and we expect the energy and cost savings to be significantly higher than this simple analysis shows. Retail costs for building materials typically come down as code requirements are implemented in a state or as builders buy in bulk. And although a 30-year useful life was specified for this analysis, wall and ceiling insulation typically lasts for 70-100 years, which means homeowners will continue to reap the savings of these improvements for decades.

We also note that the wall insulation values in the 2015 IRC maintain the flexibility for builders to use a variety of framing techniques (2X4 or 2X6), as well as cavity-only or hybrid insulation systems. This will provide builders with multiple options to achieve maximum value for homeowners and to select the insulation option most appropriate for the climate zone and home design. Given that insulation is usually a one-time decision made at construction, we urge the Department to meet or exceed the cost-effective insulation levels set in the 2015 IRC.

- **Improved Fenestration U-Factor**

  Lower fenestration U-factors will improve comfort and reduce energy costs for homeowners. The 2018 IRC improves fenestration U-factors by roughly 9-14%, depending on climate zone, which we expect will cost little or nothing to Indiana homebuilders. In fact, recent analyses show that Indiana homebuilders are already routinely exceeding the requirements of the 2018 IRC. The Midwest Energy Efficiency Alliance recently worked with RESNET to collect data on roughly half of all single-family homes built in Indiana from 2014-2016 (20,446 homes). The data show that 84% of the windows being installed in these homes meet a 0.32 U-factor and that almost half of the windows installed meet a 0.30 U-factor. Figure 3 shows a summary of the results.10

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Lower fenestration U-factors have wide support among industry groups. In fact, the improvements in fenestration U-factors in the 2018 IRC are the result of a proposal submitted by the National Association of Homebuilders; that proposal was approved and is incorporated into Table N1102.1.2 of the 2018 IRC. Figure 4 compares the fenestration U-factors in the 2009 and 2018 editions of the IRC.

<table>
<thead>
<tr>
<th>Zone</th>
<th>2009 IRC</th>
<th>2018 IRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.35</td>
<td>0.32</td>
</tr>
<tr>
<td>5</td>
<td>0.35</td>
<td>0.30</td>
</tr>
</tbody>
</table>

The U.S. Department of Energy found the fenestration U-factor improvements to be cost-effective to the consumer. Life cycle cost savings from the 2018 fenestration U-factors alone are expected to be $134.43 in climate zone 4 and $128.89 in climate zone 5. This is a significant payback for an improvement that will cost very little (or which may already be incorporated into current home designs).

- **Improved Whole House Air Tightness and Testing**

  The 2018 IRC requires each new home to be properly sealed and tested to a reasonable level of air leakage. Although the 2009 IRC allowed air leakage testing as an alternative to visual inspection, the 2018 IRC requires that every home be verified, through an objective air leakage test, to perform at expected levels. Air leakage testing is critical not only to keep energy costs low, but also to determine when to add mechanical ventilation to ensure proper air exchange for the home’s occupants. Modern construction

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practices have improved building air tightness, and most builders and energy raters understand the techniques involved in achieving air tightness at the level prescribed by the 2018 IRC (3 ACH50).

MEEA’s analysis of RESNET data from Indiana homes built in 2014-16 again showed that homebuilders are already meeting or exceeding the 2018 IRC requirement in many cases. Even though air leakage testing is optional in Indiana, and tested homes need only achieve a 7 ACH50, **77% of the homes included in MEEA’s analysis achieved 4 ACH50 or better, and 45% achieved 3 ACH50 or better – the full requirement in the 2015 IRC.** Figure 5 below provides a summary of the results.¹²

**Proper sealing of the building thermal envelope is a process that can be learned and repeated with a minimal amount of training.** Our experience in the field has been that once builders and tradespeople learn the techniques for proper air sealing, building quality improves going forward. We have also found that the cost of a blower door test is relatively low in comparison to the benefits, and the IRC permits self-testing by the builder or subcontractor. This is an incremental improvement on the front-end of construction that will yield huge benefits in comfort, HVAC system operation, reduced energy costs, and improved home health over the long-term.

- **Improved Duct Sealing and Testing**

Indiana currently requires duct systems to be tested in every new home unless all ducts and the air handler are located completely inside conditioned space.¹³ This is a good policy; according to the U.S. Department of Energy, the duct tightness requirement in the 2009 IRC saves roughly 12% in total heating

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¹² U.S. DOE’s recent field study results showed that air tightness is generally improving across the country, but is improving the most in states that require homes to test to 3 ACH50 or less, such as Maryland. See U.S. Department of Energy, Single Family Residential Energy Code Field Study at 48 (Dec. 7, 2015), available at https://www.energycodes.gov/sites/default/files/documents/Field_Study_120715_Final.pdf.

¹³ See IRC Section N1103.2.2.
and cooling energy use, as compared to a code with no testing requirement. The 2018 IRC further improves this requirement by tightening the allowable level of duct leakage from 8 cfm per 100 ft.\(^2\) at post-construction (or 6 cfm at rough-in) to 4cfm per 100 ft.\(^2\) at either rough-in or post-construction. The exception for ducts and air handler located in conditioned space is carried forward into the 2018 IRC. This requirement and exception create an incentive for builders to place all HVAC equipment and ductwork inside conditioned space, which is by far the most efficient setup for a home. Indeed, 12% of the homes that received HERS ratings in Indiana between 2014 and 2016 placed all ducts and air handlers inside conditioned space, and homes like this would continue to be exempt if Indiana adopts the full 2018 IRC. But where such design is not possible, ducts must be sealed and designed to leak as little as possible.

Duct tightness is important for several reasons. First, it saves energy and saves homeowners money. Second, tighter ducts are better able to deliver conditioned air to occupied spaces, thus keeping a home more comfortable (and making occupants less likely to adjust the thermostat to compensate). Third, tighter ducts can improve indoor air quality and promote safety by reducing backdrafting. As with air leakage, our experience has been that once proper duct sealing techniques are learned, they are easy and cost-effective to repeat. DOE’s 2015 Field Study data showed that homes in states with tighter requirements for duct leakage (e.g., 6 cfm in NC and 4 cfm in MD) achieved better results.

**Conclusion**

We urge Indiana to build upon the improvements made with the adoption of the 2009 IRC by adopting the 2018 IRC Chapter 11 or, at a minimum, adopting our package of key amendments outlined above. A reasonable investment in efficient homes today will yield a multitude of benefits for homeowners for decades to come.

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