Highlights

+ Energy & Buildings (INTRO)
+ DOE Program Overview (BECP)
+ Available Resources
+ Field Study Highlights (UPDATE)
ENERGY PRODUCTION IN TRILLION BTU: 2012

Click on each state to learn more about how much energy it produces

Source: EIA State Energy Data Systems
Maps & Gadgets (energy.gov/maps)

Personal Energy Use
U.S. Oil Production
COP21 Country CO₂
Energy & carbon
Power Plants
DOE National Labs

Renewable Production
eGallon Calculator
Utility-scale PV Cost
Wind Manufacturing
Smart Meter Installations
Alternative Fuel Stations
U.S. Department of Energy

Mission: Ensure America’s security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions.

Energy Efficiency & Renewable Energy (EERE):
  + Initiatives targeting energy efficiency & renewables
  + Spans several technology offices (e.g., Buildings, Vehicles, Solar, Wind, Hydrogen, etc.)

Building Technologies Office (BTO):
  + Focus on technologies in residential & commercial buildings
  + From R & D, to deployment, and eventual standardization

http://energy.gov/eere/buildings/building-technologies-office
FY11:  $25,692,000,000
- 90% approved
- 57% enacted

FY16:  $30B
- $8.8 Weapons Activities to ensure a safe, secure, and effective nuclear stockpile, and sustain nuclear security research and development.
- $5.8 billion for Environmental Management to address the legal and moral obligations to clean up the legacy of the Cold War, including $248 million to maintain critical progress toward returning the Waste Isolation Pilot Plant to normal operations, with the goal of restarting limited operations early in 2016.
- $1.9 billion for nuclear nonproliferation activities that will continue to reduce global stocks of weapons useable nuclear materials.
- $2.72B EERE
Why Buildings?

“Residential & commercial buildings represent the single largest energy-consuming sector in the U.S. economy—responsible for more than 70% of our electricity, and 40% of total energy demand & greenhouse gas emissions.”
Building Technologies Office

**Ecosystem** (Helix):

- **Emerging Tech**: New technology R&D
- **Deployment**: Market-based activities to validate R&D
- **Codes & Standards**: Market standardization
DOE Building Energy Codes Program

**Federal Role:** DOE plays a role in all aspects of energy codes:

- Participate in code development and consensus processes (e.g., ICC & ASHRAE)
- Review published editions of IECC & Standard 90.1
- Provide technical assistance to support state code implementation

**Statutory Directives** (42 USC 6833 through 6836):

- Participate in code development and consensus processes (e.g., ICC & ASHRAE)
- Review published editions of IECC & Standard 90.1
- Provide technical assistance to support state code implementation

http://www.energycodes.gov/about/statutory-requirements
How are energy codes developed?

There are two model energy codes:

2. Commercial: Standard 90.1 (ANSI/ASHRAE/IES)

Developed through public consensus processes:

1. Broad range of stakeholders and interests
2. Published every three years
3. Anyone can participate!

https://www.youtube.com/watch?v=ZB_IR1RCM7o
DOE Model Code Determinations (42 USC 6833)

Review: DOE is required by federal law to evaluate the IECC & 90.1, and issue a determination as to whether new editions will increase EE.

+ Residential: 2015 IECC (0.7% energy cost savings vs. 2012 IECC)
+ Commercial: Standard 90.1-2013 (8.7% energy cost savings vs. 90.1-2010)

State Certifications: If the DOE issues an affirmative determination, states are required to review and/or update their codes within 2 years.

+ Residential: June 12, 2017
+ Commercial: September 26, 2016

https://www.energycodes.gov/determinations
Federal Building Standards (42 USC 6834 & 6835)

Federal Buildings: DOE also establishes minimum energy efficiency standards for all new federal buildings:

+ Commercial: 90.1-2013 (10 CFR 433)
+ Residential: 2009 IECC (10 CFR 435)

Target: 30% better than the minimum standard (where cost-effective)

Commercial Code Improvement

ENERGY USE INTENSITY (EUI)


- 90.1-2004
- 90.1-2007
- 90.1-2010
- 90.1-2013
Support for Code Implementation (42 USC 6833)

**Technical Assistance**: DOE is directed to provide technical assistance to support implementation of state building energy efficiency codes.

**Examples**:

- Technical analysis (national and state-level)
- Adoption tracking (maps)
- Field studies (residential & commercial)
- Compliance tools & resources (e.g. RES/COMcheck, field studies, etc.)
Michigan

Current Codes:
- 2009 IECC*
- 90.1-2007

Savings Potential*:
- \(x\) quads
- \$230 million
- \(y\) CO2

State Tracking:
- Code news & events
- Current codes (res & com)
- Amendments
- Adoption framework (e.g. Dillon’s vs. Home Rule)
- Certifications
- Important dates
- RES/COMcheck
- State-specific analysis:
  - Energy & cost savings
  - Cost-effectiveness
  - Impacts (E, $, CO2)
- State-owned buildings

...And more!
Building energy codes are projected to save U.S. home and business owners (2010-2040)

**Impact:**
+ $126B (energy costs)
+ 841 MMT (avoided CO₂)
+ 12.82 quads* (primary energy)

**Equivalency:**
+ 177M passenger vehicles
+ 245 coal power plants
+ 89 million homes

* For perspective, the primary energy consumption of the entire U.S. commercial & residential sectors in 2015 was estimated at 38 quads
Available Resources
Building Energy Codes Program

How Much Do Energy Codes Save?
Energy codes will save U.S. home and business owners $126 billion through 2040. This equates to 841 million metric tons of avoided carbon emissions. Learn more...

Popular Links
Tools
- COMcheck
- REScheck

Technical Assistance
- Help Desk

Status of State Energy Codes
- Select a state

News
- Kathleen Hogan Awarded 2016 Sammie for Career Achievement
  Source: Partnership for Public Service
- Guide to Understanding What Builders Want from HERS Ratings
Sample publications:

+ Energy & cost savings (national & state)
+ Cost-effectiveness (national & state)
+ Impact analysis (E, $, CO₂)
+ Specialized studies (e.g. HERS and the IECC)
+ Supporting methodologies (technical support documents)
+ State-level cost calculator (customizable)
State Technical Assistance

Typical requests from states:

+ Energy savings and cost impacts associated with codes
+ Comparative analysis of future codes and amendments
+ Draft code language and requirements
+ Customized educational and training resources
+ Web-based and in-person training programs
+ Compliance resources and software tools

https://www.energycodes.gov/adoption/technical-assistance
REScheck & COMcheck™

Compliance software:

+ Simplifies compliance with IECC & Standard 90.1
+ Assists architects, engineers and builders in demonstrating energy code compliance
+ Creates compliance reports for code officials based on project inputs
+ New user interface currently under development
+ Available *free of charge* in both desktop and web-based formats

https://www.energycodes.gov/software-and-web-tools
Training Portal & Webinar Series

Presentations:

+ Codes 101: An Introduction to Building Energy Codes
+ Model code updates:
  - **90.1**: 2007, 2010, 2013
+ Series: Adoption, Compliance & Enforcement (ACE)

Webinars:

+ Energy Code Compliance Paths
+ Tight Residential Envelopes
+ REScheck & COMcheck Basics
+ Lighting Requirements of 90.1-2013
+ 2015 IECC Energy Rating Index (ERI)
+ Introduction to Commercial HVAC
+ Daylighting Controls
Resource Center

Search additional tools & resources:

+ Help Desk (user inquiries)
+ Training resources
+ Publications
+ Resource Guides
+ Code notes
+ Technical articles
+ Software tools
+ Compliance materials (e.g. checklists)
+ FAQ search
+ Building America™ Solution Center

https://www.energycodes.gov/resource-center
Help Desk

Common questions:

+ What’s the code in my jurisdiction?
+ What’s required?
+ Who should I talk to?
+ What resources are available?
+ Where can I get more information?

https://www.energycodes.gov/HelpDesk
Updates

Subscribe to our stakeholder mailing lists:

+ BECP News & Updates
+ Development
+ Compliance tools
+ Publications
+ Events & training

https://www.energycodes.gov/subscribe
National Energy Codes Conference

Highlights:

+ Sessions on energy code development, adoption, compliance, policy and research
+ Over 200 attendees from 35 states
+ Past program and presentations are available
+ Presentation of the J.A. Johnson Award
+ Currently planning the 2017 event (July 17-20th) in Pittsburgh, PA—submit your ideas!

Regional Energy Efficiency Organizations (REEO)
Highlights: Field Studies
Residential Energy Code Field Study

Background:
+ Compliance is key to ensuring code-intended savings
+ Largely unknown—uncertainty with past studies
+ $6M in funding across 8 states (plus a few more)

Objectives:
+ Establish a methodology that equates to energy
+ Assemble a set of empirical data based on field observations
+ Build the business case for private investment (e.g. utilities)

https://www.energycodes.gov/compliance/residential-energy-code-field-study
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<thead>
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<th>STATE</th>
<th>LEAD ORGANIZATION</th>
<th>STATUS</th>
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<tbody>
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<td>AL</td>
<td>Institute for Market Transformation (IMT)</td>
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<tr>
<td>AR</td>
<td>Southeast Energy Efficiency Alliance (SEEA)</td>
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<tr>
<td>GA</td>
<td>Southeast Energy Efficiency Alliance (SEEA)</td>
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<tr>
<td>KY</td>
<td>Midwest Energy Efficiency Alliance (MEEA)</td>
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<td>*MI</td>
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<td>Appalachian State University</td>
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<td>PA</td>
<td>Performance Systems Development (PSD)</td>
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<td>TX</td>
<td>National Association of State Energy Officials (NASEO)</td>
<td>Complete</td>
</tr>
<tr>
<td>*WV</td>
<td>Appalachian Residential Consortium for EE</td>
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</table>
Residential Methodology

Highlights:

+ Results based on energy metric reported at the state level
+ Based on a single site visit within new single-family homes
+ Focus on key measures with largest direct energy impact
+ Data confidentiality—no personal data shared
+ Designed for statistically significant results
+ Can be replicated in other states at a reasonable cost
<table>
<thead>
<tr>
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<th>HOMES</th>
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<td>AL</td>
<td>2A, 3A</td>
<td>2015 Alabama State Energy Code (2009 IECC w/ amendments)</td>
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<tr>
<td>AR</td>
<td>3A, 4A</td>
<td>2014 Arkansas State Energy Code (2009 IECC w/ amendments)</td>
<td>226</td>
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<td>GA</td>
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<td>GA State Energy Code (2009 IECC w/ amendments)</td>
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<td>KY</td>
<td>4A</td>
<td>2009 IECC</td>
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<td>4A</td>
<td>2015 IECC</td>
<td>207</td>
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<td>NC</td>
<td>3A, 4A</td>
<td>2012 North Carolina State Energy Code (2009 IECC w/ amendments)</td>
<td>249</td>
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<td>PA</td>
<td>4A, 5A</td>
<td>2009 IECC (2009 IRC)</td>
<td>171</td>
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<tr>
<td>TX</td>
<td>2A</td>
<td>2015 IECC</td>
<td>133</td>
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</table>
Key Items (63 each):

1. Envelope Air Tightness (ACH50)
2. Window U-factor
3. Window SHGC
4. Wall Insulation (R-value)
5. Ceiling Insulation (R-value)
6. Lighting (% HE lamps)
7. Foundation Insulation (R-value)
8. Duct Leakage
ENVELOPE TIGHTNESS
DUCT TIGHTNESS

Kentucky

Maryland

Alabama

North Carolina

Pennsylvania

Texas

Michigan

Arkansas

Climate Zone
cZ 2
cZ 3
cZ 4
cZ 5
cZ 6
cZ 7
EUI ANALYSIS (MD)

MAGENTA = MD Observed (30.49)
BLACK = 2015 IECC (27.56)
Residential Trends

**Lighting**: No consistent trend—surprisingly low compliance

**Envelope & Duct Tightness**: Similar ranges regardless of requirement

**Wall Insulation**: Typically meet label R-values:
- Generally weaker installation quality
- Similar trend for ceiling insulation

**Windows**: Almost all observations exceed requirement:
- Most better than U-factor=0.35 and SHGC=0.3
- Regardless of CZ
<table>
<thead>
<tr>
<th>State</th>
<th>CZ (state)</th>
<th>Code</th>
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<th>Target Measures (% Compliance)</th>
<th>Savings (Annual)</th>
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<td>2A, 3A</td>
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<td>Lighting (35%)</td>
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<td>Envelope Tightness</td>
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<td>Wall Insulation</td>
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<td>Window SHGC</td>
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<td>Wall Insulation</td>
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<td>Duct Leakage (72%)</td>
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<td>4A</td>
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<td>30.49</td>
<td>Envelope Tightness (48%)</td>
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<td>Wall Insulation (27%)</td>
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<td>Lighting (61%)</td>
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<td>Duct Leakage (49%)</td>
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<td>Lighting (62%)</td>
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<td>Ceiling Insulation</td>
<td>$ 443,058</td>
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</table>
Planning a Study?

**Budget:** About $120,000 per study

PNNL services available to those following methodology (free of charge):
+ Sample design
+ Customized data forms
+ Analysis

Commercial methodology pending (targeted 2017)

**For more information:**
+ Webinar overview presentation
+ Methodology guideline (coming soon)
+ Analysis technical support document (coming soon)
+ State project reports (coming soon)
+ Spreadsheets containing field data
+ Overall project report (following Phase III)

https://www.energycodes.gov/compliance/residential-energy-code-field-study
Commercial Field Study

Purpose: Maximize energy & cost savings through increased compliance in commercial buildings.

Lead Organization: Institute for Market Transformation (Washington, DC)

Summary:
+ 4 states {NE, IA, FL, NV}
+ 3 years
+ $2.1M

Project Team:
+ Florida Solar Energy Center (FSEC)
+ Cadmus Group
+ Colorado Code Consulting

http://energy.gov/eere/buildings/articles/funding-opportunity-commercial-energy-codes-field-studies
Commercial Field Study

**Goal**: Develop and pilot a methodology to maximize energy & cost savings through increased compliance in commercial buildings.

**Objectives**:

- Develop a methodology that can be replicated across states
- Identify a sampling protocol that yields representative statewide results
- Create field data collection instruments
- Recruit participating commercial buildings
- Collect field data to fulfill the required sample
- Develop educational resources and pilot training to address common issues
Multifamily Field Study

**Purpose:** Maximize energy & cost savings through increased compliance in multifamily buildings.

**Lead Organization:** Ecotope (Seattle, WA)

**Summary:**
- 4 states {OR, WA, MN, IL}
- 3 years
- $1.6M

**Project Team:**
- Center for Energy & Environment (CEE)
- Seventhwave

[http://energy.gov/eere/buildings/articles/funding-opportunity-commercial-energy-codes-field-studies](http://energy.gov/eere/buildings/articles/funding-opportunity-commercial-energy-codes-field-studies)
Multifamily Field Study

**Goal:** Develop and pilot a methodology to maximize energy & cost savings through increased compliance in multifamily buildings.

**Objectives:**
- Update the existing methodology to address low-rise multifamily buildings
- Identify challenges and practices specific to multifamily buildings (taxonomy)
- Identify a sampling protocol that yields representative statewide results
- Conduct market research to inform future training
Municipal Buildings

**Purpose:** Identify how energy codes influence municipal building portfolios over the life of the buildings.

**Lead Organization:** New Buildings Institute (Portland, OR)

**Summary:**
+ 3 cities {TBD}
+ 3 years
+ $850K

**Project Team:**
+ National Institute of Building Sciences (NIBS)
+ Maalka
+ Integral Group

[http://energy.gov/eere/buildings/articles/funding-opportunity-commercial-energy-codes-field-studies](http://energy.gov/eere/buildings/articles/funding-opportunity-commercial-energy-codes-field-studies)
Why Municipal Buildings?

+ Unique opportunity to study how codes influence building energy consumption over time
+ Typically a single-owner throughout the building lifetime
+ Generally actively managed—energy data and good records
+ Economic advantages over privately-owned buildings
+ Even simply addressing lowest-performing buildings has significant savings
+ Longer term insight on how/why energy consumption has changed over time—and how energy code plays a role
Multifamily Field Study

**Goal**: Identify how energy codes influence municipal building portfolios over the life of the buildings.

**Objectives**:

+ Collect, organize and track data to benchmark the municipal building stock
+ Input field data to EPA Portfolio Manager tool
+ Analyze data to identify low-performing buildings
+ Develop cost-effective mitigation strategies
+ Identify related policies that can be implemented locally to improve portfolio-wide performance
DOE Building Energy Codes Program

For more information:

2017 National Energy Codes Conference
July 17-20, 2017 | Pittsburgh, PA
The only national conference dedicated to all things building energy codes!

Visit: energycodes.gov
Contact: Jeremy Williams
jeremy.williams@ee.doe.gov