



Building Energy Codes

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PDH: 2

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Module 1: Introduction

Learning Objectives

By the end of this section, you will be able to:

- **Identify** the specific impacts of building energy consumption on national security and public health.
- **Evaluate** the statistical significance of the building sector's energy and electricity usage in the United States.
- **Relate** building energy codes to broader economic and environmental solutions.

Executive Summary: Building energy use is a primary driver of national energy demand, consuming nearly 40% of U.S. total primary energy and 70% of its electricity. Implementing and enforcing more stringent building energy codes is a critical strategy to mitigate economic, security, and environmental risks while improving occupant health.

Impact of Building Energy Use

The effects of energy use in buildings are nationwide, worldwide, and varied. These impacts have a fundamental effect on people's lives across several key domains:

- **National Interests:** Energy consumption impacts the economic well-being of the nation, U.S. dependence on foreign oil, and national security.
- **Individual Health:** Rising energy costs can render a conditioned, comfortable, and healthy indoor environment unaffordable, directly affecting human health.
- **Global Environment:** Carbon emissions, which are directly tied to building energy use, affect the health of the planet.

Key Energy Statistics

Data highlights the significant role the building sector plays in the national energy landscape:

- **Primary Energy Consumption:** Nearly 5 million commercial buildings and 115 million residential households in the U.S. consume nearly **40 percent** of the nation's total primary energy.
- **Electricity Demand:** Buildings consume **70 percent** of all electricity in the United States.
- **Carbon Emissions:** In 2007, CO₂ emissions from building services (lighting, HVAC, water heating, etc.) totaled **2517 million metric tons**. This represents 40 percent of the U.S. total and 8 percent of the global total.

The Role of Building Energy Codes

To curb the significant and growing impact of this energy use, the adoption and enforcement of more stringent building energy codes is a critical component.



⚠ **Safety Constraint:** More stringent building energy codes are not just suggestions; they are a vital part of the energy solution required to address economic and environmental challenges.

💡 **Design Tip:** Professionals should view energy codes as a comprehensive framework covering:

- **Benefits:** Addressing current energy, economic, and environmental challenges.
- **Implementation:** Navigating the challenges of adoption, compliance, and enforcement.
- **Development:** Understanding the processes led by the International Code Council (ICC) and ASHRAE.
- **Execution:** Proper incorporation into design and construction across state and local jurisdictions.

Checkpoint Quiz

1. Which sector accounts for approximately 70% of total electricity consumption in the United States?

- a) Industry
- b) Transportation
- c) Buildings
- d) Agriculture

Answer: (c). Per statistics provided by the U.S. Department of Energy, buildings are responsible for 70 percent of U.S. electricity consumption.

2. How does building energy use specifically impact individual human health?

- a) Primarily through outdoor air pollution.
- b) By making comfortable and healthy indoor environments unaffordable as energy costs rise.
- c) Solely through the noise generated by HVAC equipment.
- d) It has no documented effect on individual health.

Answer: (b). High energy costs can prevent individuals from maintaining a healthy, conditioned indoor environment, leading to health issues.

3. Building-related CO₂ emissions account for what percentage of the global total?

- a) 40%
- b) 25%
- c) 8%
- d) 70%

Answer: (c). While building services account for 40% of U.S. carbon emissions, they represent 8% of the total global CO₂ emissions.

Module 2: Code Benefits and Challenges

Learning Objectives

By the end of this section, you will be able to:

- **Quantify** the long-term energy, economic, and environmental impacts of increasing code stringency by 30% to 50%.
- **Evaluate** the systemic roadblocks to code adoption, including lack of training and jurisdictional "patchwork".
- **Analyze** the financial trade-offs between immediate construction savings and long-term building owner cost reductions.

Executive Summary: Increasing building energy code stringency to 30%–50% above 2006 baselines can yield up to \$30 billion in annual cost savings and reduce primary energy use by 3.5-quadrillion Btu by 2030. However, achieving these results requires overcoming critical barriers in statewide adoption, professional training, and the "first-cost" financial challenge.

Strategic Benefits of Stringent Codes

Upgrading the **2006 IECC** and **ASHRAE 90.1-2004** by 30% to 50% provides significant national benefits.

Impact Projections (2015–2030)

| Benefit Category | Impact by 2015 | Impact by 2030 |
|--------------------|--------------------------|-------------------------------------|
| Primary Energy Use | 0.5-quadrillion Btu/year | 3.5-quadrillion Btu/year |
| Owner Cost Savings | >\$4 billion/year | >\$30 billion/year |
| CO2 Reduction | N/A | ~3% of national projected emissions |

Energy Equivalence: The 2030 energy reduction is equivalent to the power generated by **260 medium (450-MW) power plants**.

Critical Roadblocks to Implementation

Despite clear savings, several challenges impede the effective adoption and enforcement of modern codes.

Adoption and Jurisdictional Issues

- **Non-Automatic Adoption:** In most states, adoption is not automatic; without statewide mandates, builders face a **patchwork of codes** across a single region.
- **Guidance Deficits:** Jurisdictions without state-level adoption often lack the necessary guidance or resources for effective implementation.

Enforcement and Manpower

- **Resource Scarcity:** Lack of **manpower** and **training** are primary roadblocks to proper enforcement.
- **Staffing Demands:** Plan reviews and inspections are time-intensive activities that must be factored into department staffing models.

⚠ **Safety Constraint: Training is critical** for design, building, and enforcement communities. Professionals must understand not only new code language but also emerging construction techniques, materials, and technologies.

The "First-Cost" Challenge

A significant gap exists between immediate construction costs and long-term operational savings.

- **Current vs. Future Savings:** Choosing less energy-efficient methods saves money **now**, while efficient designs save money **down the road**.
- **Economic Transformation:** Implementing energy-efficient designs and solar power could cut household energy expenses in 2030 from **\$285 billion** to **\$130 billion**.
- **Global Cost of Inaction:** Failing to catalyze building-sector transformations could increase the cost of meeting climate goals by **\$500 billion per year** globally.

💡 **Design Tip:** Builders are often challenged to justify the initial expense of energy-saving measures. Use public energy-use policies and incentives to influence human behavior and empower stakeholders.

Checkpoint Quiz

1. According to research, what is the projected annual cost savings to building owners by the year 2030 if codes are effectively upgraded and implemented?

- a) \$4 billion
- b) \$15 billion
- c) \$30 billion
- d) \$500 billion

Answer: (c). While savings are projected at \$4 billion by 2015, they are expected to rise to over \$30 billion by 2030.

2. What is a major consequence of a state failing to adopt a statewide energy code?

- a) Reduced construction material costs.
- b) A "patchwork" of varying codes across the region that complicates compliance for builders.
- c) Automatic adoption of the International Green Construction Code.
- d) Elimination of the need for plan reviews.



Answer: (b). Without statewide adoption, jurisdictions are left without guidance, and builders must navigate inconsistent requirements across different local areas.

3. Failing to transform the building sector toward energy efficiency is estimated to increase the global cost of meeting climate goals by how much?

- a) \$4 billion per year
- b) \$30 billion per year
- c) \$130 billion per year
- d) \$500 billion per year

Answer: (d). Research indicates that failure to catalyze these transformations will raise the cost of meeting long-term climate goals by at least \$500 billion annually on a global scale.



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