Ohio Gap Analysis

September 2014

Prepared by the Building Codes Assistance Project for the Ohio Development Services Agency’s Office of Energy and Redevelopment with funding from US Department of Energy’s Annual State Energy Program
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ACRONYMS AND ABBREVIATIONS

AIA – American Institute of Architects
ASHRAE – American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BCAP – Building Codes Assistance Project
BBS - Ohio Board of Building Standards
CEU – Continuing Education Unit
CPA - Compliance Planning Assistance
CSI - Common Sense Initiative
DOE – Department of Energy
ECAP – Energy Code Ambassadors Program
EECBG – Energy Efficiency and Conservation Block Grants
EERS - Energy Efficiency Resource Standard
EPA – U.S. Environmental Protection Agency
ESCO - Energy Service Company
HERS – Home Energy Rating System
IBC – International Building Code
ICC – International Code Council
IECC – International Energy Conservation Code
IOU – Investor Owned Utilities
IRC – International Residential Code
JCARR – Joint Committee on Agency Rule Review
LEED – Leadership in Energy and Environmental Design
NAAB – National Architectural Accrediting Board
OBC – Ohio Building Code
ODOC- Ohio Department of Commerce
OCEAN – Online Code Environment and Advocacy Network
OCILB – Ohio Construction Industry Licensing Board
OHBA – Ohio Home Builders Association
OFCC – Ohio Facilities Construction Commission
RCAC – Residential Construction Advisory Committee
RCO – Residential Code of Ohio
RESNET – Residential Energy Services Network
SEP – State Energy Program
USGBC – U.S. Green Building Council
EXECUTIVE SUMMARY

This Ohio Gap Analysis Report was prepared as part of the BCAP Compliance Planning Assistance Program.

The purpose of this report is twofold: 1) to document and analyze the unique strengths and weaknesses of the state’s existing building energy code adoption and implementation infrastructure and policies; and 2) to recommend actions that state agencies, local jurisdictions, and other stakeholders can take to support and encourage local jurisdictions to adopt, enforce, and improve compliance with model energy codes. The report also details some of the state’s current best practices and offers Ohio-specific recommendations for actions that would improve the energy-efficiency of its built environment.

This report is an updated review of the original Ohio Gap Analysis report, published in 2010 with funding from the United States Department of Energy. Since that time, Ohio has updated its building codes from 2006 versions to 2009 versions. This report documents the current strengths, weaknesses, and opportunities for improvement in Ohio’s energy code adoption and implementation infrastructure. The report is organized into these sections: National Perspective on Energy Codes, State Overview, Adoption, Enforcement, and Implementation.

The National Perspective on Energy Codes section provides a background on the national code development process, and a map showing the status of energy code adoptions across the U.S. Two underlying national policies that influence state energy codes are described: the Energy Policy Act of 1992 and the Recovery Act of 2009. The Recovery Act obligated states to ensure compliance with energy codes by the year 2017. This report is a first step in determining the critical actions necessary to improve energy code compliance now and into the future.

As preparation for the rest of the report, the State Overview section provides important background information on Ohio’s population, energy resource production and consumption, and an overview of both commercial and residential construction. While the housing crisis of 2007-2009 was a major hit to the construction industry in Ohio, demand for new homes and buildings is beginning to increase.

The Adoption section details the process and stakeholders involved in adopting new building energy codes in Ohio, which are a part of the Ohio Building Code (OBC) for commercial buildings, and the Residential Code of Ohio (RCO). It includes an overview of the standards for state-funded buildings, including successful state-administered programs that have made Ohio the leading state in the country for Leadership in Energy and Environmental Design (LEED) certified schools, and are saving the state more than $6 million annually in reduced energy bills.

The Enforcement section details important differences in how the OBC and RCO are enforced in Ohio. Ohio law requires that all commercial construction in Ohio has oversight by either local or state code officials, to ensure that buildings are safe and energy efficient. However, enforcement of residential construction codes is woefully inadequate, leaving homeowners in 66 of Ohio’s 88 counties without any oversight of the basic requirements that assure healthy, safe and energy efficient dwellings. This section
includes maps and data that visually showcase where residential enforcement is lacking. Also included are insights garnered from numerous interviews with local building department code officials.

The Implementation section covers the ways in which state and local agencies, the design and construction industries, utilities, and other stakeholders work to promote the adopted energy codes, establish efficient, feasible, and cost-effective enforcement and compliance infrastructures, and prepare code officials and building professionals to carry out their responsibilities. Ohio is need of a statewide code compliance study to determine current actual compliance, and identify training and other needs by local jurisdictions.

The report’s Conclusion includes a summary of the key opportunities and recommendations for improving energy code compliance in Ohio. Finally, each of the Gaps and Recommendations from this report are provided in a table.
A large amount of energy is used to power and maintain buildings, which account for nearly 49 percent of total energy consumption and 72 percent of electricity use in the United States. Buildings are also responsible for at least 56 percent of U.S. greenhouse gas emissions.

Building energy codes establish minimum levels of energy efficiency for residential and non-residential buildings. Energy codes improve the energy efficiency of buildings by requiring specifications for components of a building such as wall, ceiling, and foundation insulation, windows and doors, heating, ventilation and air conditioning (HVAC), lighting, and more. Buildings last a long time -- today’s building energy policies will affect energy consumption through 2060 and beyond.

Ohio spends about $50 billion annually on energy, which is nearly ten percent of its gross domestic product. The money Ohio spends to import energy from outside of its borders is money exported from the state’s economy. Energy codes protect citizens from high energy costs and allow residents and businesses to keep more of their money, improving the economy. Energy efficient homes and buildings protect owners from high energy bills and are more comfortable to live and work in.

Some claim that energy codes will result in higher upfront building costs or that an energy-efficient building or home is too costly. However, there are two costs that should always be considered when purchasing a building:

1. The upfront (first) cost; and
2. The long-term (operational) cost over the life of the building, which includes:
   - Design and construction costs for buildings: five to ten percent of the total occupant spending.
   - Ongoing operation and maintenance costs: 60 to 85 percent of the total lifecycle costs.
   - Land acquisition, conceptual planning, renewal or revitalization, and disposal: five to 35 percent.

When these costs are considered from the beginning of a construction project, energy codes prove advantageous. The benefits of energy code compliance include:

1. Saves homeowners and businesses hundreds or thousands of dollars each year.
2. Enhances the competitiveness of Ohio’s businesses that experience lower energy bills, which may reduce the risk of a company relocating out of state to reduce costs; also may preserve jobs.
3. Helps keep energy rates low by allowing utilities to defer costly investments in new generation power plants and new transmission and distribution infrastructures.
4. Decreases a utility’s peak energy demand, which also decreases the stress on Ohio’s aging transmission and distribution infrastructure; helping to avoid blackouts or other power grid failures.
5. Reduces greenhouse gas emissions, air and water pollution caused by the combustion of fossil-fuels; also reduces the associated human health impacts caused by such pollution.
6. Improves indoor air quality, indoor comfort, reduces noise, and improves the quality of construction.
• Reduces demand for imported energy, maintaining more dollars in-state and improving local economies.

Recent improvements in the stringency of the model energy codes—and the development of the first green building codes—continue to raise the bar for energy-efficient design and construction to levels that were almost unimaginable a few years ago. Retail and office buildings constructed to meet the requirements of the 2012 International Energy Conservation Code (IECC) can be at least 15 percent more energy-efficient than those constructed to meet the 2009 IECC.\(^6\)

The American Recovery and Reinvestment Act of 2009 (Recovery Act) provided states and cities with unprecedented funding and incentives to adopt the 2009 IECC. This assistance from the federal government is part of a larger transformation in the way advocates, policymakers, industry and utility representatives, and the general public view energy efficiency. Today, energy codes are increasingly perceived as a viable and cost-effective component of a comprehensive solution to our current economic, environmental, and energy concerns.

Despite the recent progress, in municipalities across the country, energy code enforcement and compliance remain insufficient. While code development and adoption are the necessary first steps of the energy codes process, they do not guarantee compliance. To ensure that energy codes deliver what they are designed to, states and cities must design and carry out effective and realistic energy code implementation strategies.

The goals of this report are to:

• Document Ohio’s energy codes infrastructure, existing gaps, and best practices; and
• Provide the initial recommendations for actions the state, local jurisdictions and involved third party organizations can take to fill these gaps and begin to move towards full compliance with the adopted codes in Ohio.

The original version of this report was funded by the U.S. Department of Energy, and was part of BCAP’s Compliance Planning Assistance (CPA) program to improve energy code compliance in states. The CPA program analyzes the gaps in a state’s existing energy code infrastructure and provides recommendations for improvement. The first phase of CPA is the Gap Analysis Report, which identifies barriers to successful energy code adoption and implementation, opportunities for improvement, available resources, key stakeholders and potential partnerships. The second phase of CPA is the Strategic Compliance Plan, which provides a plan for implementing the recommendations from the Gap Analysis report to improve energy code compliance longer-term.

During the original composition of this report, BCAP interviewed building officials from multiple local building departments representing various sized communities in Ohio, including: three large cities – Columbus, Cleveland, and Cincinnati; two medium-sized cities – Canton and Toledo; two small cities – Grove City and Willoughby; two rural counties – Wayne and Ashtabula; and one metropolitan county – Montgomery. For this updated report, the top six fastest growing counties (Delaware, Warren, Union, Fairfield, Licking, and Medina) and incorporated jurisdictions within each county were interviewed for insights about the implementation of Ohio’s updated energy code. In addition, the counties of Franklin and Athens were also interviewed.
This report contains the consolidated insights and recommendations from numerous experts, state officials, and code officials working in the trenches to ensure safe, healthy, energy efficient buildings are Ohio’s future.
NATIONAL PERSPECTIVE ON ENERGY CODES

The IECC and ASHRAE Standard 90.1 are developed and published every three years by consensus-based non-governmental organizations: the International Code Council (ICC) and the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), respectively. While there is no federally-mandated minimum standard for energy efficiency in private residential or commercial buildings, both organizations release national model codes every three years. States that want to ensure that construction within their boundaries meets national minimum standards typically use these codes as a model for the building codes they adopt for residential and commercial buildings. The most recently developed model codes are the ASHRAE Standard 90.1-2013 and the 2015 IECC.

State and local government representatives and others impacted by building codes may voluntarily participate in the code development process. Ohio Board of Building staff has participated in this process, but future participation is dependent on funding.

STATE CODE STATUS

Figure 1: Code Status Maps shows the status of residential and commercial energy code adoptions as of September 1, 2014 and is summarized here.

Residential Energy Codes

As of September 1, 2014, 39 states and U.S. territories have residential codes that meet or exceed the efficiency of the 2009 IECC. To date, 11 states and the District of Columbia have implemented the 2012 IECC. Dozens of local jurisdictions across the nation have also adopted the 2012 IECC, and others are pending.

Commercial Energy Codes

As of September 1, 2014, 44 states and U.S. territories have mandatory statewide commercial energy codes in effect that meet or exceed the efficiency of ASHRAE Standard 90.1-2007. Fourteen states, the District of Columbia, and dozens of local jurisdictions have already implemented a commercial energy code that meets or exceeds ASHRAE Standard 90.1-2010, and others are pending.
Although energy code adoption occurs on the state and local levels, the federal government—through Congress and United States Department of Energy (DOE)—has played a significant role in advancing energy code development, determining the relative energy savings of national model energy codes and supporting state- and local-level adoption and implementation.
The Energy Policy Act (EPAct) of 1992 requires DOE to determine whether the most current model energy codes would improve energy-efficiency for residential and commercial buildings. It also mandates that DOE make a new determination within twelve months for every subsequent revision of these codes. Each state then has two years to certify that it has revised its own energy code to meet or exceed the requirements of the latest edition of the national models. A state can decline to adopt a residential energy code by submitting a statement to the Secretary of the DOE detailing its reasons for doing so.\(^7\)

For commercial buildings, DOE issued a positive determination in October 2011 that ASHRAE Standard 90.1-2010 would achieve greater energy-efficiency in buildings subject to the standard than if they were built to ASHRAE Standard 90.1-2007.\(^8\) For low-rise residential buildings, DOE issued a final determination in May 2012 that the 2012 IECC would achieve greater energy-efficiency in buildings subject to the code than if they were built to the 2009 IECC.\(^9\)

In May 2013, DOE transmitted letters to all 50 state executives, reminding states of their obligations under EPAct to certify that they have reviewed and updated their energy codes within two years of DOE's positive determination or request an extension.\(^10\)

### THE RECOVERY ACT

In 2009, Congress passed the American Recovery and Reinvestment Act (Recovery Act), which provided states with stimulus funds through the State Energy Program (SEP) and the Energy Efficiency and Conservation Block Grant (EECBG) Program. Accepting Recovery Act funding obligated states to: (1) adopt the 2009 IECC or equivalent for residential construction and the ASHRAE Standard 90.1-2007 or equivalent for commercial construction; and (2) to achieve at least 90 percent compliance with these codes by 2017.\(^11\) In a letter dated March 9, 2009, then-Governor Ted Strickland accepted $96,083,000 million in Recovery Act funding and an additional $24,979,600 EECBG formula grant, a portion of which went to the state’s energy office within the then-Ohio Department of Development (ODOD) for investments in various residential and commercial energy-efficiency projects and other purposes.\(^1\) In his letter, Governor Strickland assured DOE that Ohio would begin actions to: 1) update the code to the 2009 IECC or an equivalent code, and 2) achieve 90% compliance with these codes by 2017.\(^12\)

### STATE OVERVIEW

\(^1\) Note, the ODOD has since been renamed the Ohio Development Services Agency’s Office of Energy and Redevelopment (OER) and is currently (as of September 30, 2014) considering another name change - therefore it is referred to as the “Ohio energy office” in this report.
Ohio is the seventh most populated state, with 11.5 million people. The almost 41,000 square mile state has a population density of 282.3 persons per square mile (PPSM), which is higher than the national average of 87.4 PPSM. Ohio’s population grew more slowly than the national average between 2010 and 2013, at 0.03 percent, compared to the national growth of 0.74 percent. The capital city of Columbus is the largest city, with more than 800,000 residents; it was the 15th largest city in the U.S. according to the U.S. Census Bureau statistics for 2010. There are more than five million housing units in Ohio. Per capita personal income is fairly low (ranked 30th in the nation), and the cost of energy is a concern in Ohio. Like much of the Midwest, Ohio experiences the temperature extremes of cold, snowy winters and hot, humid summers.

**Figure 2: Ohio Population Map**

![Ohio Population Map](image)

**ENERGY PORTFOLIO**

**Production**

Ohio is a moderate energy producer, and ranks 20th in the nation in terms of production. Ohio was the eighth most electricity-producing state in the nation in 2012, but because its electricity generation does not meet demand, Ohio is a net recipient of electricity from outside its borders.

Ohio’s energy resources are primarily coal from the Appalachian Basin in the eastern part of the state (which provides less than one-third of its consumption); and two nuclear plants along Lake Erie. Offshore wind resources from Lake Erie are classified as having very high energy potential. Ohio’s consumption of natural gas is high, especially in the residential and industrial sectors, although the state’s production has typically only provided less than one-tenth of demand.

**Consumption**

The majority of Ohio’s energy consumption is for heating, cooling, and powering residential and commercial buildings and for industrial purposes. Ohio is among the top 10 energy states in total energy consumption due to its large population, variable climate, and heavy industry. In 2011, Ohio
ranked fifth in the nation for industrial sector energy consumption; output from its factories accounted for 17% of the state’s gross domestic product (GDP).  

The residential sector accounts for more than two-thirds of Ohio’s natural gas consumption as it is the primary energy source for home heating. As shown in the graph below, the industrial sector dominates energy consumption, although the residential and commercial sectors combined consume more.

Figure 3: Ohio Energy Consumption by End-Use Sector, 2011

Sources
Ohio is the third most coal-consuming state in the nation following Texas and Indiana. In 2013, about 69 percent of the electricity generated in the state was derived from coal; natural gas contributed 15%; nuclear energy 12%. There are numerous coal mines in the state, but Ohio uses almost twice as much coal as is produced in-state. As a result of Ohio’s intensive use of coal, the state has the fourth highest carbon dioxide emissions in the country.

CONSTRUCTION OVERVIEW

Like most states, as a result of a mortgage industry crisis in 2007-2009, new construction slowed significantly. Even before the mortgage industry crisis, Ohio had begun to experience a decline in residential building permits and a decrease in commercial development. The considerable drop in demand for new buildings and homes over the past decade has caused some builders to leave the business. Those remaining may be more interested in gaining a competitive edge in the market by learning new approaches that will allow them to market their homes or buildings as having lower energy bills and lower environmental impacts. A sign that this may already be happening is that the market penetration of ENERGY STAR certified new homes in Ohio achieved 23 percent in 2012, one of the top 18 states with an ENERGY STAR Certified New Homes Market Index.
Total square footage of new commercial construction in Ohio slowed overall between 2002 and 2012 as shown in the following graph. In 2012, new commercial construction in Ohio amounted 20,971,932 square feet.

**Figure 4: New Commercial Construction 2002-2012**

![Graph showing new commercial construction from 2002 to 2012](image)

By 2009, local jurisdictions issued far fewer permits than in 2004, as shown in Figure 5: 1- and 2-unit Residential Building Permits 2000-2013, Ohio. However, U.S. Census Bureau data shows that the number of residential building permits increased from 16,905 permits issued in 2012 to 20,543 permits in 2013.
EXISTING BUILDINGS

While there were about 13,000 new homes built in Ohio in 2013, there are 5,128,619 existing housing units in the state. The amount of remodeling, additions and alterations to existing housing and buildings is unknown, as permit data for such alterations is not captured at the state level, nor by the US Census Bureau. According to the National Association of the Remodeling Industry (NARI) in Westerville, Ohio, permitting data for existing structures can only be obtained by contacting each building department individually; NARI does not have data on existing building permits in Ohio. However, we know that remodeling happens - the Joint Center for Housing Studies of Harvard University estimates that spending on home improvements increased about 9 percent in 2012 (nationally). Expenditures for home improvements and repairs represented 1.8 percent of GDP in 2011, exceeding the amount spent on single- and multifamily home construction. The U.S. Census Bureau estimates that by 2030, the “baby boomer” population will be aged 65 and older. The near-term growth of this aging population is likely to result in increased demand for retrofitting existing homes to enable people to age in place.

Gap #1: Permit data for major remodels, alterations and/or additions in existing homes and buildings is not available; nor is data such as the amount of investment (compared to new buildings/homes for example).

Recommendation: The Board of Building Standards could add a section to its annual survey of local building departments to capture the number of permits given for major remodels or additions, which
would help the state begin to assess the need for training for remodeling of existing homes and buildings.

**ADOPTION**

The process of adopting building codes differs from state to state. Typically codes are adopted through a legislative process, a regulatory process, or a combination of both. A few states are considered “home rule” and allow codes to be adopted at the local rather than state level.

**OHIO’S ADOPTION PROCESS**

Since 1955, within the Ohio Department of Commerce (ODOC), the Ohio Board of Building Standards (BBS) is comprised of fifteen individuals appointed by the Governor and confirmed by the Senate. The BBS is responsible for adopting and administering Ohio’s building codes. It is authorized to formulate, adopt, and amend non-residential building codes for the state; until the year 2006, there was no building code adopted for residential dwellings at the state level.

The Residential Construction Advisory Committee (RCAC) was created in 2005, when House Bill 175 was signed into law. The RCAC is comprised of nine members experienced in residential construction and appointed by the Director of the Department of Commerce. (see Appendix A for Ohio Revised Code, section 3781.07 “Organization of the Board”, and section 4740.14 of the Ohio Revised Code “Residential Construction Advisory Committee – Recommendation of Residential Building Code”). The intent of the RCAC is to provide the construction industry’s input into the code adoption process to assure that building codes are feasible and realistic. In 2006, the BBS worked with the RCAC to adopt the first statewide residential building energy code, which was based on the 2006 IECC. The Director of Commerce works with the Ohio Home Builders Association, the Ohio Fire Chiefs Association, and the Ohio Building Officials Association (and others) to appoint specific individuals to the RCAC.

The ODOC has had experience working with similar committees, which typically provide helpful insight to the agency. However in practice, the RCAC operates differently than other ODOC committees, such that no changes can be made to the residential building code without participation from the RCAC. The process for adopting or amending building codes is as follows:

1. To request change to the Residential Code of Ohio, anyone may petition either the BBS or the RCAC for a rule change, or the BBS or RCAC may recommend their own.

2. The BBS works with the RCAC to determine if such a rule change is beneficial. Both the BBS and RCAC must agree upon the proposed rule change language.

3. BBS solicits input from stakeholders through personal and electronic outreach. Stakeholder input is reviewed by BBS and any amendments must be agreed upon by both BBS and RCAC.

4. Rules agreed upon by both the BBS and RCAC are then filed with the Common Sense Initiative (CSI) within the Lieutenant Governor’s Office. The CSI vets the proposed rule change to assure that it will not adversely impact Ohio businesses.
5. If approved by the CSI, the BBS then files the rules with the Secretary of State, the Legislative Service Commission, and a committee of the General Assembly known as the Joint Committee on Agency Rule Review (JCARR) at least 60 days prior to adoption. The JCARR is comprised of five State Representatives and five State Senators who review proposed rules to ensure they do not exceed the rule-making authority granted to them by the General Assembly.

6. If approved by JCARR, the Board acts to adopt rule amendments and sets an effective date. The rule is then final-filed with JCARR and the Legislative Service Commission.

As statewide minimum construction codes, all residential and commercial construction in all jurisdictions in Ohio must comply with the codes as promulgated by the BBS. Cities are not permitted to adopt regulations that conflict with the regulations adopted by the BBS; as determined by the BBS on a case-by-case basis. For residential building regulations, local governments are not permitted to adopt a regulation of the same subject matter as is already in the state building code; this restricts local governments from adopting a code different from the state adopted residential building code.

The state does not offer local jurisdictions the option of adopting a stretch code—which is a state-adopted alternative to the minimum state-mandated code. A stretch energy code is a voluntary appendix to a mandatory statewide minimum energy code that allows municipalities to adopt a uniform beyond-code option to achieve greater levels of energy efficiency. Stretch codes pull the construction market forward, priming the construction industry for changes that could well be part of the next update for the state baseline energy code. A stretch code also provides consistency for the construction sector because the stretch code is developed through the same public process as other statewide codes. Rather than the state having to develop an entirely separate second code, the stretch code can simply be based on a third-party standard such as Energy Star, or it may be the next model code version (e.g. the 2012 IECC). A stretch code helps ease the transition to new codes by familiarizing the marketplace, while allowing local jurisdictions the ability to stay current with the latest codes as they are developed.

In 2009, the RCAC initially opposed the adoption of the 2009 IECC, mainly due to concerns about the additional costs to builders associated with the code. After negotiating with proponents of the 2009 IECC, a compromise was reached, allowing home builders two additional alternative compliance paths; both deemed to be as energy-efficient as the 2009 IECC.

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ii Of course, building owners may choose to build a more efficient building than required by code, and cities may choose to build their own public buildings at a higher level.
Many states have an automatic code review cycle as new codes are published at the national level and this is considered a best practice. Ohio does not have an automatic code update process cycle for adopting new codes. According to the Ohio Home Builders Association’s Legislative Review, February 27, 2014, the RCAC has “agreed that a three-year code cycle update is not appropriate for Ohio”. Although this appears to be the prevailing sentiment in Ohio, it’s still considered a best practice to review codes every three years as they are published to keep up with current technological and construction practices.

**Gap #2: The state does not have an automatic energy code review process on a three-year cycle.**

**Recommendation:** The BBS should consider adopting an automatic review process for future iterations of the model energy code to lock in future energy savings after the release of each new model energy code.

**GAP #3: The RCAC appears to lack representation from those impacted by new energy codes, such as consumer and environmental advocates.** The RCAC could also benefit from expertise of building scientists who should be part of the conversation when considering the details of a new residential building code.

**Recommendation:** In addition to the specific statutorily-required sectors represented on the RCAC (see Appendix A: Excerpts from Ohio Revised Code), appointed individuals should represent other stakeholder groups besides the construction industry, such as environmental and consumer protection groups. Such appointees to the RCAC may be sought from universities, building science related organizations, Energy Code Ambassador Program, or the Ohio Consumer’s Council, Energy Star builders, and home energy raters.

**POTENTIAL ENERGY SAVINGS**

Many state and local governments do not have reliable, unbiased information on the cost-effectiveness of adopting a new energy code via an analysis of the upfront incremental cost for the updated provisions in the code, and the resulting energy cost savings. Builders that oppose updating energy codes may present elected officials with inflated numbers of the upfront costs and argue that the new code are too expensive, without taking into account that the reduced monthly energy bills often offset the slightly higher purchase price of the home. To address concerns about the costs that home builders (and ultimately home buyers) will face, it is helpful to compare the incremental cost associated with building to a higher code to the anticipated energy cost savings such improvements will yield over time. Reliable information empowers consumers to make smart decisions.

DOE has provided analyses to help states assess the cost-effectiveness of adopting residential energy codes. DOE’s cost analysis for Ohio includes the estimated incremental construction costs for complying with the 2012 IECC and the resulting energy bill savings, as compared to the 2009 IECC. Its analysis for
Ohio shows that the 2012 IECC average life-cycle cost savings\(^{iii}\) over 30 years would be $5,151.\(^{35}\) The data shows that homebuyers in Ohio would save an average of $330 per year, and that the initial investment would be paid off in 4.5 years.\(^{iv}\)

Figure 6: U.S. Department of Energy’s Residential 2012 IECC Cost Analysis

<table>
<thead>
<tr>
<th>Table A.6. Total Construction Cost Increase for the 2012 IECC Compared to the 2009 IECC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 4</td>
</tr>
<tr>
<td>Slab, Unheated Basement, or Crawlspace</td>
</tr>
<tr>
<td>2,400 ft(^2) House</td>
</tr>
<tr>
<td>Heated Basement</td>
</tr>
<tr>
<td>Zone 4</td>
</tr>
<tr>
<td>Zone 5</td>
</tr>
</tbody>
</table>

Table A.7. Life-Cycle Cost Savings Compared to the 2009 IECC

<table>
<thead>
<tr>
<th>Code</th>
<th>Zone 4</th>
<th>Zone 5</th>
<th>State Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012 IECC</td>
<td>$6,209</td>
<td>$5,044</td>
<td>$5,151</td>
</tr>
</tbody>
</table>

Two resources developed by BCAP help policymakers assess the impacts on energy code adoption and compliance both on the individual homeowner level and on the macro state level:

1. **BCAP's Incremental Cost Analyses**\(^{v}\) for both the 2009 IECC and the 2012 IECC, as amortized within a homebuyer’s mortgage is available for select states and cities for both the 2009 IECC and the 2012 IECC. This resource helps explain how the incremental construction costs added by updated energy codes are amortized within a homebuyer’s mortgage and return thousands of dollars in profits over a typical mortgage term\(^{vi}\) (see Appendix D: Cost Analysis).

2. **Fact Sheet: Potential Savings from Energy Codes** provides a statewide estimate of the energy, utility cost, and carbon emissions savings via implementation of updated residential and commercial energy codes over the next three decades (see Appendix E: Fact Sheets)

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\(^{iii}\) A life-cycle cost is full accounting over a 30-year period, considering: energy savings, the initial investment financed through increased mortgage costs, tax impacts, and residual values of energy-efficiency measures.


The Potential Impact of full compliance with 2009 Energy Codes. To illustrate the significant benefits energy codes provide for Ohio households and businesses, BCAP used its proprietary Codes Calculator to compare a “business-as-usual” baseline scenario to two target scenarios:

- Increased compliance with the current state code based on the 2009 IECC
- Adoption of the 2012 IECC statewide with increased compliance.

**STAKEHOLDERS**

In Ohio, the main stakeholders involved in energy codes are as follows:

**The ODOC’s Board of Building Standards (BBS)**-see “Ohio’s Adoption Process”.

**The ODOC’s Residential Codes Advisory Committee (RCAC)** see “Ohio’s Adoption Process”.

**The Ohio energy office** works to grow Ohio’s economy by connecting companies and communities to financial and technical resources to increase efficiency and deploy advanced energy technologies. The Ohio energy office is designated as the state’s energy office by the State of Ohio and the U.S. Department of Energy, and is responsible for administering U.S. Department of Energy funding allocated to the state and for carrying out requirements in the Energy Policy Act.

**Ohio Building Officials’ Association (OBOA)** membership includes about 1,500 building officials, building inspectors, architects, engineers, fire officials, and contractors. OBOA worked with BBS to help create code official certification standards, local department collection fees supporting BBS educational resources, and a uniform residential code that eventually became the RCO. There are seven regional OBOA chapters in Ohio.

**The Ohio Home Builders Association (OHBA)** represents its more than 5,000 members (home builders and related vendors) in a legislative and regulatory advocacy capacity on a statewide basis. The OHBA has generally opposed the adoption of updated energy codes, and is involved in the selection of appointees to the RCAC. There are more than 20 local HBA chapters across Ohio; many chapters meet regularly for meetings or dinners with speakers.

**Regional planning commissions** are governmental bodies operating at the municipal, county or regional level that are responsible for guiding orderly development in a specified area. For example, the Mid-Ohio Regional Planning Commission (MORPC) is a voluntary association representing Central Ohio

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*BCAP’s Code Calculator* is a tool that estimates energy, utility cost (in real 2011 dollars), and carbon emissions (CO₂ equivalent) savings at a state level through the adoption and implementation of residential and commercial energy codes. The Code Calculator compares the desired “target code” scenario to the “business-as-usual” baseline scenario based in part on the Annual Energy Outlook (AEO) reference case published by the U.S. Energy Information Administration (see [http://www.epa.gov/cleanenergy/energy-resources/refs.html#houseenergy](http://www.epa.gov/cleanenergy/energy-resources/refs.html#houseenergy) for more details). Details at: [http://energycodesocean.org/resource/bcap-codes-savings-estimator-primer](http://energycodesocean.org/resource/bcap-codes-savings-estimator-primer).
governments and regional organizations in 12 counties. It “envisions and embraces innovative directions in transportation, energy, housing, land use, the environment and economic prosperity”. MORPC, along with other regional planning organizations, may provide a connection through which to promote energy code training or related initiatives.

**Other Professionals** are typically the front line in working with buyers of homes or commercial buildings. In most communities, energy code and green building outreach and education for professionals such as real estate professionals, appraisers, lenders, architects, engineers, insurers and others has been limited, or even non-existent. This knowledge gap is a barrier to code compliance, as these individuals may not know how to sell these features to their customers, assess their value, or offer more affordable mortgage or insurance rates.

### OHIO’S ENERGY CODE

**For Commercial buildings, the 2011 Ohio Building Code (OBC)** went into effect November 1, 2011 for construction that is not detached one, two, or three-family dwellings. The OBC incorporates the 2009 International Building Code (IBC), including its references to the 2009 IECC and ASHRAE 90.1-2007 as compliance paths for energy efficiency for non-residential buildings. Both compliance paths reference the nationally-recognized climate zone map that both the IECC and ASHRAE codes provide. The majority of Ohio is in climate zone five, with a few southern counties in zone four.

**For residential buildings, the 2013 Residential Code of Ohio (RCO)** has been in effect since January 1, 2013. Chapter 11 of the RCO contains the energy conservation requirements for residential buildings. Section 1101.2 allows for three methods of demonstrating compliance, purportedly designed to allow the owner and/or the designer maximum flexibility in the design of a new home. They are:

1. The International Energy Conservation Code (which reference a nationally-recognized climate zone map); or
2. Sections 1101 through 1104 of Chapter 11 (which reference a nationally-recognized climate zone map); or
3. Section 1105 – The Ohio Home Builder’s Association (OHBA) Alternative Energy Code Option, (which provides two simplified compliance paths applicable in any climate in Ohio).

These numerous compliance options are graphically depicted in the following flow chart. The multiple compliance options were created by negotiations between proponents and opponents of Ohio’s adoption of the 2009 IECC. However, the numerous options tend to confuse code users, according to local enforcement staff interviewed for this report (see *Insights from local jurisdictions* of this report). Owners, design professionals or builders must choose which compliance path to use and communicate this choice to the building department (if a certified building department exists in the area where the home is being built).
In January of 2007, House Bill 251 was passed, which required colleges and universities to develop 10 year plans with energy reduction goals. Additionally, Executive Order 2007-02S (now expired) required all state agencies, boards and commissions to conduct an energy audit for all owned and leased facilities by June 2007 and to reduce statewide energy use in their facilities by 5% in one year and by 15% during the next four fiscal years. The state did achieve a 5.5% savings in the first year, and 15% over four years for those agencies reporting. It should be noted that not all facilities reported in the utility database, so savings for those facilities were uncertain. Also in 2007, an inter-university council was created to develop energy-efficiency guidelines and a 10-year plan for university Boards of Trustees. This council’s status is unknown.\(^{39}\)

In 2012 the Ohio Facilities Construction Commission (OFCC) was formed, which consolidated the operations of the former Ohio School Facilities Commission (OSFC) and the State’s Architect’s Office. The OFCC now administers three programs that reduce energy use in state funded buildings:

1. **The Capital Energy Conservation program**, which funds specific energy-efficiency measures for state agencies. In July 2014, $3,000,000 was appropriated to the OFCC for the purpose of investing in energy projects for state agencies over the next two years. These energy projects are typically less than $200,000 each, with a goal to payback in 7 years or less. OFCC energy specialists work with agency
personnel to help them identify savings opportunities, and assist these agencies with executing the projects. Since the inception of the program, more than $17 million in energy projects have been completed through the capital program.

(2) The Performance Contracts program, which has simplified and accelerated the process for state agencies in Ohio to enter into contracts with private Energy Service Companies (ESCOs). The Performance Contracts program offers oversight and consultation to state agencies – from the initial contact between the state entity and the ESCO, through the energy needs analysis, design, implementation of improvements, maintenance, and energy-saving measurement and verification for up to 15 years. The program provides state agencies with technical support, customized advice, and ready-made contracts. As a result, the state is saving more than $6 million each year in reduced energy costs with 29 projects. Administrative costs are recovered by fees rolled into the overall project cost, and funded via bond sales initiated by the Ohio Air Quality Development Board – so no taxpayer funding is needed to run the program.

In addition the OFCC oversees a performance contract program for K-12 schools, known as the School Energy Conservation Program. In existence since 1986, approximately 44 construction projects worth $56 million are completed each year through this program. Local school districts have the authority to administer and award these energy savings performance contracts, with the OFCC providing technical review of the proposed projects, and reviewing annual savings reports.

(3) The Green Schools program, which requires (since September 2007) that all K-12 schools participating in state-funded programs must achieve at least LEED Silver Certification, with strong encouragement to achieve the Gold level. As of June, 2014, 340 schools have pursued LEED; 159 are already-certified. As designed, these schools will save 35% on utility bills compared to baseline standards, although the state does not track or monitor utility bills. If a school cannot achieve LEED (e.g. it’s a partial renovation), the OFCC uses its Ohio School Design Manual to assist the school in making construction choices that result in lower utility bills. Ohio has more LEED certified public schools than any other state in the nation.

GAP #4: Other than the standards in place for K-12 schools, Ohio has not adopted a modern energy code for state-funded buildings, nor one that “pushes the market” by leading by example.

Recommendation: The state should “lead by example” by requiring standards for state-owned, state-leased or state-funded buildings that are more stringent than minimum state energy codes. By requiring more advanced energy standards for state-funded buildings, the state demonstrates fiscal responsibility with tax payer dollars. Also, more efficient public buildings are a hedge against uncertain future energy costs and availability, and reduce the government’s susceptibility to fuel price increases. Use of advanced standards also familiarizes and trains the construction industry and code enforcement officials, and increases demand for “greener” products from product suppliers, manufacturers and service providers, stimulating the local economy.

GAP #5: The Performance Contracts program administered by the OFCC to state agencies is an exemplary program that is saving Ohio significant dollars. There is no equivalent program for local governments.
**Recommendation:** The Ohio energy office should consider the feasibility of offering consulting services to local governments (in addition to state agencies). Alternatively, perhaps the SAO Performance Contracts model could be replicated at the county-level to help municipalities reduce energy use and familiarize local construction communities with modern building products and practices, helping to pave the way for future energy code updates.

**STANDARDS FOR MUNICIPAL-FUNDED FACILITIES**

State law does not permit municipal governments to set more progressive energy code policies for their communities. However, local governments can choose to set higher standards for their own buildings. By requiring higher standards for public buildings, municipalities demonstrate fiscal responsibility with taxpayer dollars while also familiarizing the local construction market with updated energy products and building practices. They have the added benefit of reducing municipal energy bills while providing more comfortable public buildings.

**OTHER OHIO BUILDING CODES**

Other state codes promulgated by the BBS include: a commercial building code (which includes specific referenced standards such as the electrical and energy codes); a mechanical code, a plumbing code, an elevator code, and a boiler code. These codes are enforced by certified building departments or the local health department (which often times enforces the plumbing code).

**CURRENT BEST PRACTICES**

- The OFCC’s Performance Contracts program is successfully removing barriers for state agencies by providing technical assistance to state agencies, and is already saving the state more than $6 million in reduced energy bills annually, while educating and familiarizing the construction industry on how to utilize energy-efficiency technologies and practices.
- Ohio is leading by example by setting higher energy standards for K–12 state-funded schools; and is leading the nation in having the most LEED-certified schools.

**ENFORCEMENT**

Enforcement provides the teeth behind adopted codes, as it is the responsibility of design professionals and builders to ensure that their projects comply with the provisions of all construction codes. As codes are regularly evolving, it is also incumbent on the state, municipalities, and involved third party organizations to provide the enforcement community with access to sufficient energy code training, especially for those inspection departments where multiple barriers to enforcing the energy code exist.

**OVERVIEW OF ENFORCEMENT INFRASTRUCTURE**

The BBS authorizes eligible city, county, township and municipal building departments as “certified building departments”. Some local building departments are certified to enforce both the residential and commercial construction codes, some only commercial codes, and some only residential codes. Certified building departments are authorized to accept and approve plans and make inspections in
accordance with the provisions of the OBC and/or RCO. Complete lists of certified OBC and RCO building departments are made available by BBS.

Building departments set their own permit fees. All departments that charge fees for plan review, plan approval, and inspections must collect and remit a specified percentage of those fees monthly to BBS, which uses the funds for administrative costs, code books, training and education. For residential projects, BBS collects one percent\(^1\); for commercial projects, BBS collects three percent.\(^2\) Some local departments are able to cover their costs through fee collection; others are not and general funds are used to cover the gap. Some departments have had to reduce staff in recent years due to low construction activity.

Designers and builders typically use DOE software called COMcheck to demonstrate compliance for commercial projects. For residential projects, multiple compliance options are used.

The process for enforcing building codes is as follows: builders apply for a building permit and submit building plans which include details on insulation and other energy features; plan reviewers assure that plans meet the code; and code inspectors review the approved plans provided to them onsite by the builder to ensure that the installed measures match the plans and comply with the code. Energy code enforcement is typically incorporated into other inspections, although most jurisdictions make sure to conduct a special insulation inspection.

Many Inspectors are unaware of when a structure is being built to above-code programs such as LEED or Energy Star. They view their job as enforcing the state adopted code, and they are typically not involved (or even notified) about above-code buildings.

There are major differences between the structure of enforcement for commercial and residential buildings in Ohio.

**THE COMMERCIAL ENERGY CODE**

Enforcement for commercial construction occurs at both the state and local levels. Local enforcement is conducted by local building departments certified by the BBS to enforce the OBC. In areas without a certified building department, commercial plans must be approved by the Ohio Department of Commerce (DOC), Division of Industrial Compliance (DIC) which reviews building plans for the construction, alteration and renovation of commercial and public building projects, and conducts inspections of plumbing, electrical and structural systems for compliance.\(^4\) There are 14 state Plan Reviewers and more than 30 state Inspectors that work from home offices regionally across Ohio.

The majority of plans submitted to DIC demonstrate energy code compliance via COMcheck, and there are often problems with the submissions. For example, the COMcheck report may not match the plans, or the R-value submitted for a given area may not actually be accurate – for example, plans may show R-19 cavity insulation in a 2x4 wall, which is not possible. Once the COMcheck report is approved by a state Plans Examiner, it is stapled to the building plans which the builder is required to have available at the building site for use by the field inspector. However, those attached pages tend to get in the way, and may be lost or torn off so that they are not available.
Individual Plans Examiners have their own strengths and some may pay more attention to the energy code provisions of building plans than others. Some carefully review the COMcheck reports and require corrections where there are errors. Others prioritize the health and safety provisions of the code more than the energy provisions, and may not require corrections; yet others may not fully understand how to use COMcheck to assure that the plans comply with OBC requirements. Specific training on this topic may help to assure the energy provisions of the OBC are reviewed in equal import as the health and safety provisions of the OBC.

DIC does not conduct special energy inspections other than an insulation inspection; rather, energy code compliance is inspected during other relevant inspections (e.g. HVAC, structural). However, the health and safety provisions of the OBC (e.g. fire, electrical, structural) may be prioritized over the energy provisions by both Plan Reviewers and Inspectors.

The commercial energy code is:

- Simple - there are two compliance paths;
- Has been in place for much longer than the residential code so the building industry and code officials have become accustomed to it; and
- Enforced statewide.

**Gap #6:** State building inspectors and Plan Reviewers tend to prioritize the health and safety provisions of the commercial energy code over the energy provisions, and state inspectors are not required to inspect for energy provisions other than insulation. It is unknown whether inspectors are enforcing the other energy provisions of the OBC.

**Recommendation:** The BBS should emphasize to state building inspectors that the energy code should be prioritized with equal importance as other building codes. For example the BBS should:

- Require that all energy provisions of the OBC are inspected.
- Heighten the importance that code enforcement staff put on the energy provisions of the OBC by providing information to Plan Reviewers and Field Inspectors about how energy codes benefit Ohioans and benefit the state.

In addition, the state should conduct an energy code compliance evaluation study to determine the specific strengths, weaknesses, and needs in enforcement of the energy provisions of the OBC (see Gap and Recommendation #1).

**THE RESIDENTIAL ENERGY CODE**

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**OBC section 108.2.8 Energy efficiency inspections** reads “Inspections shall be made to determine compliance with Chapter 13 of the "OBC" and shall include, but not be limited to, inspections for: envelope insulation "R" and "U" values, fenestration "U" value, duct system "R" value, infiltration air barriers, caulking/sealing of openings in envelope and ductwork, and "HVAC" and water heating equipment efficiency.”
Enforcement for residential construction occurs at the local level by local building departments certified to enforce the residential building code. In areas without a certified building department, there is no residential code enforcement.

The residential energy code:
- Is complex: it offers additional ways to comply in addition to the compliance paths offered in the IECC (see Figure 7: RCO Compliance Options);
- Has only been in place since 2006; and
- Is not enforced statewide.

There are 88 counties in Ohio; 22 are certified to enforce the residential energy code. See Figure 8: Population Map Overlaid with Areas of Residential Building Code Enforcement below for a map that shows where residential enforcement exists in Ohio. While it appears from the map below that less than half the state (geographically) has residential enforcement, according to the BBS, about 80% of Ohio’s population is in areas with residential code enforcement. However, enforcement is not uniform. In counties (outlined in yellow), residential enforcement occurs only in un-incorporated areas of the county, and any incorporated areas that request the enforcement services from a nearby certified building department (denoted by orange circles). The green dots denote incorporated areas with certified building departments that enforce the RCO, and the orange dots denote incorporated areas that do not have their own certified building department but have requested enforcement services from another. Note that the darker the blue shading; the higher the population.

Figure 8: Population Map Overlaid with Areas of Residential Building Code Enforcement
Taking a Closer Look
Of the 88 counties in Ohio, 53 have positive population growth. Within those 53 counties, 24 do not have a certified building department; that is, no one is inspecting their new homes for basic health, safety, and energy code compliance, leaving occupants of these homes at higher risk from construction that could lead to unsafe homes with high energy bills over the lifetime of the structures.46

Table 1: Growing Counties without Residential Code Enforcement

<table>
<thead>
<tr>
<th>County/Population</th>
<th>Pop. Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knox, OH / 60,921</td>
<td>11.78%</td>
</tr>
<tr>
<td>Morrow, OH / 34,827</td>
<td>10.11%</td>
</tr>
<tr>
<td>Holmes, OH / 42,366</td>
<td>8.79%</td>
</tr>
<tr>
<td>Highland, OH / 43,589</td>
<td>6.64%</td>
</tr>
<tr>
<td>Perry, OH / 36,058</td>
<td>5.81%</td>
</tr>
<tr>
<td>Minton, OH / 13,435</td>
<td>4.91%</td>
</tr>
<tr>
<td>Hancock, OH / 74,782</td>
<td>4.89%</td>
</tr>
<tr>
<td>Adams, OH / 28,550</td>
<td>4.46%</td>
</tr>
<tr>
<td>Noble, OH / 14,645</td>
<td>4.18%</td>
</tr>
<tr>
<td>Athens, OH / 64,757</td>
<td>4.07%</td>
</tr>
<tr>
<td>Hocking, OH / 29,380</td>
<td>4.03%</td>
</tr>
<tr>
<td>Pike, OH / 28,709</td>
<td>3.66%</td>
</tr>
<tr>
<td>Meigs, OH / 23,770</td>
<td>3.03%</td>
</tr>
<tr>
<td>Tuscarawas, OH / 92,582</td>
<td>1.83%</td>
</tr>
<tr>
<td>Jackson, OH / 33,225</td>
<td>1.79%</td>
</tr>
<tr>
<td>Ashland, OH / 53,139</td>
<td>1.17%</td>
</tr>
<tr>
<td>Morgan, OH / 15,054</td>
<td>1.05%</td>
</tr>
<tr>
<td>Coshocton, OH / 36,901</td>
<td>0.67%</td>
</tr>
<tr>
<td>Marion, OH / 66,501</td>
<td>0.43%</td>
</tr>
<tr>
<td>Hardin, OH / 32,058</td>
<td>0.35%</td>
</tr>
<tr>
<td>Hardin, OH / 32,058</td>
<td>0.35%</td>
</tr>
<tr>
<td>Belmont, OH / 70,400</td>
<td>0.25%</td>
</tr>
<tr>
<td>Huron, OH / 59,626</td>
<td>0.23%</td>
</tr>
<tr>
<td>Lawrence, OH / 62,450</td>
<td>0.21%</td>
</tr>
<tr>
<td>Harrison, OH / 15,864</td>
<td>0.05%</td>
</tr>
</tbody>
</table>

Figure 9: *Examples of Growing Counties with and without Residential Enforcement* provides two examples of counties with residential enforcement, and two without. All counties have positive population growth, but enforcement is absent in two counties.
Gap #7: Numerous additional compliance paths add complexity and confusion to the residential energy code (see Figure 7: RCO Compliance Options).

**Recommendation:** With the next adoption of the energy code, the BBS should strive to simplify the residual code if possible, so that there are fewer methods of compliance. This will reduce confusion among the construction community, the code enforcement community and the public.

Gap #8: Unlike the commercial building code, residential building code enforcement is absent in a large portion of the state. There is no oversight or administration to protect citizens from residential construction that could result in life-threatening or costly dwellings for Ohioans.

**Recommendation:** The Ohio energy office should coordinate with the BBS to consider the best approach to providing state-administered plan review and building code enforcement for residential dwellings in areas without enforcement. A precedent for state-enforcement of the building code already exists since the commercial building code has both local and state enforcement. An Energy Code Collaborative in Ohio could be tasked with this as an issue (see Gap and Recommendation #9).

**INSIGHTS FROM LOCAL JURISDICTIONS**
In 2011, BCAP interviewed numerous code officials from certified building departments to glean insight into energy code enforcement. In 2014 BCAP conducted additional interviews with code officials in nine counties with certified building departments, and also with building officials in incorporated jurisdictions within those counties. The counties included: Delaware, Warren, Union, Fairfield, Licking, Medina, Franklin, Athens, and Hancock. Insights from these interviews are summarized below.

- Of the multiple options for demonstrating compliance to RCO, there does not appear to be one that is more used than others. Builders in different areas tend to use different compliance options. For example, in Delaware County, the majority of builders use the Ohio Homebuilders Prescriptive path; in Powell (within Delaware County), REScheck/COMcheck is most often used; and in Medina County builders use REScheck, REMrate, and the OHBA path #1 and #2.
- Building departments typically incorporate energy code enforcement into their other inspections, rather than set up a specific energy inspection. However, code officials do typically conduct an insulation inspection.
- Several code officials interviewed don’t trust the accuracy of the performance path reports they get from third-party energy raters. Additional training would be helpful to better understand the reports, and the process code officials should be using to assure that third-party energy raters are qualified and producing accurate reports.
- Code officials and builders interviewed gave mixed messages on the level of energy code compliance. Several code officials reported that builders are complying with the energy code; others reported that residential builders are confused by the numerous compliance options, which leaves the code official in the position of having to train them on the job. Some code officials feel it is not their responsibility to teach builders how to comply with the code, nor do they have time to teach them, as their budgets and staff are already stretched thin. Some code officials prioritize “health and safety” over energy efficiency, and say that in some cases they need to “let things go” regarding energy code compliance.
- Some code officials believe that code officials understand the energy code well, but that the construction community does not, and that builder education is the critical missing part of achieving compliance with energy codes.
- Some code officials may not completely understand or support more stringent energy codes. Some are concerned about the impact on builders and, therefore, on local building departments that depend on permit fees to operate. Straining the working relationships with residential builders/contractors is a concern of some code officials.
- Some cite political pressures as the main reason the residential code is not enforced statewide. Builders are considered a generally conservative industry inclined to “do things the way they’ve always been done,” and were recognized as being philosophically opposed to regulatory changes. ix

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ix For example, one Plans Examiner Supervisor said that commercial code enforcement is “no problem”, but that “Residential builders try to cut corners – builders don’t know the latest in codes and standards. We need an analysis and education to teach them the methods and show an economic comparison, including ASHRAE or IECC or alternative methods... they [builders] don’t know the alternatives.”
Some code officials believe strongly that the lack of consistent enforcement of the RCO statewide is a major problem, and that it’s “just a matter of time before a home buyer is hurt or killed by sub-standard construction”.

Code officials and builders interviewed gave mixed messages on the level of energy code compliance occurring in the field. Some code officials believe that code compliance and enforcement of the OBC and RCO is generally stronger in larger urban areas than smaller rural communities.

Some code officials said that they need code books and other technical resources, and were unaware that BBS provided all departments with such resources.

Code officials need a better understanding of REMrate software and how it works (requests for this came from Delaware County, Union County, Fairfield and Avon, and Groveport). Multiple code officials suggested that the software shows a building complies, when it actually doesn’t.

In Licking County, the majority of production builders are using REMrate software to show energy code compliance. As one code official said “Licking County needs training for builders – we have 668 square miles to enforce, and don’t have the capacity to launch a builder license program like in Columbus.”

Builders need a checklist for energy code provisions. As one code official said “It would be great if the state worked with OBOA to design and distribute one for local jurisdictions to provide to builders.” Another said “Builders don’t know the difference between REScheck and REMrate – they just say ‘tell me what to do’, and they do that.”

It’s problematic that residential builders don’t need licensed architects. According to some code officials “Drafts people have no clue what they’re doing – anybody can draw up plans for a house, using a drafting program from BestBuy, and call themselves a designer (not an architect).”

**CURRENT BEST PRACTICES**

- The statewide coverage of commercial energy code enforcement assures that commercial building standards are consistently enforced across Ohio.

**IMPLEMENTATION**

The state plays a crucial role in providing municipalities with the resources and support they need to establish effective enforcement infrastructures and practices. As codes are regularly evolving, it is also incumbent on the state, municipalities, and others to provide the enforcement community with access to sufficient energy code training, especially for those inspection departments where multiple barriers exist to enforcing the energy code sufficiently to achieve compliance with the state code requirements.

In order to assure that buildings are constructed to the adopted energy code, states and cities must carry out full implementation – that is, they must prepare state and local code officials, the building industry, and other stakeholders for compliance with the energy code. States must raise awareness of the need for energy codes; identify needs and opportunities for training; conduct outreach to stakeholders; offer on-site, classroom, and web-based training; establish and utilize enforcement infrastructure, tools, and systems; and offer technical support to both code officials and builders.
STATE’S ROLE IN PROMOTING CODES

The BBS provides support to certified building department staff in multiple ways. BBS support includes:

- Technical support via the phone or email;
- Concise written descriptions of particularly confusing or new code requirements;
- Free (mandatory) training each time a building code is updated;
- Code books, including both IECC and ASHRAE standards, Energy Code Inspector’s Guide, and other supporting resources when codes are updated.
- Online educational videos, available at Ohio Department of Commerce, BBS website.
- An online energy code training module at www.ohiobsesducation.com (see Figure 10: Online Classes Offered by BBS).

The BBS is considering providing building departments with a ready-made energy code checklist for builders. These checklists can be copied by local jurisdiction staff to help them communicate to builders the required energy code provisions and/or inspections. This will help ensure that code inspectors are able to view the energy features before they are covered up.

The BBS also offers free training to builders, and has reached out to the OHBA. However, the BBS has not had success in reaching the construction community with free training; few individuals from the construction community attend. This is likely because builders:

- Are not required to obtain Continuing Education Units (CEUs) like code officials and other professional trades.
- Are busy working in the field and it’s difficult to take time off to attend a class, or send their subcontractors to a class and lose the productivity in the field.
- Are motivated to maximize profits in each new home or building; many view the building codes as adding cost (thereby reducing profit).
- Are not the beneficiaries of low energy bills and increased comfort in a new home or building.
- Are typically not well-suited for traditional classroom learning. As some interviewed for this report said “builders learn on the job – when they’re out building houses.”

Additionally, appraisers are not permitted (by lenders) to increase the value of a property for increased energy efficiency. While a higher appraisal would be an incentive for builders to invest the time and effort required to learn to build more efficient buildings, rather they are left to compete in the market with builders that install the minimum.

There is not an Energy Codes Compliance Collaborative or other group of stakeholders helping the state work toward full compliance with Ohio’s adopted energy codes.

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x BBS staff can offer opinions regarding the RCO. However, the enforcement and interpretation authority for the code lies with the local building official having jurisdiction.

xi Online training video is accessible from http://www.com.ohio.gov/dico/bbs/, under “Certifications”, then “Continuing Education” column. (Or directly from http://www.codecollegenetwork.com/oh/)
Gap #9: Ohio lacks an Energy Code Compliance Collaborative to help it achieve greater compliance with energy codes.

**Recommendation:** The Ohio energy office should convene an Energy Code Compliance Collaborative; a forum for experts from diverse stakeholder groups impacted by energy codes to come together to work toward common interests and goals. The collaborative is a long-term initiative to assist its state in implementing a plan to achieve full compliance with energy codes. An Energy Code Compliance Collaborative can:

- Provide a team of local experts to assist the state in implementing a plan to achieve full compliance with energy codes, which may be especially helpful at times when Ohio faces declining budgets and resources;
- Provide a forum for improving relations between diverse stakeholders affected by energy codes as stakeholders listen and learn about each other’s concerns, and work together to find common interests and goals.

GAP #10: **Builders and contractors** don’t seek out free BBS training and technical assistance; leaving the training to the local building inspector, who doesn’t have time to train the builders and contractors. As building products and practices evolve, it’s important that the construction industry understand the changes.

**Recommendation A:** As a first step, the state should conduct a study of residential and commercial buildings to determine actual energy code compliance and assess the needs of the construction industry (see Gap #18).

**Recommendation B:** Consider approaches to require that builders and contractors be licensed and required to obtain CEUs like other construction trade professionals. See *Construction Professionals* section of this report.

**Recommendation C:** The state should offer specialized education to the construction industry in such a way that the benefits of taking time off to attend are clear from the builders’ perspective. Builders must understand the marketing benefits and financial gain for building energy-efficient homes. For example, by attending a course, builders will learn to implement approaches to construct the best homes possible, **at the lowest cost**. The Ohio energy office could partner with an existing non-governmental organization, (e.g. OHBA or the Mid-Ohio Regional Planning Commission) to develop/market such a program.

**Gap #11:** Consumers don’t have ready-made information available to be able to compare the energy efficiency of one building to another. There’s a lack of easily accessible information during the buying process.

**Recommendation:** In order to help increase demand for new, highly efficient homes and recognize builders and raise public awareness, the Ohio energy office or Collaborative should reach out to consumers and key stakeholders that influence consumers. For example:
• **Raise consumer demand for home energy efficiency.** Launch a statewide campaign including public relations efforts and earned media radio and TV interviews, news releases and articles all with the intent to raise awareness of the benefits of energy-efficiency.

• **Engage real estate professionals.** Real estate professionals need education to better understand how to assess the energy-efficiency of one home compared to another. This may include providing a check box to the Multiple Listing Services (MLS) to help agents (and buyers) compare the energy-efficiency of sale listings. Training with Continuing Education (CE) credits could accompany a larger effort to provide training to this audience.

• **Consumers** need concise information at the right time - while shopping for new homes or buildings - about the benefits of energy efficiency in order to demand it from builders. Since energy efficiency is largely “out of sight, out of mind” to consumers, the state or Collaborative could consider ways to educate the general public and create demand for more energy-efficient construction, making energy codes easier to adopt as the people become more aware and begin to demand energy efficiency in new housing.

Other actions the state and/or Collaborative could consider are:

- Expand the Energy Star® New Homes program currently offered in Columbia Gas and AEP territories (see ENERGY STAR for Homes section of this report), to offer paid incentives for builders that achieve above-code standards.
- Expand the state’s existing code training website to include modules designed especially for builders and contractors.
- Work with Appraisers to boost the appraised value of buildings built to code or better.
- Work with lenders to create a financial incentive program for energy-efficient homes and buildings; such buildings have lower monthly bills and borrowers are less likely to default on mortgages.

### CERTIFICATION, LICENSING, AND CONTINUING EDUCATION REQUIREMENTS

#### CODE ENFORCEMENT PROFESSIONALS

Section 103 of the OBC and RCO provide the requirements and process for becoming certified by BBS to work as a building official, plans examiner, or inspector for a building department that reviews, inspects and approves buildings.  

Certified building departments must have at least one certified staff member for each of the following five disciplines: building official, master plans examiner, building inspector, plumbing inspector, electrical safety inspector. BBS certifies individuals for three years for a fee of $30 per discipline certification. Newly certified individuals approved to enforce commercial codes must have successfully completed the Ohio Building Code Academy offered by BBS. Building department professionals must complete 30 CE hours every three years, including any courses mandated when new code editions are adopted.
The Ohio Architects Board and the Ohio Landscape Architects Board regulate the roughly 6,400 license architects in the state (although there are two boards, they share one budget and one staff). Plans submitted for commercial buildings must be sealed by a registered Architect or Engineer. No seal is required for residential construction. The National Architectural Accrediting Board (NAAB) is the only agency authorized to accredit U.S. professional architecture degree programs, and the Ohio Architects Board requires architects licensed in Ohio to have graduated from a NAAB-accredited program. There are four in Ohio: Kent State, Miami University of Ohio, Ohio State University, and the University of Cincinnati.

Architects must renew their license every two years for a fee of $125. They must complete 24 hours of CE every two years – of which 16 hours must be in the areas of health, safety, and welfare. Energy codes and similar “sustainable design” credits are considered acceptable topics within the required health, safety, and welfare categories.

The American Institute of Architects (AIA) require members to obtain 18 CEUs per year, four of which must be in sustainable design.

The State Board of Registration for Professional Engineers and Surveyors licenses such professionals in Ohio. Engineers and surveyors must obtain 15 professional development hours and renew their license annually.

Gap #12: Residential dwelling plans do not require an Architect’s seal; there are no requirements for the qualifications of design professionals that often work with home builders.

Recommendation A: The Ohio energy office, BBS, and the Collaborative should work together to seek solutions to improving the quality of the plans submitted to building departments. Consider requiring the same stringency for both commercial and residential building plans to assure safe homes.

Recommendation B: Forge strategic alliances with community colleges - especially any that have recently received grants for “green jobs” training to coordinate and encourage (and perhaps provide additional funding for) the inclusion of energy code training (and/or RESNET training) for students who may become code officials or building professionals upon graduation. Structure the collaboration to assure that the community college continues to teach the energy code even when the funding is exhausted so that the next generation of construction trades professionals are better informed about the importance of including energy-efficiency in the design and construction of buildings in Ohio.

CONSTRUCTION PROFESSIONALS

For individuals seeking employment in the construction industry, education is available via multiple four-year accredited universities, community colleges, and even online schools that offer degrees or certificates in construction management and related degrees. However, the majority of the construction trades learn “on the job”.
It is the responsibility of the design and construction community (designers, architects, engineers, developers, builders, and subcontractors) to comply with the requirements of the adopted building codes. It is imperative that builders and contractors understand such codes.

The Ohio Construction Industry Licensing Board (OCILB) provides testing and licensure of occupations regulated to the commercial construction industry only. Five commercial contractor trades are regulated by OCILB (electrical, HVAC, hydronics, plumbing, and refrigeration). To be licensed, each of these trades must have at least five years of experience in the trade, pass an exam, have a background check, and have proof of insurance. About 20,000 individuals are licensed in these trades and can be searched for online. Licensed professionals must pay an annual license fee and have completed 10 hours of CE and have proof of insurance.

General contractors are not required to be licensed by the state and are not subject to CEU requirements. Some local jurisdictions may require these professionals to be registered, bonded, and insured. The state has no requirements for residential contractors or their subcontractors (even structural or electrical) to be licensed, own a code book, or demonstrate a core proficiency in construction through education or passing an examination to assure that they have a basic knowledge of building a safe home that meets building codes. Some local jurisdictions have requirements. In 2008 the OCILB survey certified building departments and found that several have some requirements for local contractors.

**Gap #13:** Residential general contractors are not required to be licensed in Ohio. They are not required to have experience nor obtain any education related to building codes or state energy standards. Without such requirements there is no motivation for those in the construction community to obtain formal education, or take a class on the energy code.

**Recommendation:** The appropriate way to solve this problem is to require residential designers, general contractors and their sub-contractors (electrical, plumbing, etc.) to be licensed and obtain CEUs, as they are for commercial construction. This would help solve numerous building code compliance issues, and protect Ohio citizens from sub-standard construction that may be dangerous, not withstand severe weather events, and cause building owners to have high energy bills over the lifetime of the structure. The state has already made efforts to partner with the OHBA to offer classes to their members, and offers free training classes on building codes. However, attendance by builders is consistently low.

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xii To receive a state license, an applicant must meet the following requirements: 1) be at least 18 years of age; 2) be a United States citizen or a legal alien—must provide proof of being a legal alien; 3) either have been a tradesperson in the type of licensed trade for which the application is filed for not less than five years immediately prior to the date the application is filed, currently be a registered engineer in this state with three years of business experience in the construction industry in the trade for which the engineer is applying to take the examination, or have other experience acceptable to the appropriate section of the board; 4) Never have been convicted of a disqualifying offense as defined in S.B. 337; 5) pass the examination in the trade; 6) carry minimum $500,000 contractor liability coverage; 7) pay the applicable fees.
Whenever there are changes to building codes, the BBS provides free training and requires certified building department personnel to attend. For example, when the last residential energy code was updated, the BBS provided six regional trainings for local enforcement staff. BBS provides periodic in-person training on codes; but no regular, ongoing energy code courses.

BBS offers education opportunities online and through training events. The BBS’s online training website - www.ohiobsseducation.com - is well-organized and concise. It provides links to online code editions, relevant certification information for individuals and building departments, a limited Learning Catalogue, and online courses (modules) (see Figure 10: Online Classes Offered by BBS). However, several pages (e.g. “Resources”, “FAQ”, “Codes On-Line” (link to the RCO)) are “under construction”, several links are broken or missing, and the scrolling “Announcements” display outdated material from 2012 and 2013. One module provides an on-line, basic overview of the RCO Chapter 11 requirements. The website could be made much more user-friendly and educational with the addition of:

- Photos of specific provisions that show examples of compliant vs. non-compliant provisions within Module 6.
- Other BBS resources such as its concise handouts (e.g. BBS Memos on blower door testing, raised heel trusses, more). The website is a very good start to what could be a very useful resource if brought up to date, maintained, and promoted to certified building departments.
- A link to the online energy code videos currently only available at the BBS website. xiii

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A popular way for code officials to get education and obtain CEs is the OBOA annual education conference. About 300 people attended the 2014 OBOA conference held February 23-25, 2014. Code officials can attend multiple classes and obtain CE hours approved by BBS and AIA. Attendees can generally obtain 12 hours during the conference. Following a class presented by Energy Code Ambassador Mike Rudey called “Air Barriers” at the 2014 conference, OBOA is considering expanding the number of energy code classes offered next year.

**LOCAL GOVERNMENT’S ROLE IN PROMOTING CODES**

Most local building departments do not promote energy codes, but as the front line in code enforcement, they are often faced with educating builders one-on-one especially when inspectors find lapses in compliance.

**Gap #14:** There is a lack of political support at the local government level to “champion” energy codes. Areas with a local champion (whether within a building department, a mayor, or other political figure), are more successful in implementing energy codes.

**Recommendation A:** The Ohio energy office should consider ways to give public acknowledgement to those local governments that are taking leadership roles in moving energy codes forward. To help with market transformation, The Ohio energy office should recognize and publicize existing champions as role models for the state. The Ohio energy office should work with the Mayors Associations, the Mid-Ohio Regional Planning Commission, the Municipal League, utilities that offer rebates for energy-efficient construction and/or other similar groups to raise awareness among local government leaders of what other municipalities within Ohio are doing to take a leadership role in energy efficiency. Key messages should include that their work demonstrates fiscal responsibility for taxpayer dollars, stimulates jobs, and saves people in their community money through lower energy...
bills. For example, awards and news releases could be disseminated for those that have recently completed an energy-efficiency upgrade to an existing building; completed a new efficient building or home and related efforts. It is a cost-effective way to educate the public and other builders and move the market forward.

Even those best practices that may not seem “news-worthy” could be acknowledged. For example, a building department that creates a simple but efficient method (such as a random sample) of requiring energy ratings from builders, or an energy code checklist that’s given to builders are best practices that could be highlighted on the BBS website to acknowledge the local jurisdictions going above and beyond, and provide ideas for other local building departments.

**Recommendation B:** The Ohio energy office could make a list of Energy Code Ambassadors available on their websites, to acknowledge existing champions in Ohio. Highlighting the good work of peers helps to transform the market and encourages leadership by others.

**GAP #15: Local jurisdictions don’t have simplified, ready-made compliance materials to provide to builders and designers.**

**Recommendation:** BBS could create ready-made materials tailored for design professionals and contractors, such as a list of inspections, compliance checklists, or a form that describes to builders/contractors specific requirements for especially confusing provisions of the energy code. Local jurisdictions could require that builders submit such forms with the permit application. Such forms could help relieve some pressure from the Plan Reviewer who typically is the front line in dealing with confused builders.

In addition, the Ohio energy office/BBS could develop and provide ready-made marketing materials that support building departments as they educate designers and consumers about the importance and benefits of energy codes. Informational outreach materials targeted to different audiences such as consumers, designers, and policymakers would assist code enforcement personnel who are in the position of defending and educating codes. Information should emphasize the potential money saved by lower energy bills in order to gain support for private investments in energy efficiency and boost market demand for energy-efficient products and services.

**ENERGY CODE AMBASSADOR PROGRAM**

In 2013, with the support of the BBS and the Ohio energy office, BCAP and ICC partnered with AEP Ohio and Columbia Gas of Ohio to launch an Energy Code Ambassador Program (ECAP) for Ohio. Eight Ohio code enforcement professionals were specially trained and certified as Energy Code Ambassadors. Ambassadors serve as a peer-to-peer resource for local enforcement staff. They help increase awareness and understanding of Ohio’s energy code among their peer code officials and the construction industry. Ambassadors have volunteered to answer questions and provide guidance, and may present energy code classes at conferences, testify at code hearings, or provide other support as needed to further energy code implementation in Ohio. Over the winter (non-construction season) of 2013-2014, they educated more than 650 code officials about Ohio’s energy codes.
In March 2013, with support of the Ohio Development Services Agency’s Office of Energy and Redevelopment, the Energy Foundation, and funding from two utilities - AEP Ohio and Columbia Gas of Ohio – BCAP established an enhanced ECAP in Ohio. The project was completed April 2014.

The Ohio ECAP is unique from other ECAP states in that it included specific enhancements that increased the success of the program. These enhancements are described below.

- **Paid Honoraria Strengthened Ambassador Engagement:** A $500 honorarium incentive was paid to compensate Ambassadors or their home building departments for providing energy code assistance to another jurisdiction or for speaking engagements.

- **Offering CEUs Increased Local Jurisdiction Participation:** To increase demand for Ambassador assistance, Ambassadors developed and offered five training classes that were approved for Continuing Education Units (CEUs) by the Ohio Board of Building Standards (BBS).

The initial Ohio pilot program was a great success but limited in scope, so that Ambassadors were only provided honoraria when educating code officials (code inspectors and plan reviewers) and only in AEP Ohio and Columbia Gas territory. Of the more than 650 individuals educated by Ambassadors, most were from the code enforcement community; and a few were members of the construction industry. Current Ohio Ambassadors have advised BCAP that the construction industry should be a target audience if the honorarium program continues. This would increase the impact that Ambassadors can make on the improving energy code compliance in the state.

*Figure 11: Ohio Energy Code Ambassadors*
GAP #16: There is no ongoing support for the Ohio ECAP program.

Recommendation A: Provide existing Ambassadors with continued honorariums to continue to energize the program and include the construction industry into the targeted audience.

Recommendation B: Expand the ECAP program by certifying more candidates and opening the program to other interested parties such as HERS Raters.

COMPLIANCE EVALUATION

In order to understand the status of energy code compliance across Ohio, the state needs to determine its current compliance. Currently, the state does not have a process in place to measure and evaluate compliance, so it is unknown whether details such as air sealing, window and door efficiencies and other provisions of the energy code are being met. A statewide compliance evaluation study can help identify the needs of local jurisdictions and other code users, and help the state understand where its resources should be allocated.

It is important to note that two utilities - AEP Ohio and Columbia Gas of Ohio - recently conducted a study in their service territories, to better understand residential code compliance and the needs. The study is expected be complete in late 2014.

The BBS requires that local certified building departments submit a “Yearly Operational Report” which includes basic data on the certified building department personnel, the number of plans approved, and number of inspections performed. This information is not captured electronically (only in paper format), and specific questions regarding the energy code are not included on the form. However, BBS has taken steps to collect such information: in 2012, it included an “Optional Energy Survey for Residential Departments” along with its Yearly Operational Report, and 20 of the 267 Certified Residential Building Departments returned the survey. The purpose of the survey was for building departments to:

1. Demonstrate overall compliance with the 2006 residential energy code;
2. Determine which compliance option is being used to demonstrate compliance;
3. Determine whether Plans Examiners use an energy code checklist and Building Inspectors perform energy-efficiency inspections; and
4. The degree of compliance as measured by the plans that were successful upon first inspection.

While the state has not yet implemented a plan to achieve compliance with energy codes, this survey was an important first step in readying local governments for working with the state to report on energy code compliance. Future surveys can help the state determine compliance and assess the needs of local jurisdictions.

GAP #17: A plan to achieve energy code compliance has not yet been implemented.

Recommendation: The Ohio energy office and the Ohio Board of Building Standards (BBS) should utilize the outline of a Strategic Compliance Plan provided to the state by BCAP in 2014 as the basis for implementing the tasks necessary to improve energy code compliance.
Gap #18: The state has not conducted an energy code compliance evaluation study; current compliance is unknown. There is not a method in place to measure and evaluate compliance with the energy code.

**Recommendation:** The energy office should conduct a compliance evaluation study to determine the current level of compliance with its commercial and residential energy codes. The energy office should review DOE’s guidance on measuring energy code compliance. The study should include both:

- A determination of the current level of compliance with the energy provisions of the OBC and RCO (both during plan review and field inspection); and
- A determination of the needs regarding the process of enforcing the energy provisions of the OBC and RCO.

The DOE provides assistance to help states in designing such a study, and more information can be found here: [www.energycodes.gov/compliance/evaluation](http://www.energycodes.gov/compliance/evaluation). In addition, the BBS should develop an ongoing process to measure and evaluate compliance, including an annual survey to Certified Building Departments. The Ohio energy office could coordinate an “Energy Code Collaborative” – a group of stakeholders that could work together to assist the state in its efforts to conduct a compliance study.

Also, it would be helpful and more efficient for local jurisdictions to be able to submit their Yearly Operational Reports online. This would allow the BBS to capture permit data for assessing construction rates, identifying trends, and other information and be more useful than the paper formats.

**GAP #19: Ohio lacks a funding mechanism to implement many of the recommendations within this report.**

**Recommendation A:** The Ohio energy office should consider potential sources of funding for energy code activities. Some of the recommendations may be very cost-effective (e.g. updating the BBS website), while others will be more costly (e.g. a state compliance study). Where possible, leverage funding; with utility companies or organizations with grant funding, for example.

**Recommendation B:** The Ohio energy office, BBS, or an Energy Code Compliance Collaborative should educate policy-makers in the state so that they understand the benefits of energy codes to Ohio, and the state’s obligations to DOE.

**Recommendation C:** The EERS legislation that mandates IOUs to meet set energy reduction goals may be a potential source of funding. The Ohio energy office should investigate opportunities to engage utilities in support of energy codes.

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**RELATED LEGISLATION – OHIO’S ENERGY EFFICIENCY RESOURCE STANDARD**

In May 2008, Ohio Senate Bill 221 was signed into law, requiring investor-owned utilities to implement energy efficiency initiatives that result in a cumulative energy reduction of 22 percent by the end of 2025, and includes specific annual benchmarks. As a result, Ohio’s IOUs are helping to transform the construction market by training and incentivizing builders to build more energy-efficiently in their service territories. IOUs are able to recover their costs for offering such programs, which overcomes a barrier that might otherwise exist for utility companies to offer energy-efficiency programs. This also
provides an opportunity for a new, critical funding source from utilities that can benefit Ohio citizens by reducing energy demand and deferring the need to build costly, new generation plants that raise rates. During the composition of this Gap Analysis report, the state legislature passed Senate Bill 351, a law to “freeze” and study the standards for a two-year period. This is a setback for the forward momentum that has begun to allow utilities to provide critically-needed funding for energy code support functions.

There are four IOUs operating in Ohio: AEP Ohio, Dayton Power and Light, Duke Energy, and First Energy (which owns Ohio Edison, Cleveland Electric Illuminating, and Toledo Edison). If these IOUs were able to claim savings toward their required energy-efficiency goals for investments in energy code support, they could make important contributions to improving energy code compliance in Ohio.

**ABOVE-CODE PROGRAMS and THIRD PARTY INFRASTRUCTURE**

Above-code programs provide voluntary standards that raise public awareness of the benefits of energy-efficient buildings, and familiarize the construction and code communities with advanced building products and practices. Above-code programs accelerate and help shape the development and adoption of future model codes. The most prevalent above-code programs in Ohio are Energy Star and LEED.

**HOME ENERGY RATING SYSTEM (HERS) INDEX**

The Residential Energy Services Network’s (RESNET’s) Home Energy Rating System (HERS) index is a nationally-recognized scale that helps compare the energy performance of different homes.

There are 26 companies that employ home energy auditors and certified HERS raters in Ohio. These home-performance consultants evaluate homes and use equipment (such as a blower door) to perform tests on homes. Data is entered into a software program that then compares the home to a standard “reference home” – which is a comparable home constructed to the energy standards of the 2006 IECC. A home that scores 100 points on the HERS index is as efficient as a home built to the 2006 IECC. The software program calculates a HERS score for each home analyzed; the lower the score, the more energy-efficient the home. For example, a home that scores 65 points on the HERS index is a home that is about 35% more efficient than a home built to 2006 IECC standards.

**LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN**

The U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) Green Building Rating System is a nationally accepted benchmark for the design, construction, and operation of high performance green buildings. The Columbus, Cleveland, and Cincinnati all rank among the top 40 cities in the...
US with the most LEED project activity. Ohio is ranked 11th in the nation with 1,375 LEED registered and certified commercial buildings.

As of July 2014, USGBC lists 1,874 projects in Ohio that have achieved LEED certification or are registered pursuing certification. The state has more than 133 million square feet of LEED registered and certified green building space. Ohio has more LEED-certified public schools than any other state in the nation (see STANDARDS for State-funded Facilities section for more information).

ENERGY STAR FOR HOMES

New ENERGY STAR qualified homes use at least 15 percent less energy than standard new homes. According to the ENERGY STAR website, 2,406 ENERGY STAR certified homes were built in Ohio in 2013; and 868 so far in 2014. Ohio ranks in the top ten states with the most market penetration of ENERGY STAR, at 23 percent in 2012. There are 89 Ohio builders registered with Energy Star. This high market penetration is likely due to utility programs that offer rebates to builders that achieve ENERGY STAR in their service territories. For example:

Columbia Gas of Ohio and AEP Ohio have partnered to offer an Energy Star® New Homes program for new homes or complete gut rehabs in their service territories. The program provides rebates to builders that construct to Energy Star levels. Rebates range from $850 to $3,500 depending on the type of dwelling and HERS score achieved.

The AEP Ohio New Construction Program for non-residential construction offers financial incentives to encourage building owners, designers, and architects to implement energy-efficiency provisions that exceed energy code standards such that the new buildings require less energy to operate than standard new buildings. The program is educating building owners and designers about energy-efficient design strategies, technologies, and practices.

Since inception in March of 2011, the Energy Efficient New Homes Program offered by Ohio Edison, The Illuminating Company, and Toledo Edison has approved more than 2,800 homes for incentives totaling nearly $1.9 million. In a typical year, these homes will save more than 7,300 Megawatt hours (MWh) compared to if they had been built to the code in effect at the time of their construction, which is about as much energy as it would take to power 680 average American homes every year.

These programs are important market transformation programs. They train and familiarize the construction industry on how to construct energy-efficient homes. They also reduce the initial cost for builders, and result in higher-performing, more comfortable homes with reduced energy costs. They also benefit the state and all energy customers by slowing the growing demand for energy in Ohio.

BUILDING AMERICA

Building America is a research program initiated by DOE to advance residential building energy technologies, strategies, and practices. This world-class research program partners with industry (including many of the top U.S. home builders) to bring cutting-edge innovations and resources to market.
Building America has worked with hundreds of leading builders and has resulted in over 14,000 energy-efficient homes and millions of dollars in energy savings. The DOE’s Zero Energy Ready Home (formerly the DOE’s Challenge Home program) represents a new level of home performance, with rigorous requirements for a home so energy-efficient that a renewable energy system can offset all or most of its annual energy consumption.

The program is not active in Ohio, with only one builder located in the state and one home built to Building America guidelines. The Building America program could help Ohio builders improve the housing stock by exceeding minimum energy codes, and encourage builders to embrace high-performance building approaches and technologies.
CURRENT BEST PRACTICES

- The Energy Efficiency Resource Standard created by Senate Bill 221 has spurred energy efficiency investments by electric IOUs, creating an important potential funding mechanism for energy code support. If credit toward required goals is allowed for energy code support (e.g. training in above-code programs for builders), IOUs may be interested in providing such support.
- Whenever there are changes to the energy code, the BBS provides training and requires certified building department personnel to attend.
- The BBS offers free, online video module courses on building codes, including the energy provisions of the codes, available to code officials, builders, and the general public.\textsuperscript{xiv}
- The state building department ensures statewide coverage in commercial code enforcement.
- The BBS assures that local building departments are educated in building codes by requiring code officials to pass ICC certification tests, and regularly obtain Continuing Education credits, which is an opportunity to keep them apprised of the latest technological or policy developments.

CONCLUSION

Ohio’s building energy codes are the first line of defense in protecting Ohio citizens and the state’s economy from excessive energy expenses. As new buildings are constructed and connected to the power grid and add to the state’s total demand for energy, achieving full compliance with the state energy code will help consumers and businesses save money, strengthen the economy, reduce pollution, decrease peak loads and the demand for new power generation capacity – all resulting in a cleaner environment, more stable energy prices, and lower energy bills.

Some positive aspects that will lead to improved energy code compliance in Ohio include:

- The state has adopted the 2009 IECC and equivalent options.
- The Board of Building Standards (BBS) has the funding, staff experience, and ability to provide training, technical assistance, code books and other resources to a variety of stakeholder groups, especially local code enforcement officials and construction industry professionals.
- Code officials are required to meet state requirements for certification and continuing education.
- Ohio has more LEED-certified schools than any other state, a higher than average Energy Star new homes market penetration rate, and other related programs that support energy codes.
- Six active Energy Code Ambassadors provide peer-to-peer support to neighboring jurisdictions.

\textsuperscript{xiv} The course was originally developed for the state of California with BCAP assistance.
Full compliance with the energy code is a key goal for Ohio. The state should begin by convening stakeholders via an Energy Code Compliance Collaborative. A first task of the Compliance Collaborative could be to help the state conduct a formal assessment of current compliance from which to evaluate future progress. The Collaborative can also address the major gaps in Ohio’s energy code, such as:

- The absence of required education on building and/or energy codes by the residential construction industry.
- The lack of residential code enforcement in 66 of Ohio’s counties.
- The need for expanded representation on the RCAC.
- The need for consumer outreach and education to increase consumer demand for energy-efficient buildings and homes.
- Certified building departments need for ready-made compliance materials they can share with builders and sub-contractors.
- How to continue and expand the reach of the Energy Code Ambassador Program.

The Energy Code Compliance Collaborative can be tasked with formalizing and assisting the state in implementing a Strategic Compliance Plan to accomplish the recommendations identified in this report.

By building on the existing strengths of Ohio’s energy code processes, forming an Energy Codes Compliance Collaborative, and implementing the key recommended improvements in this report, all citizens of Ohio will benefit, and may result in Ohio being recognized as a national leader in the implementation of building energy codes.

The Gaps and Recommendations in this report are summarized below.

<table>
<thead>
<tr>
<th>Gap</th>
<th>Recommendations</th>
<th>Page</th>
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<tbody>
<tr>
<td>#1: Permit data for major remodels, alterations and/or additions in existing homes and buildings is not available; nor is data such as the amount of investment (compared to new buildings/homes for example).</td>
<td>The Board of Building Standards could add a section to its annual survey of local building departments to capture the number of permits given for major remodels or additions, which would help the state assess the training needs regarding remodeling of existing homes and buildings.</td>
<td>14</td>
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<td>#2: The state does not have an automatic energy code review process on a three-year cycle.</td>
<td>The BBS should consider adopting an automatic review process for future iterations of the model energy code to lock in future energy savings after the release of each new model energy code.</td>
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<td>#3: The RCAC appears to lack representation from those impacted by new energy codes, such as consumer and environmental advocates. The</td>
<td>In addition to the specific statutorily-required sectors represented on the RCAC (see Appendix A: Excerpts from Ohio Revised Code), appointed individuals should represent other stakeholder groups besides the construction industry, such as environmental and consumer protection groups.</td>
<td>17</td>
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<td>RCAC could also benefit from expertise of building scientists who should be part of the conversation when considering the details of a new residential building code.</td>
<td>Such appointees to the RCAC may be sought from universities, building science related organizations, Energy Code Ambassador Program, or the Ohio Consumer’s Council, Energy Star builders, and home energy raters.</td>
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<td><strong>#4:</strong> Other than the standards in place for K-12 schools, Ohio has not adopted a modern energy code for state-funded buildings, nor one that “pushes the market” by leading by example.</td>
<td>The state should “lead by example” by requiring standards for state-owned, state-leased or state-funded buildings that are more stringent than minimum state energy codes. By requiring more advanced energy standards for state-funded buildings, the state demonstrates fiscal responsibility with tax payer dollars. Also, more efficient public buildings are a hedge against uncertain future energy costs and availability, and reduce the government’s susceptibility to fuel price increases. Use of advanced standards also familiarizes and trains the construction industry and code enforcement officials, and increases demand for “greener” products from product suppliers, manufacturers and service providers, stimulating the local economy.</td>
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<td><strong>#5:</strong> The Performance Contracts program administered by the OFCC to state agencies is an exemplary program that is saving Ohio significant dollars. There is no equivalent program for local governments.</td>
<td>The Ohio energy office should consider the feasibility of offering consulting services to local governments (in addition to state agencies). Alternatively, perhaps the SAO Performance Contracts model could be replicated at the county-level to help municipalities reduce energy use and familiarize local construction communities with modern building products and practices, helping to pave the way for future energy code updates.</td>
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| **#6:** State building inspectors and Plan Reviewers tend to prioritize the health and safety provisions of the commercial energy code over the energy provisions, and state inspectors are not required to inspect for energy provisions other than insulation. It is unknown whether inspectors are enforcing the other energy provisions of the OBC. | The BBS should emphasize to state building inspectors that the energy code should be prioritized with equal importance as other building codes. For example the BBS should:  
- Require that all energy provisions of the OBC are inspected.  
- Heighten the importance that code enforcement staff put on the energy provisions of the OBC by providing information to Plan Reviewers and Field Inspectors about how energy codes benefit Ohioans and benefit the state.  
In addition, the state should conduct an energy code compliance evaluation study to determine the specific strengths, weaknesses and needs in enforcement of the energy provisions of the OBC (see Gap and Recommendation #18). |
| **#7:** Numerous additional compliance paths add complexity and confusion to the residential energy code (see Figure 7: RCO Compliance Options). | With the next adoption of the energy code, the BBS should strive to simplify the residential code if possible, so that there are fewer methods of compliance. This will reduce confusion among the construction community, the code enforcement community and the public. |
**#8:** Unlike the commercial building code, residential building code enforcement is absent in a large portion of the state. There is no oversight or administration to protect citizens from residential construction that could result in life-threatening or costly dwellings for Ohioans.

**Recommendation:** The Ohio energy office should coordinate with the BBS to consider the best approach to providing state-administered plan review and building code enforcement for residential dwellings in areas without enforcement. A precedent for state-enforcement of the building code already exists since the commercial building code has both local and state enforcement. An Energy Code Collaborative in Ohio could be tasked with this as an issue (see Gap and Recommendation #9).

**#9:** Ohio lacks an Energy Code Compliance Collaborative to help it achieve greater compliance with energy codes.

The Ohio energy office should convene an Energy Code Compliance Collaborative; a forum for experts from diverse stakeholder groups impacted by energy codes to come together to work toward common interests and goals. The collaborative is a long-term initiative to assist its state in implementing a plan to achieve full compliance with energy codes. An Energy Code Compliance Collaborative can:

- Provide a team of local experts to assist the state in implementing a plan to achieve full compliance with energy codes, which may be especially helpful at times when Ohio faces declining budgets and resources;
- Provide a forum for improving relations between diverse stakeholders affected by energy codes as stakeholders listen and learn about each other’s concerns, and work together to find common interests and goals.

**#10:** Builders and contractors don’t seek out free BBS training and technical assistance; leaving the training to the local building inspector, who doesn’t have time to train the builders and contractors. As building products and practices evolve, it’s important that the construction industry understand the changes.

**A:** As a first step, the state should conduct a study of residential and commercial buildings to determine actual energy code compliance and assess the needs of the construction industry (see Gap #18).

**B:** Consider approaches to require that builders and contractors be licensed and required to obtain CEUs like other construction trade professionals. See Construction Professionals section of this report.

**C:** The state should offer specialized education to the construction industry in such a way that the benefits of taking time off to attend are clear from the builders’ perspective. Builders must understand the marketing benefits and financial gain for building energy-efficient homes. For example, by attending a course, builders will learn to implement approaches to construct the best homes possible, at the lowest cost. The Ohio energy office could partner with an existing non-governmental organization, (e.g. OHBA or the Mid-Ohio Regional Planning Commission) to develop/market such a program.

**#11:** Consumers don’t have

**Recommendation:** In order to help increase demand for
ready-made information available to be able to compare the energy-efficiency of one building to another. There’s a lack of easily accessible information during the buying process.

new, highly efficient homes and recognize builders and raise public awareness, the Ohio energy office or Collaborative should reach out to consumers and key stakeholders that influence consumers. For example:

- **Raise consumer demand for home energy-efficiency.** Launch a statewide campaign including public relations efforts and earned media radio and TV interviews, news releases and articles all with the intent to raise awareness of the benefits of energy efficiency.

- **Engage real estate professionals.** Real estate professionals need education to better understand how to assess the energy efficiency of one home compared to another. This may include providing a check box to the Multiple Listing Services (MLS) to help agents (and buyers) compare the energy-efficiency of sale listings. Training with Continuing Education (CE) credits could accompany a larger effort to provide training to this audience.

- **Consumers** need concise information at the right time - while shopping for new homes or buildings - about the benefits of energy efficiency in order to demand it from builders. Since energy efficiency is largely “out of sight, out of mind” to consumers, the state or Collaborative could consider ways to educate the general public and create demand for more energy-efficient construction, making energy codes easier to adopt as the people become more aware and begin to demand energy-efficiency in new housing.

Other actions the Collaborative could consider are:

- Expand the Energy Star® New Homes program currently offered in Columbia Gas and AEP territories (see ENERGY STAR for Homes section of this report), to offer paid incentives for builders that achieve above-code standards.

- Expand the state’s existing code training website to include modules designed especially for builders and contractors.

- Work with Appraisers to boost the appraised value of buildings built to code or better.

- Work with lenders to create a financial incentive program for energy-efficient homes and buildings; such buildings have lower monthly bills and borrowers are less likely to default on mortgages.

| #12: Residential dwelling plans do not require an Architect’s seal; there are no requirements for the qualifications of design professionals that often work | **Recommendation A:** The Ohio energy office, BBS, and the Collaborative should work together to seek solutions to improving the quality of the plans submitted to building departments. Consider requiring the same stringency for both commercial and residential building plans to assure |
with home builders.

<table>
<thead>
<tr>
<th>#13: Residential general contractors are not required to be licensed in Ohio. They are not required to have experience nor obtain any education related to building codes or state energy standards. Without such requirements there is no motivation for those in the construction community to obtain formal education, or take a class on the energy code.</th>
<th><strong>Recommendation:</strong> The appropriate way to solve this problem is to require residential designers, general contractors and their sub-contractors (electrical, plumbing, etc.) to be licensed and obtain CEUs, as they are for commercial construction. This would help solve numerous building code compliance issues, and protect Ohio citizens from sub-standard construction that may be dangerous, not withstand severe weather events, and cause building owners to have high energy bills over the lifetime of the structure. The state has already made efforts to partner with the OHBA to offer classes to their members, and offers free training classes on building codes. However, attendance by builders is consistently low.</th>
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<td><strong>Recommendation B:</strong> Forge strategic alliances with community colleges - especially any that have recently received grants for “green jobs” training to coordinate and encourage (and perhaps provide additional funding for) the inclusion of energy code training (and/or RESNET training) for students who may become code officials or building professionals upon graduation. Structure the collaboration to assure that the community college continues to teach the energy code even when the funding is exhausted so that the next generation of construction trades professionals are better informed about the importance of including energy efficiency in the design and construction of buildings in Ohio.</td>
<td></td>
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<tr>
<td>#14: There is a lack of political support at the local government level to “champion” energy codes. Areas with a local champion (whether within a building department, a mayor, or other political figure), are more successful in implementing energy codes.</td>
<td><strong>A:</strong> The Ohio energy office should consider ways to give public acknowledgement to those local governments that are taking leadership roles in moving energy codes forward. To help with market transformation, the Ohio energy office should recognize and publicize existing champions as role models for the state. The Ohio energy office should work with the Mayors Associations, the Mid-Ohio Regional Planning Commission, the Municipal League, utilities that offer rebates for energy-efficient construction and/or other similar groups to raise awareness among local government leaders of what other municipalities within Ohio are doing to take a leadership role in energy efficiency. Key messages should include that their work demonstrates fiscal responsibility for taxpayer dollars, stimulates jobs, and saves people in their community money through lower energy bills. For example, awards and news releases could be disseminated for those that have recently completed an energy-efficiency upgrade to an existing building; completed a new efficient building or home and related efforts. It is a cost-effective way to educate the public and other builders and move the market forward.</td>
</tr>
</tbody>
</table>
Even those best practices that may not seem “news-worthy” could be acknowledged. For example, a building department that creates a simple but efficient method (such as a random sample) of requiring energy ratings from builders, or an energy code checklist that’s given to builders are best practices that could be highlighted on the BBS website to acknowledge the local jurisdictions going above and beyond, and provide ideas for other local building departments.

**B**: The Ohio energy office could make a list of Energy Code Ambassadors available on their websites, to acknowledge existing champions in Ohio. Highlighting the good work of peers helps to transform the market and encourages leadership by others.

| **#15**: Local jurisdictions don’t have simplified, ready-made compliance materials to provide to builders and designers. | BBS could create ready-made materials tailored for design professionals and contractors, such as a list of inspections, compliance checklists, or a form that describes to builders/contractors specific requirements for especially confusing provisions of the energy code. Local jurisdictions could require that builders submit such forms with the permit application. Such forms could help relieve some pressure from the Plan Reviewer who typically is the front line in dealing with confused builders.

In addition, the Ohio energy office/BBS could develop and provide ready-made marketing materials that support building departments as they educate designers and consumers about the importance and benefits of energy codes. Informational outreach materials targeted to different audiences such as consumers, designers, and policymakers would assist code enforcement personnel who are in the position of defending and educating codes. Information should emphasize the potential money saved by lower energy bills in order to gain support for private investments in energy-efficiency and boost market demand for energy-efficient products and services. | 38 |

| **#16**: There is no ongoing support for the Ohio Energy Code Ambassador Program. | **A**: Provide existing Ambassadors with continued honorariums to continue to energize the program and include the construction industry into the targeted audience.

**B**: Expand the ECAP program by certifying more candidates and opening the program to other interested parties such as HERS Raters. | 40 |

| **#17**: A plan to achieve energy code compliance has not yet been implemented. | The Ohio energy office and the BBS should utilize the outline of a Strategic Compliance Plan provided to the state by BCAP in 2014 as the basis for implementing the tasks necessary to improve energy code compliance. | 40 |

| **#18**: The state has not conducted | The energy office should conduct a compliance evaluation | 41 |
an energy code compliance evaluation study; current compliance is unknown. There is not a method in place to measure and assess compliance with the energy code.

<table>
<thead>
<tr>
<th>Study to determine the current level of compliance with its commercial and residential energy codes. The energy office should review DOE’s guidance on measuring energy code compliance. The study should include both:</th>
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<tr>
<td>• A determination of the current level of compliance with the energy provisions of the OBC and RCO (both during plan review and field inspection); and</td>
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<tr>
<td>• A determination of the needs regarding the process of enforcing the energy provisions of the OBC and RCO.</td>
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<td>The DOE provides assistance to help states in designing a compliance verification study.</td>
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<td>In addition, the BBS should develop an ongoing process to measure and evaluate compliance, including an annual survey to Certified Building Departments. The Ohio energy office could coordinate an “Energy Code Collaborative” – a group of stakeholders that could work together to assist the state in its efforts to conduct a compliance study.</td>
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<tr>
<td>Also, it would be helpful and more efficient for local jurisdictions to be able to submit their Yearly Operational Reports online. This would allow the BBS to capture permit data for assessing construction rates, identifying trends, and other information and be more useful than the paper formats.</td>
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### #19: Ohio lacks a funding mechanism to implement many of the recommendations within this report.

**A:** The state should consider potential sources of funding for energy code activities. Some of the recommendations may be very cost-effective (e.g. updating the BBS website), while others will be more costly (e.g. a state compliance study). Where possible, leverage funding; with utility companies or organizations with grant funding, for example.  

**B:** The state energy office, BBS, or an Energy Code Compliance Collaborative should educate policy-makers in the state so that they understand the benefits of energy codes to Ohio, and the state’s obligations to DOE.  

**C:** The EERS legislation that mandates IOUs to meet set energy reduction goals may be a potential source of funding. The Ohio energy office should investigate opportunities to engage utilities in support of energy codes.

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**xv** For more information, see www.energycodes.gov/compliance/evaluation
ACKNOWLEDGMENTS

This report was prepared by the Building Codes Assistance Project with funding from the Ohio Development Services Agency’s Office of Energy and Redevelopment with funding from United States Department of Energy’s State Energy Program. Additional supplemental funding was provided by the Energy Foundation.

We are grateful for the thoughtful review of this report by the Ohio Board of Building Standards and the Midwest Energy Efficiency Alliance (MEEA). Many state and local officials, builders, code officials, design and construction professionals, utility and trade association representatives, and other interested parties provided us with crucial insights that contributed to our efforts to document and analyze energy code issues in Ohio. The opinions expressed in this report are our own and are not necessarily endorsed by any of the people that helped us.

Cover image taken in Cincinnati, OH, courtesy of Shutterstock, by author Bryan Busovicki
APPENDIX A: EXCERPTS FROM OHIO REVISED CODE

Section 3781.07 “Organization of the Board” reads, “One of the members appointed to the board shall be an attorney at law, admitted to the bar of this state; two shall be registered architects; two shall be professional engineers, one in the field of mechanical and one in the field of structural engineering, each of whom shall be duly licensed to practice such profession in this state; one shall be a person of recognized ability, broad training, and fifteen years experience in problems and practice incidental to the construction and equipment of buildings specified in section 3781.06 of the Revised Code; one shall be a person with recognized ability and experience in the manufacture and construction of industrialized units as defined in section 3781.06 of the Revised Code; one shall be a member of the fire service with recognized ability and broad training in the field of fire protection and suppression; one shall be a person with at least ten years of experience and recognized expertise in building codes and standards and the manufacture of construction materials; one shall be a general contractor with experience in residential and commercial construction; two, chosen from a list of ten names the Ohio home builders association submits to the governor, shall be general contractors who have recognized ability in the construction of residential buildings; one shall be a person with recognized ability and experience in the use of advanced and renewable energy in the construction of commercial and residential buildings; one shall be a person with recognized ability and experience in the use of energy conservation in the construction of commercial and residential buildings; and one, chosen from a list of three names the Ohio municipal league submits to the governor, shall be the mayor of a municipal corporation in which the Ohio residential and nonresidential building codes are being enforced in the municipal corporation by a certified building department.”

Section 4740.14 “Residential construction advisory committee - recommendation of residential building code” reads, “(A) There is hereby created within the department of commerce the residential construction advisory committee consisting of nine persons the director of commerce appoints. The advisory committee shall be made up of the following members: (1) Three shall be general contractors who have recognized ability and experience in the construction of residential buildings. (2) Two shall be building officials who have experience administering and enforcing a residential building code. (3) One, chosen from a list of three names the Ohio fire chief’s association submits, shall be from the fire service certified as a fire safety inspector who has at least ten years of experience enforcing fire or building codes. (4) One shall be a residential contractor who has recognized ability and experience in the remodeling and construction of residential buildings. (5) One shall be an architect registered pursuant to Chapter 4703. of the Revised Code, with recognized ability and experience in the architecture of residential buildings. (6) One, chosen from a list of three names the Ohio municipal league submits to the director, shall be a mayor of a municipal corporation in which the Ohio residential building code is being enforced in the municipal corporation by a certified building department.”
APPENDIX B: OHIO ENERGY COMPLIANCE FLOWCHART

* As defined in the IECC

Ohio Building Code (OBC) Chapter 13

Residential Code of Ohio (RCO) Chapter 11 (based upon 2009 IRC w/DOE & Ohio changes) Section 1101.2

IECC 2009

ASHRAE 90.1-07
Scopes of standard includes all buildings except low-rise residential structures meaning:
2. Group R-1
3. Multi-family structures (R-2, R-3, and R-4) > 3 stories above grade

IECC 2009 - Chapter 4

IECC 2009 - Chapter 4: Mandatory Prescriptive (Sections 401.1, 402.1, 403.1, 404.1, 405.1, 406.1, 407.1, and 408.1)

ASHRAE 90.1

IECC 2009 - Chapter 5

IECC 2009 - Chapter 4: Simulated Prescriptive

IECC 2009 - Chapter 4: Simplified Prescriptive

IECC 2009 - Chapter 4: Simplified Performance

IECC 2009 - Chapter 4: Enhanced Performance

IECC 2009 - Chapter 4: Advanced Performance

ENR/Design, ENR/Use, DOE-2, EnergyGage, DOE-2, EnergyGage Summit Package, Testa Testa, and other simulation tools that demonstrate code compliance
The U.S. Department of Energy’s Building Energy Code Program (BECP) provides technical assistance and important resources to assist states and local governments and other code users at energycodes.gov.

An example of some key BECP resources for improving code compliance include:


- **DOE-sponsored software programs Rescheck and Comcheck**, which simplify the process of evaluating energy code compliance in residential and commercial buildings, and can help designers, builders, and code officials streamline code compliance efforts. [http://www.energycodes.gov/software-and-web-tools](http://www.energycodes.gov/software-and-web-tools)

- **Resource Guides** that provide custom information for specific code users such as: Architects and designers, policy makers, and Code Officials (including sample inspection checklists); and information on specific topics such as: air leakage, lighting, beyond code, and HVAC controls. [http://www.energycodes.gov/resource-center/resource-guides](http://www.energycodes.gov/resource-center/resource-guides)

APPENDIX D: COST ANALYSIS

TRUE COST OF THE
2009 INTERNATIONAL ENERGY CONSERVATION CODE

One of the major barriers to energy code adoption across the country is the concern that new codes will add to the purchase price and potential buyers will not be able to afford the homes they want. In Ohio, upgrading homes to the 2009 International Energy Conservation Code will actually reduce out-of-pocket expenses for homeowners — paying off their initial investment in a matter of months.

For the average new home, BCAP estimates the costs of the new code will add a total of $803 in construction costs—an increase of only 0.3%. When this amount is rolled into the average mortgage, real costs to homebuyers will mean a down payment increase of $166.61, and $3.47 extra on monthly mortgage bills.

These added mortgage costs will be offset, however, by monthly energy savings of $19.08, helping homebuyers pay off their initial investment in only eleven months. After breaking even in month eleven, the home will return buyers a profit of $16 per month—for a total return of $190 every year. This return on investment is graphed below and presented as a balance sheet at right.

Energy Code Payback for Ohio Single Family Homes:

<table>
<thead>
<tr>
<th>Month</th>
<th>Mortgage Increase</th>
<th>Monthly Energy Savings</th>
<th>Cumulative Cost/Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$100.61</td>
<td>$19.08</td>
<td>-$141.53</td>
</tr>
<tr>
<td>2</td>
<td>$3.47</td>
<td>$19.08</td>
<td>-$103.11</td>
</tr>
<tr>
<td>3</td>
<td>$3.47</td>
<td>$19.08</td>
<td>-$94.70</td>
</tr>
<tr>
<td>4</td>
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<td>$19.08</td>
<td>-$79.09</td>
</tr>
<tr>
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<td>$3.47</td>
<td>$19.08</td>
<td>-$63.48</td>
</tr>
<tr>
<td>6</td>
<td>$3.47</td>
<td>$19.08</td>
<td>-$47.87</td>
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<tr>
<td>7</td>
<td>$3.47</td>
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<td>-$31.26</td>
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<td>$19.08</td>
<td>-$1.94</td>
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<td>$19.08</td>
<td>$14.57</td>
</tr>
<tr>
<td>11</td>
<td>$3.47</td>
<td>$19.08</td>
<td>Break Even</td>
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<tr>
<td>12</td>
<td>$3.47</td>
<td>$19.08</td>
<td>$30.18</td>
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<td>$3.47</td>
<td>$19.08</td>
<td>$108.23</td>
</tr>
<tr>
<td>18</td>
<td>$3.47</td>
<td>$19.08</td>
<td>$123.84</td>
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</tbody>
</table>

This model assumes an average sale price of $297,415 for a 2,400 square foot home. The mortgage is conservatively set at 30 years, with 15% down and the current average nationwide interest rate of 5.05%. With a lower down payment—such as 10% down—consumers will break even on their investment sooner.

BCAP
Dedicated to the adoption, implementation, and enforcement of building energy codes
for the full incremental Cost Analysis study, please visit: bcap-ohio.org
THE POTENTIAL IMPACT OF FULL COMPLIANCE WITH 2009 ENERGY CODES IN OHIO

As one component of the building codes adopted by state and local governments, energy codes specify minimum requirements for the efficient design and construction of new and renovated residential and commercial buildings. Ohio’s current code is based on the 2009 International Energy Conservation Code (IECC) and ASHRAE Standard 90.1-2007.

Assuming a baseline compliance rate of 80%, if the state achieved full compliance with its current energy code beginning in 2017, then by 2040 Ohio would...

STRENGTHEN THE ECONOMY & REDUCE IMPORTS

- Allow businesses and households to keep about $121 million annually via reduced energy bills (about $1.54 billion cumulatively through 2040).

- Reduce the demand for about 8 trillion Btu of energy per year (about 1% less than the projected baseline energy demand of Ohio’s building sector in 2040).

- Reduce the need for state and federal funding for low-income households that struggle with high energy bills.

PROTECT CONSUMERS AND PROMOTE HEALTH AND SAFETY

- The vast majority (83%) of Midwest consumers believe that homeowners should have a right to a home that meets national energy standards. Most (75%) believe that energy codes should be enforced like other safety and quality standards of construction.

- Lower monthly energy bills typically exceed the slight increase in the monthly mortgage payment when amortized over a standard mortgage.

REDUCE POLLUTION

- Eliminate about 5 million metric tons (MMT) of CO₂ emissions cumulatively, equivalent to one year of emissions from:
  - Over 1 million passenger vehicles.
  - The energy use of over 400,000 Ohio homes.
  - About 1.6 coal-fired power plants.

- Energy codes protect homeowners and tenants from excessive energy costs. Buildings that meet or exceed national standards are more durable and comfortable, with fewer drafts.

- Policymakers and government leaders can ensure that energy codes are enforced as effectively as other life, health, and safety codes. Residents have the right to energy-efficient homes built with modern technology and building practices.

- Buildings that meet national standards reduce pollution because fewer fossil fuels are combusted to meet demand. This reduces air, water, and land pollution and improves public health and the environment.
THE POTENTIAL IMPACT OF FULL COMPLIANCE OF 2012 ENERGY CODES IN OHIO

As one component of the building codes adopted by state and local governments, energy codes specify minimum requirements for the efficient design and construction of new and renovated residential and commercial buildings. Ohio’s current code is based on the 2009 International Energy Conservation Code (IECC) and ASHRAE Standard 90.1-2007.

Assuming a baseline compliance rate of 80% with the current code, if Ohio were to adopt and achieve full compliance with the 2012 edition of the IECC and 2010 edition of ASHRAE Standard 90.1 by the year 2017, then by 2040 Ohio would...

STRENGTHEN THE ECONOMY & REDUCE IMPORTS

- Allow businesses and households to keep about $835 million annually via reduced energy bills (about $10.2 billion cumulatively through 2040).
- Reduce the demand for about 56 trillion Btu of energy per year (about 7.3% less than the projected baseline energy demand of Ohio’s building sector in 2040).
- Reduce the need for state and federal funding for low-income households that struggle with high energy bills.

Millions of Ohio dollars flow out of state to import energy for buildings. Through lower energy bills, households can improve the standard of living for families and strengthen the economy. Ohio businesses with reduced energy costs are more competitive and less likely to move overseas to cut costs.

Upfront efficiency improvements through energy code implementation are much more cost-effective than back-end retrofit and subsidy programs. Over $165 million was spent to assist low-income Ohio households with high energy bills in 2012.

PROTECT CONSUMERS AND PROMOTE HEALTH AND SAFETY

- The vast majority (83%) of Midwest consumers believe that homeowners should have a right to a home that meets national energy standards. Most (75%) believe that energy codes should be enforced like other safety and quality standards of construction.
- Lower monthly energy bills typically exceed the slight increase in the monthly mortgage payment when amortized over a standard mortgage.

Energy codes protect homeowners and tenants from excessive energy costs. Buildings that meet or exceed national standards are more durable and comfortable, with fewer drafts. Policymakers and government leaders can ensure that energy codes are enforced as effectively as other life, health, and safety codes. Residents have the right to energy-efficient homes built with modern technology and building practices.

REDUCE POLLUTION

- Eliminate about 41 million metric tons (MMT) of CO₂ emissions cumulatively, equivalent to one year of emissions from:
  - 8.6 million passenger vehicles.
  - The energy use of 3.4 million homes.
  - Eleven coal-fired power plants.

Buildings that meet national standards reduce pollution because fewer fossil fuels are combusted to meet demand. This reduces air, water, and land pollution and improves public health and the environment.
REFERENCES

Number derived by adding 2010 building sources of CO₂ (residential, commercial and industrial), then dividing by total CO₂. See page Energy 3-1 for Table 3-1 depicting Gas/Source information from 1990-2010.
30 Ibid
31 Ibid
38 Numerous enforcement staff was interviewed for this report between November, 2013 and March 2013, and again between January 2014 and July 2014. Comments were kept confidential.

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