

Colorado GapAnalysis

December 2010



Prepared by the Building Codes Assistance Project the Colorado Governor's Energy Office, and the Department of Local Affairs for the United States Department of Energy



The Building Codes Assistance Project (BCAP)

BCAP is a non-profit advocacy organization established in 1994 as a joint initiative of the Alliance to Save Energy, the American Council for an Energy-Efficient Economy, and the Natural Resources Defense Council. BCAP focuses on providing state and local governments in the U.S., as well as stakeholder organizations, with support on code adoption and implementation through direct assistance, research, data analysis, and coordination with other activities and allies. With over sixteen years of experience supporting numerous state energy offices and city building departments, along with tracking code activities across the country, BCAP is well-positioned to assist in local and statewide activity to advance codes. As a trusted resource, BCAP is able to identify and navigate past policy and programmatic pitfalls to help states and jurisdictions put the best possible strategy in place to improve efficiency in both new and existing buildings. Our work pulls together local efforts, identifies national-scale issues, and provides a broad perspective, unbiased by corporate/material interests. BCAP also hosts OCEAN—an online international best practice network for energy codes—and is increasingly working abroad to gather and share best practices that provide value across organizations.

Table of Contents

Acronyms and Abbreviations	5
Executive Summary.....	7
Introduction	10
State Overview	10
Construction Overview	11
Energy Portfolio	12
Potential Savings from Energy Codes	13
Adoption	15
Federal Policy	15
EPAct	15
The Recovery Act	15
State Policy.....	16
Political Environment.....	16
Energy Code Infrastructure.....	17
Recent Energy Codes Legislation	17
Other Colorado Building Codes.....	18
Energy Codes for State-funded Facilities	18
Statewide Climate Change Initiatives	19
Overview of Green and Above-Code Programs	20
Local Policy.....	23
Energy Code Adoption Process	23
The IECC and Standard 90.1.....	25
Other Building and Energy Codes	25
Local Adoption Challenges.....	26
Energy Codes for Municipal-funded Facilities	26
Local Climate Change Initiatives	27
Overview of Local Green and Above-Code Building Programs.....	28
Adoption Summary	29
Current Best Practices.....	29
Recommendations	30
Implementation	36

Overview of State and Local Implementation Policies	36
Outreach	36
State’s Role in Promoting Codes.....	36
Local Government’s Role in Promoting Codes.....	37
Stakeholders’ Role in Promoting Codes.....	38
Enforcement Community.....	39
Overview of Enforcement Infrastructure.....	39
Certification.....	42
Training and CEUs	42
Third Party Infrastructure	43
Local Implementation Spotlight.....	44
Design/Construction Community	45
Overview of Design/Construction Community Infrastructure.....	45
Licensing.....	46
Training and CEUs	47
Compliance Measurement and Verification	48
Past and Current Activities.....	48
Implementation Summary	49
Current Best Practices.....	49
Recommendations	50
Conclusion.....	56
Acknowledgments.....	58
Appendix A.....	59
References	61

Acronyms and Abbreviations

ACEEE – American Council for an Energy-Efficient Economy
AIA – American Institute of Architects
ASHRAE – American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BCAP – Building Codes Assistance Project
BPI – Building Performance Institute
CAHB – Colorado Association of Home Builders
CCC – Colorado Codes Consulting
CCI – Colorado Counties, Inc.
CCICC – Colorado Chapter of the International Code Council
CEBP – Colorado Examining Board of Plumbers
CEUs – Continuing Education Units
CHFA - Colorado Housing and Finance Authority
CML – Colorado Municipal League
CO-CHPS – Colorado Collaborative for High Performance Schools
CORE – Community Office for Resource Efficiency
CSEB – Colorado State Electrical Board
DOE – U.S. Department of Energy
DOLA – Colorado Department of Local Affairs
DORA – Colorado Department of Regulatory Agencies
ECAP – Energy Code Ambassadors Program
EEBA – Energy & Environmental Building Alliance
EECBG – Energy Efficiency and Conservation Block Grants
EPA – U.S. Environmental Protection Agency
E-Star – E-Star Colorado
FLIHTC – Federal Low Income Housing Tax Credits
GA – Green Advantage
GBGP – Green Building and Green Points Program
GEO – Governor’s Energy Office
HBA – Home Builders Association
HERS – Home Energy Rating System
IBC – International Building Code
IBPSA-USA – International Building Performance Simulation Association
ICC – International Code Council
IECC – International Energy Conservation Code
IgCC – International Green Construction Code
IRC – International Residential Code
LEED – Leadership in Energy and Environmental Design
MEC – Model Energy Code

MLS – Multiple Listing Service
NABCEP – North American Board of Energy Practitioners
NAHB – National Association of Home Builders
NAIMA – North American Insulation Manufacturers Association
NREL – National Renewable Energy Laboratory
OCEAN – Online Code Environment and Advocacy Network
OED – Denver Office of Economic Development
OEMC – Governor’s Office of Energy Management and Conservation
OSA – Office of the State Architect
PACE – Property Assessed Clean Energy
PIMA – Polyisocyanurate Insulation Manufacturers Association
PNNL – Pacific Northwest National Laboratory
RECA – Responsible Energy Codes Alliance
REMP – Renewable Energy Mitigation Program
RESNET – Residential Energy Services Network
RMI – Rocky Mountain Institute
RPS – Renewable Portfolio Standard
SEP – State Energy Program
SESP – Colorado State Energy Sector Partnership
SWEEP – Southwest Energy Efficiency Project
USGBC – U.S. Green Building Council
WCI – Western Climate Initiative

Executive Summary

The purpose of the Colorado Gap Analysis Report is twofold: 1) document and analyze the strengths and weaknesses of the state's existing energy code adoption and implementation infrastructure and policies; 2) recommend potential actions state agencies, local jurisdictions, and other stakeholders can take to achieve 100 percent compliance with the model energy codes. The report is organized into four sections: Introduction, Adoption, Implementation, and Conclusion. The Adoption and Implementation sections both conclude by listing some of the state's current best practices and making major and minor recommendations for actions that would improve energy code compliance.

The Introduction section provides an overview of relevant state demographics and the impact of the construction boom and subsequent decline. It also covers Colorado's energy portfolio, emphasizing the state's status as a net exporter of energy, and the potential savings available through energy codes. For instance, full compliance with the 2009 International Energy Conservation Code (IECC) would yield approximately 14 percent savings in residential energy use and up to five percent savings in commercial energy use while safeguarding the state's valuable energy exportation industry.

The Adoption section takes a close look at the federal, state, and local policies that influence energy codes in the state. This section covers how Colorado's home rule status affects local adoption of building codes and the statewide minimum energy code, the 2003 IECC. It describes the roles of the Governor's Energy Office (GEO), the Department of Local Affairs (DOLA), and other state agencies in this process. Moreover, this section calls attention to the local municipalities that have adopted energy codes more stringent than the statewide minimum and highlights a number of green initiatives and high performance building programs on the state and local levels. These programs continue to raise the bar for energy-efficient construction practices and help the enforcement, design, and construction industries become accustomed to the requirements of the increasingly stringent model energy codes.

The Adoption section makes 21 major recommendations, in addition to multiple related recommendations. The core recommendations are listed below.

To improve energy code adoption practices in Colorado, the state should:

- Update Colorado's minimum energy code to the 2009 IECC
- Establish a regular and automatic review and update process for its minimum energy code that follows the three-year model energy code cycles
- Limit local jurisdictions from adopting weakening amendments and non-equivalent codes

As the state agencies in charge of state energy policy and local issues, respectively, GEO and DOLA should:

- Take on a stronger role providing increased support to local jurisdictions to adopt the model energy codes, as well as green and above-code programs

Energy codes reduce greenhouse gas emissions and pollution and increase economic and environmental sustainability. Therefore, Colorado and applicable jurisdictions should also:

- Incorporate energy codes into the New Energy Economy by updating state and local climate change action plans to include the 2009 IECC and a regular review and update process

At a minimum, all local jurisdictions should:

- Adopt the most recent building codes, including energy codes
- Establish a regular and automatic review and update process that follows the three-year model energy code cycles

With 97 percent of Colorado's population living in a community that has adopted some version of the IECC, it is critical that the state advance energy code implementation to capitalize on the energy and financial savings available through compliance with the energy codes. Beginning on page 36 of the report, the Implementation section covers the many 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 adequately prepare code officials and design and construction professionals to carry out their responsibilities. This section describes the state's outreach efforts to local jurisdictions and consumers, particularly through the promotion of state-sponsored training workshops and GEO's new website, rechargecolorado.com. Some local inspection departments also reach out to local policymakers on the importance of energy codes and engage building professionals over energy code concerns. Many of the state's utilities provide incentives and rebates to consumers for energy efficiency improvements, while energy efficiency experts work with local building departments to raise awareness of building science and energy code enforcement issues.

Enforcement and building professionals in Colorado vary in their knowledge of and attitudes towards energy codes. Some inspection departments emphasize strict, consistent enforcement, and some building professionals adhere to or exceed the adopted standards. While there is generally stronger energy code implementation along Front Range, many experts cite a need for better energy code infrastructure and practices in most locations across the state. Enforcement and building professionals alike have struggled in the wake of the recession and the collapse of the housing market and are supported by trade associations that have had to reduce services. Through GEO and DOLA, the state has been able to fill in this gap somewhat by offering statewide training in 2008 and 2009, and a more comprehensive training workshop series is currently underway. The state requires licensing for some design and building professionals, but allows localities to choose whether to license commercial developers, contractors, and all non-electrical and -plumbing subcontractors. The state's third party infrastructure is also strong, due in part to its history with green and above-code building programs. Finally, Fort Collins Utilities has gained national recognition for its work measuring and verifying energy code compliance, which has shed light on the realities of proper enforcement and compliance practices.

The Implementation section makes 18 major recommendations, in addition to multiple related recommendations, for a variety of different stakeholder groups.

To improve state efforts to support local jurisdictions with energy code implementation, the state should:

- Increase its own enforcement services for communities without building codes, as well as consider combining its three state-level enforcement activities under one agency
- Explore policy solutions to traditional funding and enforcement issues the local level
- Provide clarity, guidance, and resources to local jurisdictions to support implementation
- Encourage policy changes at the local level to promote uniformity and incentivize energy code compliance
- Conduct a statewide M&V study or expand on the state's planned study, building on Ft. Collins' previous work
- Create knowledgeable energy efficiency professionals for the New Energy Economy through job training and continuing education
- Ensure that the upcoming training workshop series emphasizes building science on on-site training
- Engage utilities, consumer groups, the real estate, appraisal, and lending communities, manufacturers, and retailers with a presence in CO to encourage greater outreach efforts and involvement in energy code work

Either with the state or on their own, local jurisdictions should:

- Initiate policies and programs highlighted in recommendations

Due to the benefits of reduced energy use for utilities, they should:

- Take a more active role in promoting energy code implementation, green and above-code programs, and conducting outreach to consumers

The Conclusion section provides a summary of the myriad benefits of energy code adoption and implementation in Colorado and concludes with Table 4, a summary list of the most important recommendations made in the report with page numbers for quick reference. Appendix A offers a list of other DOE and Pacific Northwest National Laboratory (PNNL) energy code resources.

Introduction

Energy codes have arrived. As one of the principal instruments in the energy efficiency policy toolbox, codes benefit society in a number of important ways: they reduce energy use, which decreases greenhouse gas emissions and pollution, save consumers and businesses money, lessen peak energy demand, increase utility system reliability, and improve indoor air quality.

Recent improvements in the stringency of the model energy codes—not to mention the development of the first green codes—continue to raise the floor and ceiling for energy-efficient design and construction to levels that were almost unimaginable a few short years ago. Meanwhile, the Recovery Act has provided states and cities with unprecedented funding and incentives to adopt the model energy code, and more places are taking advantage of these opportunities than ever before.

Their ascent is part of a larger transformation in the way advocates, policymakers, industry and utility representatives, and the general public view energy efficiency as a viable and cost-effective component of a comprehensive solution to our current economic, environmental, and energy concerns. Energy efficiency is widely considered one of the lowest-hanging fruits since the cheapest and cleanest fuel source is the one we do not burn. Nowhere is this more apparent than in the building sector, which accounts for almost 40 percent of total energy use and 70 percent of electricity use.¹ Moreover, the average lifespan of a building is roughly 50 years, meaning that current building energy policies will affect energy consumption until 2060 and beyond.

Yet, for all this recent progress and promise, energy codes are still falling well short of their potential. In municipalities across the country, energy code enforcement and compliance remain woefully insufficient or completely absent. While development and adoption are the necessary first steps of the energy codes process, they alone do not guarantee compliance. To ensure that energy codes accomplish their missions to reduce energy use and save money, states and cities must develop and carry out effective and realistic energy code implementation strategies.

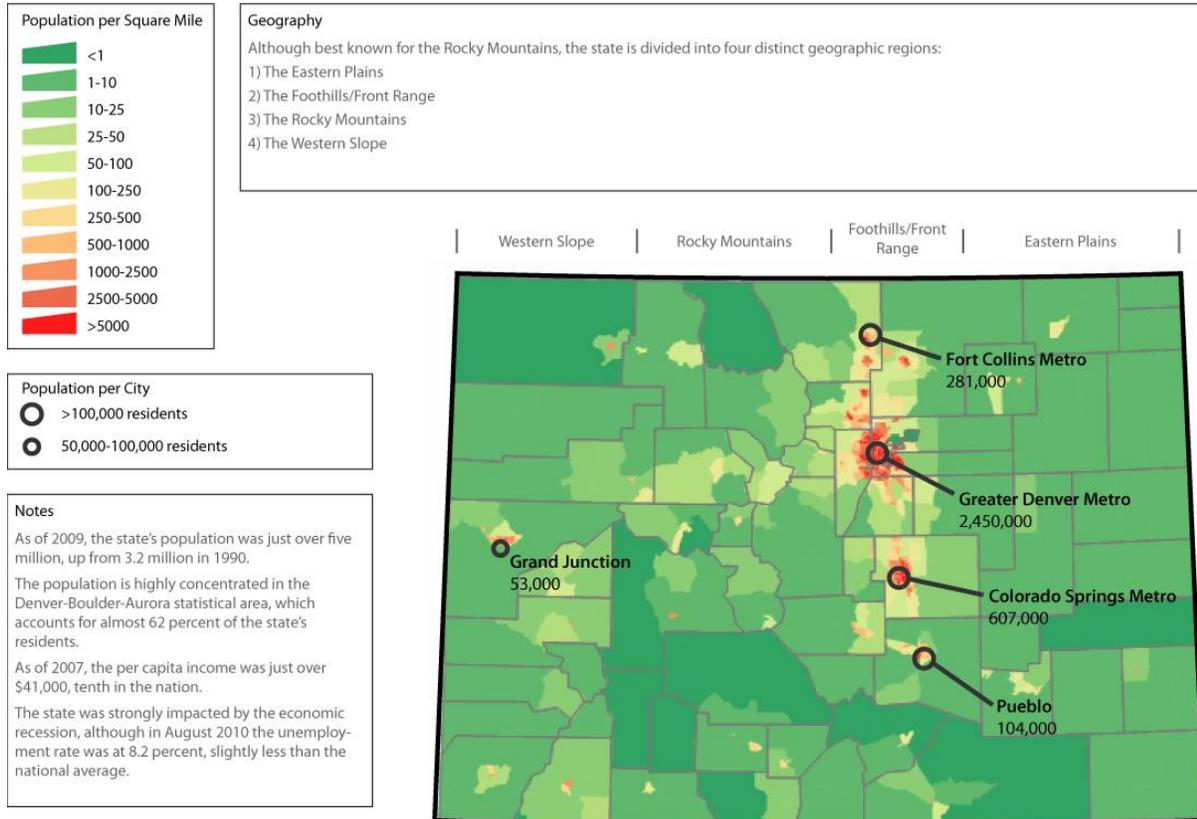
In collaboration with the U.S. Department of Energy, BCAP has undertaken a new program to improve energy code compliance in 15 states, including Colorado, by analyzing the gaps in the existing energy code infrastructure and practices and providing compliance planning assistance and on-the-ground technical support to energy code stakeholders in the state. The first phase of the program is the Gap Analysis Report, which identifies barriers to successful energy code adoption and implementation, opportunities for improvement, available resources, and key stakeholders and potential partnerships.

State Overview

Colorado is a state on the rise. With a diverse and prosperous economic base and a per capita income that has more than doubled since 1990, it is no surprise that the state has seen an influx of new residents over the past twenty years.² The capital, Denver, has grown into the federal hub for the Rocky Mountains, as well as a high-tech, commercial, financial, educational, and cultural center in the region.

Together with its strong political tradition rooted in frontier individualism and a well-earned reputation for healthy living and idyllic scenery, Colorado is a shining example of the New West.

Figure 1. State Population Map



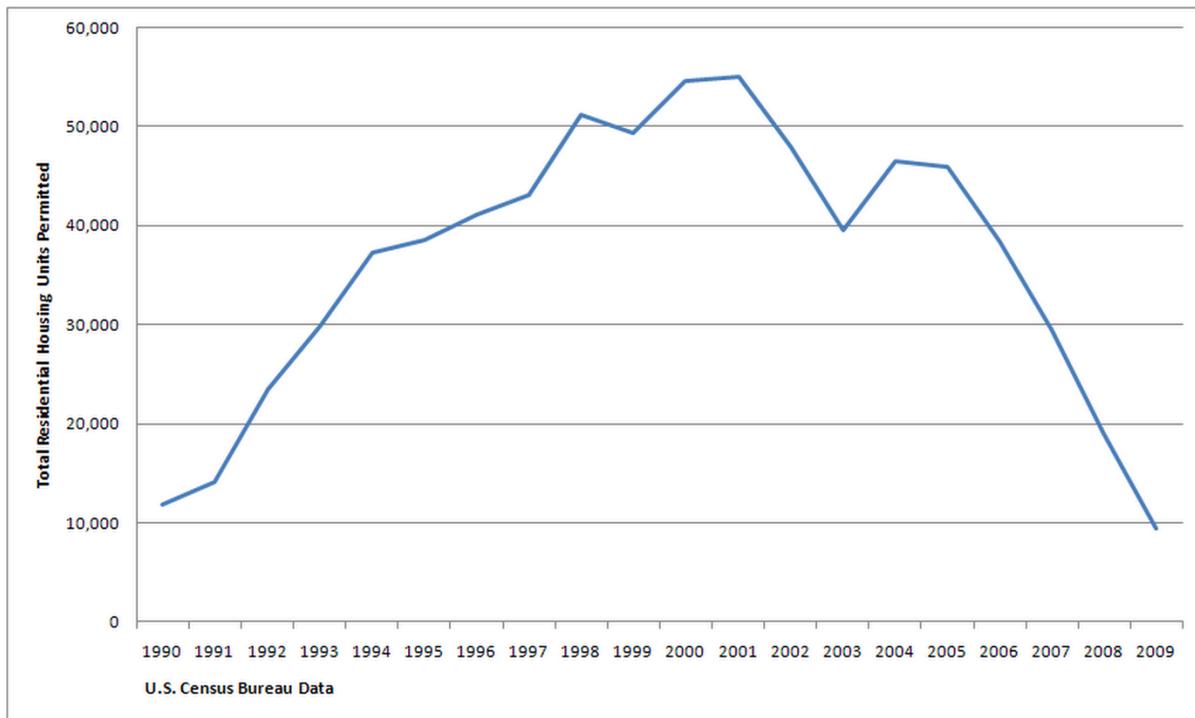
Density Map, Populations, and Income data courtesy of U.S. Census Bureau
 Census 2000 Summary File 1 Population by Census Tract
 Population Estimates as of July 1, 2007
 Unemployment Data courtesy of U.S. Dept. of Labor, Bureau of Labor Statistics

Construction Overview

Colorado grew significantly in the last two decades. From April 1990 to April 2000, the state population grew by 30.6 percent—the third highest increase in the nation.³ From April 2000 to July 2009, it grew by another 16.8 percent. Both of these rates were well above population growth for the country as a whole.⁴

As Figure 2 (next page) illustrates, construction rates followed population growth until the national housing market collapse. The total annual residential housing units permitted rose from roughly 10,000 in 1990, to a high of roughly 55,000 in 2001, and back down to fewer than 10,000 in 2009.⁵ Not surprisingly, the design, construction, and enforcement communities have struggled with five times less demand in the residential housing sector. A number of communities have had to lay off staff, while others have been able to reduce staff numbers through retirement.

Figure 2. Colorado Residential Permits by Year



The commercial construction market in Colorado is centered on the Denver metro area and the heavily populated I-25 corridor from Pueblo to Fort Collins. Like most other major urban centers, the city and surrounding region have seen a drop in the valuation of commercial construction following the burst of the housing bubble and the ensuing recession. Still, the volume of construction has gone up, as new and larger projects have given way to upgrades on existing facilities, infill projects, and other less expensive work.

According to the Emerging Trends in Real Estate 2011—a leading real estate forecast publication from the Urban Land Institute and PricewaterhouseCoopers—Denver ranks eleventh among major American metropolitan areas in commercial and multi-family investment and fifteenth in development. The report notes the region’s many positive attributes and highlights the city’s potential to make a fairly quick recovery.⁶

Even though the decline in residential and commercial construction has been detrimental to the state economy, it presents a unique opportunity for the advancement of energy codes in the state. With workloads reduced, building professionals and code officials should have more time to take advantage of available energy code training, such as the upcoming workshop series offered by the state through Recovery Act funding (see Enforcement Community: Training and CEUs). Reduced construction will also help ease all stakeholders into the new code, rather than trying to adjust while construction is high.

Energy Portfolio

Colorado has enormous energy production capabilities for both fossil fuels and renewable energy. The

state has ten of the country’s largest gas fields and three of the largest oil fields, in addition to significant potential for wind and hydropower production in the Rocky Mountains and ethanol production from the state’s expanse of cornfields. Colorado ranks tenth in the nation for total energy production, fifth for natural gas, and ninth for coal. Although rich in energy resources, Colorado’s economy has relatively low demand for energy. Colorado has the 17th lowest per capita energy consumption in the country. Not surprisingly, the state is a net exporter of energy. Reducing energy use through the adoption and implementation of the model energy codes would, thus, promote increased energy exportation and safeguard a vital industry in the state.⁷

Since his election in 2006, former Governor Bill Ritter made the creation of a New Energy Economy one of his major platforms, including the establishment of a stronger renewable energy sector. In 2006, the state ranked 29th in total renewable generation, and renewables accounted for 5.3 percent of the state’s total electric generation.⁸ As of 2008, the state ranked 16th in total renewable net generation, with six percent of the state’s electricity coming from wind power and almost four percent from conventional hydro.⁹ The state has also identified significant potential for increases in wind and solar electricity production. Reducing overall energy use through the adoption and implementation of the model energy codes would allow the state to phase out energy production from fossil fuels in favor of renewable energy, rather than having to add both in the short- and medium-term to meet growing demand. In the long-term, it would also allow the state to achieve its goals for greenhouse gas emissions reductions more quickly, as well as allow the state to become a net-exporter of renewable energy, as it is now for non-renewables.

Potential Savings from Energy Codes

Energy codes provide the state with an excellent opportunity to reduce energy use for its citizens. As Table 1 shows, 100 percent compliance with the 2009 IECC would result in a 13-14 percent estimated annual savings in residential energy costs in the state, depending on the climate zone. Included in the savings are heating, cooling, and lighting. Furthermore, new residential construction built to the 2009 IECC would produce almost \$7 million annually in energy savings.¹⁰

Table 1. Annual Savings in Residential Energy Costs

Savings Current Practice vs. 2009 IECC		
City (Climate Zone)	Savings (\$/year)	Percent Savings
Wichita, KS (Zone 4B)	\$266	14%
Boulder (Zone 5B)	\$213	13%
Eagle (Zone 6B)	\$246	13%
Alamosa (Zone 7B)	\$239	13%

Source: [2009 IECC Residential Nationwide Analysis](#), U.S. Department of Energy

There are also significant savings available for commercial buildings. Table 2 represents a percentage of potential energy savings that can be achieved by adopting the most up to date commercial building energy code, ASHRAE Standard 90.1-2007. In the table, Non Residential signifies any mid-rise

commercial building, Residential signifies high-rise residential buildings and Semi Heated represents commercial warehouses, but all three building types fall within the scope of the commercial code. 100 percent compliance with Standard 90.1-2007 would result in up to a 4.6 percent savings in commercial energy costs.

Table 2. Annual Savings in Commercial Energy Costs

Construction Type	City	Energy Savings	Cost Savings
Non Residential	La Junta	3.7%	3.4%
Residential	La Junta	7.4%	4.5%
Semi Heated	La Junta	0.6%	0.3%
Non Residential	Boulder	4.5%	4.2%
Residential	Boulder	7.5%	4.6%
Semi Heated	Boulder	0.5%	0.3%
Non Residential	Eagle	4.8%	4.6%
Residential	Eagle	1.7%	0.9%
Semi Heated	Eagle	0.4%	0.3%
Non Residential	Alamosa	4.3%	4.0%
Residential	Alamosa	2.7%	1.6%
Semi Heated	Alamosa	0.3%	0.3%

Source: [Impacts of Standard 90.1-2007 for Commercial Buildings at State Level](#), U.S. Department of Energy

Energy codes also offer large-scale gains. BCAP estimates that implementation of the model energy codes will result in substantial savings over the business-as-usual scenario:¹¹

- By 2030, \$522 million in annual energy cost savings for households and businesses, or \$4.6 billion from 2011-30;
- By 2030, annual CO2 emissions reductions of 2.4 million metric tons, or 22 million from 2011-30;
- By 2030, residential sector source energy savings of 9 percent, representing annual savings of 19 trillion Btu;
- By 2030, commercial sector source energy savings of 14 percent, representing annual savings of 24 trillion Btu.

Adoption

Federal Policy

Although energy code adoption occurs on the state and local levels, the federal government—through Congress and the U.S. Department of Energy (DOE)—has played a significant role in advancing energy code development, determining the relative effectiveness of national model energy codes, and supporting state- and local-level adoption and implementation.

EPAct

The Energy Policy Act (EPAct) of 1992 required DOE to determine whether the most current model energy codes would improve energy efficiency for residential and commercial buildings. It also mandated that the DOE make a new determination within twelve months for every subsequent revision of these codes. Each state would then have two years to certify that it had revised its own energy code to meet or exceed the requirements of the latest iteration of the national models. A state could decline to adopt a residential energy code by submitting a statement to the Secretary of the DOE detailing its reasons for doing so. The Energy Policy Act of 2005 specified that the most current model energy codes were the 2004 supplement to the 2003 IECC and ASHRAE Standard 90.1-2004.¹²

At the end of 2008, the DOE published its determination for ASHRAE Standard 90.1-2004 for commercial buildings, ruling that energy savings above the previous Standard 90.1-1999 would be 13.9 percent for national source energy and 11.9 percent for building energy consumption. DOE is currently reviewing Standard 90.1-2007, the most recent national model energy code for commercial buildings. For residential and small commercial, the last DOE determination was for the 2000 IECC. At present, DOE is reviewing the 2003, 2006, and 2009 versions of the code.

As a home rule state (see State Policy: Political Environment), Colorado does not adopt a mandatory, statewide energy code and is, therefore, not in compliance with EPAct.¹³

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 Grants (EECBG) to adopt the 2009 IECC or equivalent for residential construction and the ASHRAE Standard 90.1-2007 or equivalent for commercial construction, as well as achieve 90 percent compliance with the codes by 2017.¹⁴ In a letter dated February 24, 2009, former Governor Ritter, Jr. assured that applicable state officials in Colorado would begin actions to 1) update the code to the 2009 IECC or an equivalent code and 2) achieve 90 percent compliance with these codes in all new construction by 2017.¹⁵ In response, DOE awarded the state \$50.2 million in SEP funding for use in energy efficiency policies and improvements and an additional \$40.3 million EECBG formula grant, a portion of which the Governor's Energy Office (GEO) will use for various residential and commercial energy efficiency projects.¹⁶

State Policy

In the United States, building energy codes are adopted on the state and local levels. This is due, in part, to the diverse range of cultures and climates found across the fifty states, as well as a host of historical political influences that shaped federal-state and state-local relations. The process differs from state to state, but in most cases codes are adopted through a legislative process, a regulatory process, or a combination of both, although a handful of states—Colorado among them—are strongly home rule and permit local jurisdictions to adopt energy codes. Every state is unique in how it conducts business and creates policy, and each state requires its own particular strategy for achieving the best possible code for its local governments, citizens, and businesses.

Political Environment

Colorado is a strong home rule state with a well-defined relationship between state and local governments, including separate and concurrent powers for each outlined in the state constitution and through established legal rulings. Home rule jurisdictions exercise considerable authority from

state intervention, and local regulations supersede state law on issues of purely local importance.

Most counties in the state are statutory—meaning that they can only exercise powers given to them by the Colorado General Assembly—but a few have written home rule charters: Pitkin, Weld, and the consolidated city-county governments of Denver and Broomfield.¹⁷ Home rule gives counties more flexibility for determining administrative structure and policies of strictly local concern, but the powers granted are not as sweeping as for cities.

Some characteristics of home rule political culture include a sense of cooperation among jurisdictions, the expectation of independence from state authority on most issues, and the firm belief that local governments do a better job of delivering services to their constituents. Cities in Colorado also have greater fiscal autonomy and are responsible for a larger percentage of their revenues than cities in most other states, which give them more freedom to enact local policies without reliance on the state.¹⁸

This political system extends to energy code adoption, which is carried out primarily at the county and local levels.

What's required by the IECC?

- Depending on your location (climate zone) there are requirements for insulating ceilings, walls, and sometimes, floors, foundations, basement walls, and slab edge
- Less insulation is allowed for mass walls, and more is required for steel framing
- Also dependant on climate zone, there are requirements for windows, skylights, and doors
- The building shell, also known as the building envelope, must be caulked and sealed to limit air movement
- Duct insulation
- Pipe insulation
- Duct sealing to reduce air leakage
- Heating, ventilation, air conditioning (HVAC) and water heating equipment efficiencies and control requirements for commercial buildings
- Some residential lighting requirements
- All commercial lighting
- Heated swimming pool covers and controls
- The energy code applies to all new residential and commercial buildings, as well as additions/alterations/renovations to existing buildings
- Compliance paths include prescriptive, total building envelope UA (tradeoff method), and simulated performance

Energy Code Infrastructure

The state agency responsible for supporting local energy code adoption is GEO, formerly the Governor's Office of Energy Management and Conservation (OEMC). GEO oversees all statewide programs designed to create a New Energy Economy in the state, including energy efficiency and renewables.¹⁹ GEO encourages local adoption of the national model energy codes and works in partnership with building departments and local policymakers to provide outreach, information, data, and other resources to support this process. GEO's staff also participates in the energy codes development process at the national level.

Another state agency that supports local communities is the Department of Local Affairs (DOLA), which is building a stronger partnership with GEO on energy code adoption, training, and other issues. DOLA's mission is to strengthen Colorado's communities, and in that role supports GEO with local knowledge of adoption processes, on-the-ground expertise for accomplishing policy goals, and established relationships with stakeholders. With offices in multiple jurisdictions across the state, DOLA is effective at communicating state-level messages and providing state-level adoption assistance from GEO to local communities.

Over the past few years, adoption of the model energy codes by local jurisdictions in Colorado has been encouraging, yet incomplete (see Local Policy: The IECC and Standard 90.1), and both GEO and DOLA have influenced this process. Still, both organizations cite limited resources as a major barrier to increasing outreach and support for local energy code adoption.

DOE recently awarded GEO and DOLA additional energy codes funding to support jurisdictions that will need extra assistance adopting the 2009 IECC. The process will include building a political base and engaging local stakeholders. As of this writing, this project is still in the planning stages.

Recent Energy Codes Legislation

Even with an ingrained home rule system in place, energy efficiency has become such an important policy tool that the state chose to take a big step towards mandating a statewide energy code. In 2007, the General Assembly passed HB 1146, which set the 2003 IECC as the minimum energy code requirement for residential and commercial buildings. However, the bill has an important caveat: it applies only to jurisdictions that a) have adopted any type of building code or b) will do so in the future. Since a large percentage of jurisdictions in Colorado fall under the former, the law is a de facto mandatory minimum, albeit one that is not particularly difficult to meet. For the mostly small and rural jurisdictions in the latter category without energy codes or, in some cases, building codes of any kind, it would also serve as a mandatory minimum, but only should they decide to adopt.

Although technically a mandate, HB 1146 functions more as a suggestion for most jurisdictions—and a catalyst for the rest—because the state does not have an enforcement mechanism tied to the adoption of the code. Rather, GEO and DOLA training and technical support act as an incentive for jurisdictions to adopt or update their energy code to meet the requirement. True mandate or not, the law has had a positive effect on code adoption in the state, as many jurisdictions adopted the 2003 or 2006 IECC

(already the model energy code when HB 1146 was passed) following the promulgation of the law. A few jurisdictions have since updated to the 2009 version, as well. Had it not been for a few mitigating circumstances (see Local Adoption Spotlight), it is likely that more jurisdictions would have also moved to the latest iteration of the model energy code by now.

Some energy code advocates in the state speculated that Governor Ritter would announce an executive order that would update it to set the 2009 IECC as the minimum energy code by July 2011, although it appears that the Governor will not act before the end of his term.

The DOLA State Housing Board has also adopted a statewide code for manufactured and modular housing, as well as for hotels, motels, and multi-family housing in areas without adopted energy codes. As of July 1, 2010, the 2009 IECC is in effect for these structures.²⁰

The state has also enacted legislation aimed at improving residential sustainability and resource efficiency beyond what is in the 2003 IECC. In 2009, the General Assembly passed HB 1149, which requires new single-family residential construction to be equipped to support a photovoltaic system and/or a solar thermal system. It also requires builders to offer homebuyers the option of putting in either system, as well as a list of providers in the area, created and maintained by GEO.²¹ In 2010, the General Assembly passed HB 1358, a similar law that requires builders to offer efficient toilets, faucets, showerheads, and ENERGY STAR appliances.²²

Other Colorado Building Codes

Most building codes in Colorado are adopted on the local level, with a few exceptions. The Department of Regulatory Agencies (DORA) Colorado State Electrical Board (CSEB) is responsible for adopting the electric code, currently the 2008 National Electric Code, and enforcing it statewide. The DORA Colorado Examining Board of Plumbers (CEBP) is responsible for adopting the plumbing code, currently the 2003 International Plumbing Code, and enforcing it statewide.²³ In addition to the 2009 IECC, the DOLA State Housing Board adopts building codes for manufactured and modular housing in all jurisdictions, in addition to hotels, motels, and multi-family housing in jurisdictions without building codes in place. Currently, the codes in place are the 2006 I-codes.²⁴

Energy Codes for State-funded Facilities

It is important for states to demonstrate their commitment to energy codes by setting the example, and Colorado has done so. The Office of the State Architect (OSA) State Building Program is responsible for adopting building codes for all state-funded facilities. In 2010, OSA adopted the 2009 I-codes, including the IECC.

The state has also set more stringent green building requirements for state-funded buildings. In 2005, former Governor Owens authorized Executive Order D005 05, which mandated Leadership in Energy and Environmental Design (LEED) for Existing Buildings for the operation and maintenance of public buildings as deemed practical and LEED for New Construction for the construction of new public buildings as deemed cost-effective.



*Wolf Law Building, Courtesy of Flickr Creative Commons,
Credit—[Scott Matherson](#)*

In 2007, the General Assembly passed SB 51, which improved the standard for new construction by requiring publicly funded buildings (minimum 25 percent state funds, 5,000 square feet or larger, presence of an HVAC system) to be built to a high performance green building standard determined by OSA, given a payback period for increased upfront cost of 15 years or less.²⁵ The OSA chose LEED Gold as its minimum qualification and Colorado Collaborative for High Performance Schools (CO-CHPS), a green building program specifically for schools, as an alternate for

schools with certain sustainable priority credits also required.²⁶ One example of a LEED Gold public building is the Wolf Law Building at the University of Colorado Law School (pictured), which the school planned and constructed prior to the policy's implementation.

Statewide Climate Change Initiatives

As part of his commitment to the New Energy Economy, Governor Ritter's office released the Colorado Climate Action Plan in November 2007. The Plan sets a goal of reducing greenhouse gas emissions to 20 percent below 2005 levels by 2020 and 80 percent below 2005 levels by 2050. The Plan puts an emphasis on government leadership to enact short-term plans to reduce emissions and long-term strategies to enable the transition to a low-emission economy. The Plan identifies agriculture, transportation, large-scale renewable energy production, energy efficiency, recycling, emissions trading, and education, among other factors, as areas of focus.

The Plan offers specific energy efficiency policies, including the adoption of the 2003 IECC statewide, which will account for 16 percent of the Plan's energy efficiency reduction goals by 2020 and \$1.32 billion in savings. However, at the time of the Plan's release, the 2006 IECC was already the model energy code. Furthermore, the Plan does not mention the critical need to improve energy code compliance to achieve the promised energy savings.²⁷

Why Climate Change Initiatives Matter

Colorado is concerned with the potential impacts of climate change on the environment and the economy. Since building energy use accounts for roughly 40 percent of energy use in the nation—and in Colorado, much of that energy comes from non-renewable sources—energy codes are a vital tool for reducing energy use and, thus, greenhouse gas emissions, not to mention saving money.

Energy savings built into new construction will accrue over the life of the building. Considering that buildings typically last from 50-100 years, adopting energy codes not only impacts new building energy performance, but also the energy performance of existing buildings until 2060 and beyond. This makes energy codes an important long-term policy for mitigating climate change and supporting the Colorado economy.

The Colorado Climate Action Plan is comparable to other climate change action plans in Utah, New Mexico, Nevada, and Arizona, which all include energy code adoption as either an accomplishment or recommendation. Neighboring states Nebraska, Wyoming, Kansas, and Oklahoma do not have climate change action plans.

Colorado is also an observing, but non-partnering, member of the Western Climate Initiative (WCI), which is a collaborative agreement among states and Canadian provinces to reduce regional greenhouse gas emissions.²⁸ The WCI recommends building energy efficiency standards as a complimentary policy to its market-based cap-and-trade program, though a 2010 report does not prioritize the adoption of energy codes and also cites the 2006 IECC, not the more stringent 2009 IECC.²⁹

Colorado is also setting aggressive standards to switch to renewable energy. In March 2010, the General Assembly passed HB 1001, which was the latest statute to increase the stringency of the state's renewable portfolio standard (RPS), in place since 2004. Colorado now has an RPS of 30 percent for investor-owned utilities by 2020, 10 percent for electrical cooperatives, and 10 percent for municipal utilities that serve over 40,000 customers. This is particularly relevant given that the Environmental Protection Agency (EPA) classifies the Denver-Fort Collins corridor as a non-attainment area for federal pollution standards.³⁰

The adoption of energy codes would reduce total energy use in Colorado, which would increase the percentage of renewable energy production in the state. This alone will not meet the state's goals, and the state should continue to increase renewable energy production. However, reducing total energy use is the first step towards transitioning from non-renewable to renewable energy.

On-site renewable energy is another way in which the state can meet these ambitious targets, and energy codes play a crucial role in reducing the cost of renewable energy installations for homeowners and building operators. When homes are equipped with energy efficiency measures, the overall energy demands of the home will decrease. This allows homeowners to reduce the size of solar PV and solar hot water equipment on their rooftops. By purchasing smaller-scale equipment, homeowners save money—potentially resulting in increased market penetration for these technologies and lower cost by way of economies of scale for manufacturers. The same principle applies to the provision of on-site energy for commercial buildings.

Overview of Green and Above-Code Programs

LEED

The U.S. Green Building Council (USGBC) Colorado Chapter has a strong presence in the state and is an active participant in above-code policy discussions. According to the USGBC website, there are over 4,700 LEED Accredited Professionals (APs) in Colorado. As of January 2010, the state had 201 certified LEED projects and 557 registered ones,

Why Green and Above-Code Programs Matter

Green and advanced codes and standards help to transform the marketplace by bringing high performing buildings into the mainstream. They also raise awareness of energy- and resource-efficient design for the public, as well as design and building professionals and code officials. Finally, they raise the ceiling for building energy performance, which, in turn, accelerates and shapes the development and adoption of future model codes.

making it the undisputed leader for LEED construction in the region.³¹ Examples of LEED platinum certified buildings in the state include the National Renewable Energy Laboratory (NREL) Science and Technology Facility (pictured), the Rocky Mountain Institute (RMI) Boulder office, and the Signature Center in Golden.³²

Built Green

Colorado has also been a leader in residential green construction. One of the first green building programs in the country was Built Green, started in 1995 by the Home Builders Association (HBA) of Metro Denver, with support from OEMC, Xcel Energy, and E-Star Colorado, the first HERS provider in the state. Built Green was a voluntary program designed to encourage builders from across the state to build more energy- and resource-efficient new homes. It provided participating builders with training, checklists, and technical support to achieve the Built Green criteria. The program also conducted outreach efforts to consumers. With the national growth of the EPA's ENERGY STAR for Homes program (see below) in the mid-2000s, the state decided to shift its support to ENERGY STAR, and the HBA of Metro Denver terminated the Built Green program. Still, in its fifteen years, the program built approximately 37,000 homes. Green building experts remember the program as a pioneer that paved the way for the green building and energy rating markets in Colorado.

ENERGY STAR for Homes

ENERGY STAR for Homes is a national above-code building program started by the EPA. To qualify for the ENERGY STAR for Homes label, homes must receive a score of 85 or less on the HERS index.



ENERGY STAR for Homes has had a presence in Colorado for over ten years, but has grown significantly over the past few years with the 2008 launch of the GEO Colorado ENERGY STAR New Homes Program. As of September 2010, there were 17,422 homes built to the standard across the state, with 2,354 built in 2009, creating a 33 percent market share.³³ The state also has 355 ENERGY STAR Partner builders, including 20 builders who have committed to only build ENERGY STAR homes. Over half of the builders have signed up in the last two years, which is encouraging for the continued growth

of the program. In the second quarter of 2010, the program achieved a 45 percent market share, and the American Council for an Energy-Efficient Economy (ACEEE) acknowledged it as one of the top five state-led energy efficiency programs in the country.³⁴

Building America

Since 1994, the DOE's Building America program has been raising the bar for energy efficiency and quality in new and existing homes. Working with national laboratories and the residential building industry, its goal is to improve the quality and performance of today's homes while continually working towards net-zero energy homes. To qualify, homes must receive a score of 70 or less on the HERS index, though the program's innovative house-as-a-system approach can reduce a home's average energy

The HERS Index Explained

The HERS Index is a scoring system that provides a scale for measuring the energy efficiency of a new home compared to a reference home that was built to the 2004 IECC, which is assigned the score of 100 points. The lower a home's HERS Index, the more energy efficient it is. Every one point decrease in the HERS Index corresponds to a one percent reduction in energy consumption compared to the HERS reference home. For example, a home that scores an 85 is 15 percent more efficient than the HERS reference home, and a home that scores zero is a net zero building (see www.resnet.us for more details). Both ENERGY STAR for Homes and Building America intend to increase the stringency of their requirements in the coming months.

consumption by as much as 40 percent with little or no impact on the cost of new construction. Building America approaches have been used in more than 42,000 homes across the country to date.³⁵ These homes typically sell within weeks while other new homes sit on the market for months.

Through its Builders Challenge program, new homes that meet stringent qualifications can earn an EnergySmart Home Scale label. Builders Challenge is similar to ENERGY STAR for Homes in that both programs assist and reward builders who build homes more efficiently than standard practice. However, the energy threshold requirements for the Builders Challenge program are different than those of ENERGY STAR.³⁶

According to the Building America website, builders in Colorado have built 408 homes to Building America specifications, and another 327 are planned. It is

possible that both of these numbers are higher, given that the website lacked information on a number of projects and efforts to learn more were unsuccessful. Aspen, Longmont, and Loveland lead the way with large developments, and Boulder has a large development in the works.³⁷

Green Advantage – Colorado Community College Model

Green Advantage (GA) is a national green building certification program. Its goal is to develop design and building professionals who understand and can incorporate green building practices—such as energy efficiency and renewable energy, site and land use, water conservation, materials, and indoor air quality—into their work. While GA is not a green or above-code program, it is another indicator of the level of interest in and knowledge of green and above-code design and construction practices. Unfortunately, GA does not offer statistics on the number of construction projects GA practitioners have worked on.³⁸

As part of the New Energy Economy, the Colorado community college system has formed the first ever Strategic Alliance with GA. The program offers training and certification courses for future design and

building professionals, creates GA Testing Centers, and collaborates with GEO to offer incentives for certified practitioners.³⁹

Green and Above-Code Real Estate Listings

Finally, GEO has recently worked to incorporate green and above-code building into the largest Multiple Listing Service (MLS) listings in Colorado. The goal of the project is to “provide the industry with tangible energy and ‘green’ data through home sales; a key component of quantifying market value and identifying comparison data for appraising and lending purposes.” GEO established an Appraisal Committee of professionals from the energy efficiency, real estate, appraisal, lending, and construction fields. The Committee put together a list of recommended certifications and features to include on the listings, and various MLS providers across the state are now in the processing of including these categories on their listings.⁴⁰ Featuring green and above-code features in MLS listings will raise awareness of energy- and resource-efficient homes and their benefits. This, in turn, will increase the market for green and above-code construction, as homebuilders will respond to increased consumer demand.

Local Policy

Local energy code adoption varies greatly from state-to-state. In strong home rule states, like Colorado, local jurisdictions have full authority to adopt energy codes that best fit the needs of their community, while others must meet a statewide minimum first. On the other end, some states mandate a minimum-maximum energy code that prohibits local jurisdictions from diverging from the state code whatsoever. Most states fall somewhere in between, mandating a minimum code, but allowing some flexibility to go beyond it in progressive jurisdictions.

Energy Code Adoption Process

Both cities and counties in Colorado adopt energy codes. County codes apply to unincorporated areas, which account for 27 percent of the population.⁴¹ Although it varies somewhat by jurisdiction, the adoption process in most cities in Colorado follows this established procedure: After the release of the latest editions of the model energy codes, building department officials or a building code advisory board consisting of building professionals review the energy code (along with the other building codes, in the case of the I-Codes), sometimes at the behest of the city council or mayor’s office. The department or board then presents its recommendations to the city council at a public hearing, at which point the city council reviews any input from stakeholders, consults with the building department or board on amendments as needed, holds another meeting, and votes on the adoption. For county adoption, the process is much the same, and the board of county commissioners makes the final ruling on whether to adopt the proposed building codes.

This process often takes months, particularly in larger jurisdictions, and consists of many meetings and back-and-forth work to modify the proposals. One way in which jurisdictions can improve the efficiency of this process is to establish a review board. The City of Thornton established a Building Code Advisory Board, consisting of five building professionals from different trades. Working with relevant city officials,

the Board reviews the city's adopted building codes and the most recent iterations of the national codes and then makes recommendations for adoption to the City Council. This process establishes a pattern that gets repeated each codes cycle, increases trust between all the involved parties, and reduces the need for additional intervention and negotiation.

Some communities choose to establish a regional building inspection department. The Pikes Peak Regional Building Department was created by an agreement between the City of Colorado Springs, El Paso County, and the outlying cities of Fountain, Green Mountain Lake, Manitou Springs, Monument, and Palmer Lake. A commission of elected officials manages the department, and multiple committees advise the commission on building code issues, including adoption. The commission makes recommendations to the Colorado Springs City Council and the El Paso County Board of County Commissioners, and both bodies must approve the proposals for them to take effect.⁴² The regional model allows communities to pool resources and increase efficiency and gives smaller towns access to the greater resources available in neighboring cities.

Other examples include the Pueblo Regional Building Department, which serves the City and County of Pueblo, the Mesa County Building Department, which serves Grand Junction, Fruita, Debeque, Collbran, and Palisades, as well as unincorporated areas within Mesa County, and the Routt County Regional Building Department, which serves all communities in the county except the Town of Hayden.

Many Colorado jurisdictions exercise their right to amend national building codes to better serve local needs. According to code officials interviewed, the changes are most often administrative and do not affect building energy performance. However, sometimes jurisdictions modify or remove existing requirements or add their own amendments to either increase or decrease code stringency.

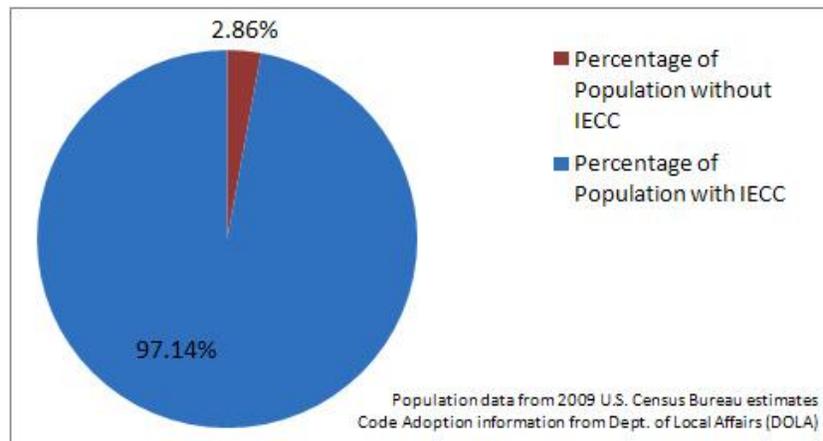
One example is the City of Fort Collins, which has put together a stakeholder group to create a series of amendments to the 2009 I-codes. The amendments will seek to ratchet up the efficiency beyond the 2009 IECC and include a number of greening amendments related to resource efficiency, water efficiency, indoor air quality, and other issues. The group plans to make their recommendations to the city council in spring of 2011. Conversely, the Pike's Peak Regional Building Department is considering amendments to the 2009 IECC that would reduce the stringency of some insulation R-values and encourage the prescriptive path, rather than the performance path.⁴³

Several communities in the state, such as Parker, Aspen, Thornton, Fort Collins, and Jefferson County, are led by energy code champions who have pushed for the adoption of the model energy codes or above-code programs, code amendments, and practices. Through trade associations and other interactive avenues, these leaders can support energy code adoption and help cultivate new champions in municipalities that have not yet taken the steps to reduce energy use and save their citizens and businesses money.

The IECC and Standard 90.1

Most counties and cities in Colorado choose to adopt an energy code. As of July 2010, 78 percent of the 333 jurisdictions in the state—including Denver and the major cities in the metro area, Colorado Springs, Fort Collins, Grand Junction, and 46 of the 64 counties—have adopted some version of the IECC, which references ASHRAE Standard 90.1 for commercial buildings. Significantly, these jurisdictions account for just over 97 percent of the state’s population (Figure 3) and account for the vast majority of new construction in the state, according to U.S. Census Bureau data.⁴⁴ Although some

Figure 3. IECC Adoption in Colorado by Population



jurisdictions are proactive about adopting and updating the code on a three-year cycle, as of this writing, only seven percent have completed the adoption process for the 2009 IECC. As an indication of the limited impact of this effort, these jurisdictions account for only 13.68 percent of the existing housing units and commercial properties in the state. The majority of jurisdictions currently enforce the 2003 or 2006 IECC.⁴⁵

Other Building and Energy Codes

A number of the cities and counties in the state that have not adopted the IECC choose not to adopt building codes at all. These jurisdictions are in sparsely populated rural areas with little construction.

Several communities choose to adopt the International Building Code (IBC), which covers commercial construction. The IBC’s Chapter 13 references the IECC—which, in turn, references ASHRAE Standard 90.1-2007 as an alternative compliance path—but does not reproduce it. In theory, then, the IBC is equivalent to the IECC and Standard 90.1, but only if the jurisdiction also adopts the IECC. The municipalities in Colorado that adopt the IBC eliminate Chapter 13 altogether or choose not to also adopt the IECC, as well. Therefore, in practice, adopting the IBC is not equivalent to adopting the IECC.

For single-family residential construction, the situation regarding energy code adoption looks a little more promising when you include the International Residential Code (IRC). Chapter 11, the energy efficiency chapter, references the IECC as an alternative compliance path, yet it also includes prescriptive energy efficiency requirements that are slightly less stringent than the IECC. This gives the building and design industries the option of taking an easier compliance path, which reduces these codes’ impact on energy savings as compared to the IECC. In fact, for the 2012 code cycle, the ICC accepted a proposal that requires compliance with Chapter 11 of the IRC to be shown through compliance with the 2012 IECC.

IECC vs. IRC

The 2009 International Residential Code (IRC) is not equivalent to the 2009 IECC. Cities in Colorado must add a number of amendments to bring the 2009 IRC up to 2009 IECC standards. These include:

- Strengthening fenestration and insulation requirements
- Eliminating trade-off allowances
- Adding new air barrier and insulation checklists
- Redefining “conditioned space”
- Adding “mandatory,” “prescriptive,” and “performance” labels in the code
- Exempting only “building thermal envelope provisions that do not contain conditioned space”

Some jurisdictions, such as Montrose County, Aguilar, and Calhan, still operate under versions of the Model Energy Code (MEC), the precursor to the IECC. While technically an energy code, any versions of the MEC outdate the 2000 IECC and are not nearly as stringent as the most recent editions of the IECC.

Local Adoption Challenges

Through their participation with the Colorado Chapter of the International Code Council (CCICC), communities in the Denver metro area have tried to update their energy codes in unison following each code cycle, thus establishing uniformity throughout the region. This, in turn, would benefit the design and building industries, which would not have to worry about differing requirements in each community, as well as the enforcement community itself, which could more

easily collaborate on energy code implementation issues. However, as of October 2010, only six municipalities in the greater Denver area had adopted the 2009 IECC: Jefferson County and the cities of Federal Heights, Golden, Littleton, Louisville, and Parker.

Most of the communities in the area chose to delay the adoption of the 2009 IECC for a combination of reasons. The first was the controversy over the residential sprinkler requirement in the IRC, which created significant debate and delayed the adoption process in communities that adopted the I-Codes as a package. The second reason was that the precipitous decline in the construction market across the state beginning in 2004 significantly reduced building departments’ income through building permits, which forced many to reduce staff through retirements and layoffs. With fewer employees and funds, many jurisdictions that had previously devoted portions of their budget to the energy code update process were no longer able to do so. Finally, massive hailstorms struck the region in May 2010, causing \$70 million in damages and further stretching already limited resources for cities and building departments.

Energy Codes for Municipal-funded Facilities

At least four cities in Colorado have separate—and more stringent—energy efficiency requirements for municipal-funded facilities. By requiring stricter standards for public buildings, jurisdictions demonstrate their commitment to energy-efficient construction, create a more conducive environment for stricter energy code adoption for private construction, and give themselves leverage in negotiating with stakeholder groups that are hesitant to upgrade the baseline energy code. They also save taxpayer dollars with lower energy bills, further reduce their environmental impact, and improve the air quality and comfort of public buildings.

In 2001, Boulder became one of the first municipalities in the country to require new or significantly renovated municipal facilities to meet LEED Silver requirements. In 2006, Fort Collins mandated that all public construction earn LEED for New Construction Gold certification and that existing buildings follow LEED for Existing Buildings standards. In 2007, Denver passed a similar Executive Order mandating LEED Silver certification for public construction, significant renovations, and existing buildings. In 2008, Golden followed suit, requiring LEED Silver for new municipal buildings 5,000 square feet and larger.⁴⁶

Local Climate Change Initiatives

As might be expected, Boulder, Fort Collins, and Denver each have their own climate change action plan. Boulder's plan for reducing greenhouse gas emissions, published in 2006, addresses increasing efficiency and renewable energy generation in the commercial, residential, industrial, and municipal sectors and reduce vehicle miles traveled, among other initiatives. It includes a number of provisions for increasing commercial and residential energy efficiency—including updating its Green Building and Green Points Program (GBGP, see Local Green Building Overview and Initiatives) for above-code residential construction, additions, and remodeling and conducting energy audits for commercial buildings—although it does not address updating or implementing the energy code specifically.⁴⁷

Fort Collins' plan, issued in 2008, builds off previous programs and goals to reduce greenhouse gas emissions. The plan addresses community engagement, recycling, energy efficiency, renewables, smart grid technologies, green building, transportation, and urban forestry. Existing measures included updating the residential energy code, while potential new measures include regularly updating the energy code, supporting above-code construction, and exploring net zero ready residential construction.⁴⁸

Denver's climate change action plan is part of the city's sustainable development initiative, Greenprint Denver.⁴⁹ Released in 2007, the action plan sets the goal of decreasing greenhouse gas emissions to below 1990 levels by 2020 through a variety of programs addressing building energy efficiency, energy conservation, transportation, community outreach, and compact growth strategies, among others. The plan's recommendations include adopting energy efficiency standards in commercial construction and renovations and energy codes for residential construction and some remodels.⁵⁰

Another way in which jurisdictions can reduce their carbon footprints and save on their energy bills is by joining national and international organizations dedicated to promoting sustainability. Such organizations give support to local jurisdictions, particularly those that may not be big enough to have professionals on staff who have experience with climate change mitigation strategies and energy efficiency and renewable energy policies.

A number of cities in Colorado have signed onto the U.S. Conference of Mayors' Climate Protection Agreement: Aspen, Basalt, Boulder, Carbondale, Denver, Dillon, Durango, Frisco, Glenwood Springs, Gunnison, Ignacio, Nederland, New Castle, Pagosa Springs, Telluride, Town of Crested Butte, and Westminster. The agreement urges federal legislative action on climate change and signals members' intent to reduce their own greenhouse gas emissions in line with the Kyoto Protocol.⁵¹

Many of the same cities are also members of ICLEI—Local Governments for Sustainability: Arvada, Aspen, Boulder, Breckenridge, Carbondale, Denver, Durango, Fort Collins, Golden, Gunnison County, La Plata County, Loveland, Manitou Springs, San Miguel County, Snowmass Village, and Westminster. ICLEI members strive to achieve international goals regarding greenhouse gas emissions, environmental preservation, sustainability, and other socioeconomic and political issues. One specific objective for members is to create a local climate change action plan. As of this writing, only a handful of ICLEI cities in Colorado had done so.⁵²

Overview of Local Green and Above-Code Building Programs

A number of jurisdictions in Colorado have adopted green and above-code building programs. In addition, some offer loans, rebates, and grants for energy efficiency and renewables, as do many of the state's utilities. As with state-level programs, local programs and incentives create awareness of and demand for green and energy-efficient construction. They also challenge and influence neighboring jurisdictions to adopt more stringent standards, as well as turn energy- and resource-efficient practices and techniques into standard practice for design, building, and enforcement professionals.

The City of Boulder has always been on the cutting edge of environmental policies and in 1996 became the first municipality in the country to adopt a green building code for residential construction. GBGP requires building professionals to achieve points from a menu of green building features, such as energy efficiency, water conservation, on-site renewables, and other green building criteria. Projects must also receive a HERS rating. Both the points total and rating are determined by building size. Boulder has updated the program periodically since its inception.⁵³

Boulder offers grants for PV and solar hot water system installations to low-income residential housing and non-profit organizations, as well as a tax rebate for all PV and solar hot water system installations. Boulder County also had a Property Assessed Clean Energy (PACE) loan program, the ClimateSmart Loan Program, which is suspended while the County reviews new federal guidelines related to PACE loans.

Eagle County's ECO-Build program applies to all new construction and significant renovations. The program requires building professionals to follow an ECO-Build checklist that assigns points for energy-efficiency and green building criteria. Commercial projects must receive 70 points or pay a fine for every point short, and LEED Gold certified projects receive a 25 percent permit rebate. Residential projects must achieve a point total based on the square footage or pay a fine, and projects that achieve a HERS of 50 or less or LEED Gold certification also receive a 25 percent permit rebate up to \$5,000. Eagle County also places a fee on external energy features, such as snowmelts and pools.⁵⁴

The City of Aspen and Pitkin County also have a number of programs and incentives related to building energy efficiency. For example, the Community Office for Resource Efficiency (CORE) runs the Renewable Energy Mitigation Program (REMP), which assigns an energy budget to each home. Homes that exceed the allotted amount must pay a fee. To encourage renewable energy generation, the program also assesses a one-time fee of \$5,000 to homes over 5,000 square feet that do not install on-site renewable energy systems, and a corresponding fee of \$10,000 for homes over 10,000 square feet.

In 2010, CORE and the City of Aspen gave a total of 755 rebates to residential and commercial projects in the Roaring Fork Valley, in addition to a number of grants for multi-year projects. The program has also been replicated in a number of other communities in Colorado and Wyoming. More information on REMF and other Aspen and Pitkin County programs and incentives can be found on their website.⁵⁵

Even though many of the jurisdictions in the Denver metro area were unable to adopt the 2009 IECC in 2010, there is still great interest in the region in adopting and possibly exceeding the model energy codes. With funding from GEO, the Southwest Energy Efficiency Project (SWEET) has been coordinating an effort to develop regional standards and best practices for green and above-code building programs and codes in the Denver metro area. After months of work with stakeholders in the region, SWEET has put together their preliminary recommendations and will release a final version in December. Jurisdictions who want to implement an above-code or green building program will be able to use this roadmap to assist them in first adopting the most current energy code, the 2009 IECC, and then a national green building code, such as the International Green Construction Code (IgCC).

Another interesting program is a state-local partnership between DOLA, Denver's Office of Economic Development (OED), and the Colorado Housing and Finance Authority (CHFA). As part of its sustainable development efforts, OED mandated that by 2010, all city-supported affordable housing projects would have to meet the Enterprise Green Communities Standards, a national green building program for affordable housing. Working with DOLA's Housing Division, CHFA, and other agencies, the city offered training workshops on the new standards for all affordable housing developers.⁵⁶ For its 2010 allocation plan, CHFA included all mandatory Enterprise Green Community Standards criteria, as well as a number of option criteria, as components for Federal Low Income Housing Tax Credits (FLIHTC).⁵⁷

Moreover, in the Colorado section of its [Description of High Performance Homes and Communities](#), SWEET has listed and summarized several green building organizations and projects in the state, including links to external web pages for more information.⁵⁸

A host of Colorado utilities—including Xcel Energy, Black Hills Energy (both Electric and Gas), Colorado Springs Utilities, Fort Collins Utilities, Longmont Power and Communications, Holy Cross Energy, United Power, and several others—offer rebates and other financial incentives for homeowners and businesses to carry out a host of different energy efficiency and renewable energy installations, purchases, and improvements. Interested parties can find more detailed information on the programs available on the [Database of State Incentives for Renewables and Efficiency](#) website.⁵⁹

Adoption Summary

Current Best Practices

Colorado's political culture makes its energy code adoption practices somewhat unique. Even so, the state has a number of best practices for adoption that other states can replicate. For buildings that do not fall under local jurisdiction, such as manufactured and modular housing and state buildings, the state set rigorous standards that meet or exceed the latest model energy codes. The state also permits

local jurisdictions to go above the minimum energy code mandated, including above-code standards for public buildings in a handful of cities and a number of successful green building programs.

Moreover, GEO works within the home rule system to provide state-level leadership and guidance to local jurisdictions, energy code advocates, and stakeholders as needed. Its collaborative arrangement with DOLA to support local adoption gives the state a connection to local issues on the ground. This communication goes both ways, as local jurisdictions have greater access to energy code expertise at GEO through DOLA, as well. GEO has also engaged in regional above-code efforts with SWEEP, which would raise the ceiling for energy-efficient construction.

On the local side, a number of jurisdictions are concerned with the quality of their buildings and have already adopted the 2009 IECC, and more are in the planning stages. A few have instituted green and advanced programs or offered rebates and incentives, and Fort Collins is working to build green and advanced energy efficiency provisions into its baseline code. Finally, regional inspection departments reduce the amount of time and energy required to adopt energy codes on the local level by consolidating resources and conducting one adoption process for multiple jurisdictions.

Recommendations

State Adoption

Most energy code stakeholders favor the state's local-first attitude towards energy code adoption and the benefits of local ownership of policies. However, a minority of stakeholders believes that a mandatory, statewide energy code would simplify the adoption process and eliminate inconsistencies from jurisdiction to jurisdiction. Advocates cite other home rule states, such as Texas and Illinois, which determined that financial savings and reduced pollution and greenhouse gas emissions through energy savings were issues that superseded purely local concern. Similar language is in HB 1146, demonstrating its sponsors' understanding of this issue.

Gap: The state lacks a mandatory, statewide energy code for residential and commercial construction.

Related Gap: The state is not in compliance with EAct.

Recommendation #1: BCAP believes that model energy codes should be a pillar of the governor's New Energy Economy platform and recommends that the state adopt the 2009 IECC and ASHRAE Standard 90.1-2010 as the mandatory, statewide energy codes without weakening amendments. In lieu of this, updating the existing law to require the most recent editions of the model energy codes would be an acceptable solution that works within the prevailing political culture, particularly given that 97 percent of the state's population lives in an area with the energy code.

Beyond updating the minimum energy code, the state can make other improvements to its existing legislation.

Gap: The state's minimum energy code does not expressly prohibit the substitution of Ch. 11 of the IRC for the 2003 IECC.

Recommendation #2: Currently, GEO permits jurisdictions that have adopted the IRC to substitute Ch. 11 for the 2003 IECC to fulfill the intent of the law. The IRC Ch. 11 is not equivalent to the IECC. Colorado should update the legislation to prohibit this practice and reflect the direction of model energy code development.

Gap: The state's minimum energy code does not prohibit local adoption of weakening amendments.

Recommendation #3: The state should consider prohibiting weakening amendments or encouraging local jurisdictions to do so.

Gap: The state does not have an automatic review and update process on a three-year cycle for future iterations of the minimum energy code.

Recommendation #4: The state should adopt a mandatory review and update cycle for future iterations of the minimum energy code to lock in future energy savings and remove speculation after the release of each new model energy code.

Gap: The state's policy for state-funded buildings that do not apply to the state's above-code standard does not meet the newly released ASHRAE Standard 90.1-2010.

Recommendation #5: The state should update its policy for state-funded buildings that do not apply to the state's above-code standard to require the newly released ASHRAE Standard 90.1-2010.

State Support

Gap: Local jurisdictions require more support from the state to assist in energy code adoption of the statewide minimum energy code.

Recommendation #6: Through GEO and DOLA, the state should expand its role in supporting local adoption of the statewide minimum energy code. The state should consider educational materials aimed at code officials, local policymakers, consumers, and other interested parties to help them understand the costs and benefits of adopting the energy code. It should provide research and data that demonstrates costs and savings estimates by house size and climate zone. It should help local jurisdictions establish legislative processes, energy code boards, and other adoption mechanisms. It should provide testimony and backing as needed to individual jurisdictions and help connect stakeholders.

Related Recommendation: The state could consider available information from BCAP on the incremental cost of constructing a new home to the 2009 IECC, which would help builders understand that more efficient homes are not cost-prohibitive, as well as give jurisdictions an additional argument for model energy code adoption. BCAP's weighted incremental cost analysis identified a simple payback period of less than four years for homeowners if Colorado updates its energy code to the 2009 IECC. Rolled into a standard thirty-year mortgage, the added costs equate to a few dollars extra on monthly mortgage payments. The estimates in Table 3 are conservative and represent the upper bound on incremental cost.

Table 3. Incremental Cost of Building to the 2009 IECC

Weighted Average Incremental Cost	Median Energy Savings	Simple Payback
\$922.73 per home	\$239.50 per year	3.9 years

Source: [Estimated Energy Savings](#), Building Codes Assistance Project

Gap: The state agencies have limited resources with which to support local energy code adoption.

Recommendation #7: Since the state is committed to developing a New Energy Economy and reducing energy consumption in buildings, it should provide additional funding to GEO and DOLA for these activities.

Related Recommendation: In the absence of increased state funding, the recent DOE funding awarded for energy code adoption presents an excellent opportunity in the near-term to give extra attention to communities that need it.

Gap: Many local jurisdictions do not work to exceed the state’s minimum energy code requirement by adopting the most recent model energy code, the 2009 IECC.

Recommendation #8: Through GEO and DOLA, the state should encourage local jurisdictions to adopt the 2009 IECC and support them with educational materials on cost and savings data and technical support to code officials and design and building professionals that outlines the changes from the 2003 or 2006 IECC to the 2009 IECC. They should also provide political support and facilitate stakeholder communication and engagement as needed.

Related Recommendation: The state should also encourage progressive jurisdictions to develop green and above-code programs and connect interested code officials and policymakers with energy code champions in the jurisdictions that have already done so. They should provide jurisdictions with state and national resources on policy options and the challenges associated with first-time adoption of green and above-code programs, as well as technical support and guidance in creating their programs. BCAP’s Online Code Environment and Advocacy Network (OCEAN) has a number of case studies on programs across the country.

Local Adoption

Gap: Many jurisdictions in Colorado still do not have any building codes at all.

Recommendation #9: At a minimum, all jurisdictions that have not adopted building codes of any kind should strongly consider the adoption of nationally recognized standards to ensure the life, health, and safety of building occupants.

Gap: Most jurisdictions have not adopted the most recent editions of the model energy codes.

Recommendation #10: All jurisdictions should consider adopting or updating to the most recent editions of the model energy codes.

Related Recommendation: Jurisdictions that have had success with adopting the model energy codes should consider green and above-code policies and programs for public and private buildings.

Related Recommendation: Jurisdictions, particularly those with smaller building departments, should consider the regional building department model as a way to combine efforts for the energy code review and adoption process.

Gap: Many jurisdictions do not have an automatic review and update process on a three-year cycle for future iterations of the model energy codes.

Recommendation #11: All jurisdictions should consider establishing an automatic review and update process on a three-year cycle to lock in future energy savings and avoid delays.

Gap: Many jurisdictions do not take advantage of available state and local resources.

Recommendation #12: GEO and DOLA are available to provide as much support as possible to encourage jurisdictions to adopt or go beyond the state's minimum energy code. Jurisdictions should take advantage of DOLA's access to their communities and GEO's energy efficiency expertise. Local jurisdictions should also look to the expertise in the cities and towns in the state that have already gone through successful adoption processes, as well as the knowledge and resources available through third party organizations mentioned throughout this report.

Additional Recommendation: Communities should consider combining their building departments to take advantage of shared resources. This is particularly relevant for smaller jurisdictions with less construction that are close to larger jurisdictions with more resources.

Manufacturers

A few manufacturers with a presence in Colorado, such as Johns Manville, CertainTeed Corporation, and Owens Corning, are members of the Responsible Energy Codes Alliance (RECA), an energy code adoption advocacy consortium, and are already working to promote energy codes.⁶⁰ Serious Materials, a windows manufacturer, is a member of the Alliance to Save Energy (the Alliance), a national energy efficiency non-profit and BCAP's umbrella organization.⁶¹ Some manufacturers are also members of the North American Insulation Manufacturers Association (NAIMA) or the Polyisocyanurate Insulation Manufacturers Association (PIMA), two national trade associations that promote and fund energy code adoption and implementation work.⁶² However, this list only skims the surface of all manufacturers in the state.

Gap: Manufacturers in Colorado do not play a large enough role in energy code adoption support.

Recommendation #13: The state should encourage all manufacturers in Colorado to join or get more involved in national energy code adoption advocacy groups and trade associations. It should also consider ways to involve manufacturers more in existing energy code stakeholder groups.

Energy Codes in the Bigger Picture

Colorado has the potential for considerable renewable energy production and a population aware of and interested in the possibilities a New Energy Economy will provide for the state.

Gap: The energy codes community has not fully leveraged the interest of the stakeholders involved in creating a New Energy Economy to create a broader coalition for state or local energy code adoption.

Recommendation #14: The energy codes community should capitalize on the state's interest in creating a New Energy Economy to build a stronger coalition of energy code advocates to promote the state adoption of the 2009 IECC in the 93 percent of jurisdictions that have yet to adopt it.

Gap: Energy efficiency is not promoted as a means to increase the market penetration of on-site renewable energy installations.

Recommendation #15: The state should market energy code adoption as a means to reduce the cost of renewable energy options for homeowners and building operators.

Gap: In conjunction with the previous gap, energy efficiency is not promoted as a way to help utilities meet the state's RPS goals.

Recommendation #16: The state and utilities should promote energy code adoption as a complimentary effort to the acceleration of large-scale and on-site renewable energy production, which would help utilities meet the state's RPS goals.

Along these lines, the state is concerned with the potential impacts of pollution and climate change.

Gap: The state's climate change action plan does not include the 2009 IECC or an automatic review and update process on a three-year cycle.

Recommendation #17: The governor's office should update its climate change action plan to include the 2009 IECC and include a regular review and update process on a three-year cycle.

Gap: The state is not a full partner in the WCI.

Recommendation #18: Colorado should also consider becoming a full partner in the WCI and help establish energy code adoption as an official policy recommendation for member states and provinces.

Gap: Many local governments have not written climate change or sustainability action plans or joined national organizations that support such action.

Recommendation #19: Local governments should explore the potential effects of climate change and adopt climate change or sustainability action plans, as well as join national organizations that provide resources and support to help with this process.

Gap: Local governments that have written climate change or sustainability action plans have either not included energy code adoption or not included an automatic review and update process on a three-year cycle.

Recommendation #20: Local governments that have written climate change or sustainability action plans should include energy code adoption and an automatic review and update process of the model energy codes on a three-year cycle.

Gap: Energy code advocates do not stress the connection between energy codes, financial savings, climate change, and economic growth.

Recommendation #21: Colorado should clearly articulate the impact of energy code adoption for reduced energy use and greenhouse gas emissions reductions.

Related Recommendation: Furthermore, reducing local demand for electricity and natural gas through energy-efficient construction will also free up more of the state's renewable and non-renewable energy resources for export, decrease costs for consumers, and increase profits for businesses, all of which will bolster the state economy in the short- and long-term.

Implementation

While energy code adoption is the necessary first step in the energy codes process, it does not guarantee compliance. To achieve the desired energy and financial savings available through energy codes, states and cities must carry out energy code implementation, a term used to describe all of the activities needed to prepare state energy offices, local building departments, the building industry, and other stakeholders for compliance with the energy code. It includes outreach to stakeholder groups, on-site, classroom, and web-based training, establishing and utilizing enforcement infrastructure, tools, and systems, and other educational and organizational efforts.

Overview of State and Local Implementation Policies

Due to its home rule status, Colorado does not have any statutes that require energy code implementation or enforcement at the state level. However, HB 1146 states that cities and counties with building codes “shall adopt and enforce a building energy code,” although the law does not establish a funding or enforcement mechanism to support and check up on local jurisdictions with this requirement. In much the same way as with adoption, the requirement to enforce the energy code is technically law, but functions more as a suggestion in practice. One implication for leaving energy code implementation to the discretion of local jurisdictions is that enforcement and compliance practices vary widely across the state. Alternatively, some jurisdictions choose to make energy code implementation a priority and, thus, achieve greater energy savings than they would have in a top-down, state-led system.

Outreach

Energy codes have come a long way, but there are still many people unaware of their benefits, including most consumers and some policymakers. Many code officials and building and design professionals are also uneducated about energy code benefits and requirements. Outreach involves all of the activities states and local jurisdictions can undertake to raise awareness of the need for energy codes, promote their adoption and implementation, and identify opportunities for training, technical assistance, and other support. Given the diversity of the energy codes community across the country, execution of strategic outreach campaigns can improve understanding of code changes, create buy-in, and can lead to greater levels of compliance.

State’s Role in Promoting Codes

State-level energy code outreach to inspection departments and local decision-makers is critical, due in large part to the state’s home rule status. By giving jurisdictions the freedom to implement the code with few state directives, the state leaves open the possibility that local jurisdictions will choose to not devote the proper resources necessary to enforce the code—measured in time, training, and budget. State outreach helps building inspectors and local policymakers believe in the value of energy codes and their role in the life, health, and safety of building occupants.

For a recently reformed state energy office with a less expansive mandate than many non-home rule states, GEO is active in promoting the implementation of energy codes across the state. It knows that local jurisdictions are not receptive to unfunded mandates, and it views its job as helping local jurisdictions understand the reasons behind the law and assisting them with whatever support and resources it can provide. As the recent GEO-DOLA partnership grows, GEO can channel its energy code expertise through DOLA to reach code officials.

Part of DOLA's upcoming training program (see Enforcement Community: Training and CEUs) will publicize the training workshops for code officials and local policymakers at conferences across the state held by organizations such as Colorado Counties, Inc. (CCI) and the Colorado Municipal League (CML). GEO and DOLA will also use a portion of their new funding from DOE to conduct outreach to decision-makers in local jurisdictions. Furthermore, GEO works with local utilities to encourage energy efficiency programs and has worked in the past with retailers and manufacturers to offer rebates on energy-efficient products.

Another way in which GEO conducts outreach is through its new website, www.rechargecolorado.com, which acts as a one-stop-shop for consumers. They can create a personalized Energy Action Plan to reduce their own energy use and save money. The site gives users energy-saving tips, a searchable database of state and national rebates and incentives for energy-efficient appliances, home upgrades, and renewable energy installations, listings of contractors in their area, and even tips on building or buying a green home and choosing a contractor. Users can then save this information to their account and return to it as they progress towards their energy goals. The site also has a similar database of rebates for contractors. Furthermore, it helps business owners determine the energy efficiency of their businesses and provides them with resources for reducing energy use in existing buildings and new construction. Finally, the site promotes GEO programs and outlines the allocation of Recovery Act funds.

Local Government's Role in Promoting Codes

Local jurisdiction engagement in energy code outreach activities varies across the state and often corresponds directly with other energy code activities. While promoting the importance of energy codes and their true costs and savings is a means and not an end, experience shows that communities that do so are more likely to adopt and enforce them, while communities that do not stress their value are less likely to put in the resources and effort needed to adopt a code and ensure compliance.

It is often critical for local jurisdictions to have an energy code champion, usually in the inspection department or on the city council, who understands the role codes play in improving life, health, and safety in the built environment and can effectively lobby for code updates, sufficient budgets, and policies that emphasize energy code enforcement. Through their connections with other inspection officials, energy code champions can also influence attitudes around the state. For example, Parker, Thornton, and Aspen have all benefited from the efforts of a codes champion to establish a culture of code enforcement in their jurisdictions and conduct outreach on a regional or state level.

Given that 78 percent of jurisdictions have chosen to adopt some version of the IECC, it is obvious that many local inspection departments and/or policymakers have made some efforts to promote the adoption of the energy code. What is more difficult to ascertain are the motivations behind adoption and the likelihood that it will lead to implementation—the crucial outcomes of successful energy code outreach activities. Some counties and cities adopt an energy code because they believe in the value of energy efficiency; some adopt because it is the law; and some adopt because it makes them appear “green.” In speaking with code officials across the state, it is clear that all three attitudes are prevalent and that continued outreach efforts for energy code implementation hinge on believing in the importance of codes to reduce energy use and save consumers and businesses money.

Thornton is a local jurisdiction that conducts outreach activities to local policymakers and the design and construction communities because it believes in the value of energy codes. After the adoption of a new code, the Building Code Advisory Board and inspection department help local building professionals prepare for the code changes six-to-eight months in advance by announcing its target effective date to the local home builders association and any commercial developers with existing projects, which is crucial for their transition to more stringent energy efficiency requirements. The inspection department then goes over these provisions with the builders and developers, discussing topics ranging from meaning and interpretation to materials and installation techniques. This ensures that all projects that will not be completed prior to that date—and not just after—will comply with the provisions.⁶³

Stakeholders’ Role in Promoting Codes

A private energy codes network has developed to compliment Colorado’s efforts to support local jurisdictions, perhaps as a consequence of the state’s home rule status. It includes local utilities, inspection and energy modeling professionals, and environmental organizations, among others. These groups can raise awareness of energy efficiency issues, often directly to energy consumers. When consumers start caring about energy issues, it increases demand for energy-efficient construction, which creates an environment in which improved construction practices and techniques required to meet the provisions of the latest energy codes become standard practice. This, in turn, allows for the adoption and implementation of even more efficient energy codes.

One way to conduct this type of outreach is to supply homeowners and businesses with energy saving practices and improvements and direct them towards energy efficiency rebates and incentives. Xcel Energy—the largest utility in the state—provides a good example. It gives its customers easy access to energy efficiency information

Fort Collins Utilities

Fort Collins Utilities has also been active in encouraging energy-efficient practices within its service area. It has sponsored a number of outreach and training efforts aimed at consumers and the building and design industries. Following a 2002 study with the Fort Collins Building and Zoning Division (B&Z) on how best to achieve compliance with the adopted code (see Measurement and Verification), Fort Collins formed a New Homes Stakeholders’ Group to continue looking at home energy performance issues. The Group collaborated on a report that envisioned the new home market in Colorado in 2010 and put a set of recommendations for moving forward with energy code compliance practices.

relevant to them. Xcel’s website has an [ENERGYsmart Library](#) with detailed information energy-efficient appliances and upgrades, as well as an interactive [Energy Classroom](#) for elementary school students. It also allows customers to enter building, appliance, and behavior variables into a [Home Energy Analyzer](#), which then breaks down the customer’s energy use and habits, compares them to other customers, and provides specific opportunities for savings. Going one step further, customers can analyze their appliances’ collective energy use, and even examine energy use separately for each appliance. Finally, Xcel supports its programs with a widespread marketing campaign, [Responsible by Nature](#), that has its own energy saving tips and promotes Xcel’s outreach efforts.⁶⁴

Other utilities—among them Fort Collins Utilities, Black Hills Energy, Colorado Springs Utilities, United Power, and Holy Cross Energy—have set up similar online features for their customers, as has Environment Colorado, the environmental advocacy organization.⁶⁵

Nevertheless, energy efficiency experts in the state acknowledge that actual commitment to energy efficiency varies among utilities, with some demonstrating a true dedication and others only doing what is politically expedient. GEO is interested in working with utilities to create a shared fund to promote these features, rather than have each one conduct its own programs, to take advantage of economies of scale. By standardizing utility outreach to consumers and centralizing a cluttered and often confusing array of options, this model could improve communication with consumers and increase the effectiveness of utility funds and programs.

Other stakeholders provide critical outreach to code officials, policymakers, and the design and construction industries. Building energy efficiency firms like Colorado Codes Consulting (CCC) and EnergyLogic make their staffs available to code officials and work with local jurisdictions on energy code implementation issues. The trade associations promote the energy code to their members with each new code cycle and provide input to local jurisdictions upon request, although level of activity varies among them.

Enforcement Community

The enforcement community provides the teeth behind adopted codes, as it is their responsibility to ensure that design and building professionals comply with the provisions of the energy code. While enforcement is most commonly a local issue, states play a crucial role in providing municipalities with the resources and support they need to establish effective enforcement infrastructures and practices. As codes are a moving target, it is also incumbent on states and cities to provide the enforcement community with access to sufficient energy code training.

Overview of Enforcement Infrastructure

As a home rule state, Colorado does not have a board or agency that enforces building codes on the state level, with the exception of the electrical and plumbing codes, enforced by DORA. However, jurisdictions can choose to opt out of state inspections. Currently, 16 counties (and their corresponding jurisdictions) conduct their own electrical inspections and 39 counties conduct their own plumbing

inspections, including most of the larger jurisdictions, such as Denver, El Paso, Arapahoe, Jefferson, and Boulder.⁶⁶

DOLA is responsible for building inspection for manufactured and modular housing in all jurisdictions, in addition to hotels, motels, and multi-family housing in jurisdictions without energy codes in place. Although the state does little energy code enforcement, GEO and DOLA support local efforts, mainly through outreach (see State’s Role in Promoting Codes) and training (see Training and CEUs). In 2008, GEO commissioned a study of energy code adoption status across the state, and DOLA conducted a similar assessment in 2010, yet neither agency has carried out an equivalent study for local energy code enforcement practices and infrastructure. Fort Collins’ work measuring compliance (see Compliance Measurement and Verification) could inform a statewide evaluation.

City and town inspection departments are responsible for energy code enforcement within their jurisdictions, while county inspection departments cover enforcement within unincorporated areas. As with adoption, regional building department also handle code enforcement. Outside of these arrangements, however, city and county inspection departments stay within their jurisdictions and generally do not work together or share resources. Still, county and city code officials communicate on local issues as needed in regularly scheduled meetings organized through the CCICC and/or the local code official chapters.

In most cities in Colorado, building inspection follows a standard procedure: building professionals submit their plans to plans examiners, who return them with comments. Building professionals then re-submit plans with corrections, and plans examiners issue building permits once they are adequate. Code officials then conduct multiple on-site inspections at different stages in the building process (foundation, frame, and final at a minimum), issuing inspection write-ups or stop-work orders for violations as needed. Once code officials have verified that construction correctly adheres to the building plans, they issue the appropriate final documentation, depending on the type of building and project.

Enforcement of State Buildings

The OSA is responsible for enforcing the 2009 IECC for public buildings, as well as the state’s high performance green building policy, based on the LEED Gold standard. OSA’s roles include creating a [uniform building code compliance process](#) and coordinating all parties involved in the planning, design, and construction of state-funded buildings. OSA contracts with private energy code firms, approved annually, for plan review and building inspection, or, in some cases, allows the local inspection department to take over jurisdiction of the project.

Building departments usually incorporate energy code enforcement into the established inspection process outlined above, rather than set up a specific energy track. In larger cities and towns, particularly along the I-25 corridor, efficiency experts interviewed believe that energy code enforcement is generally stronger than in smaller rural communities, however no statewide study has confirmed this conviction with data. However, it might be a moot point, as the consensus among the experts interviewed is that enforcement practices vary greatly among jurisdictions and that the majority of building departments—both urban and rural—do not yet enforce the code sufficiently to achieve compliance.

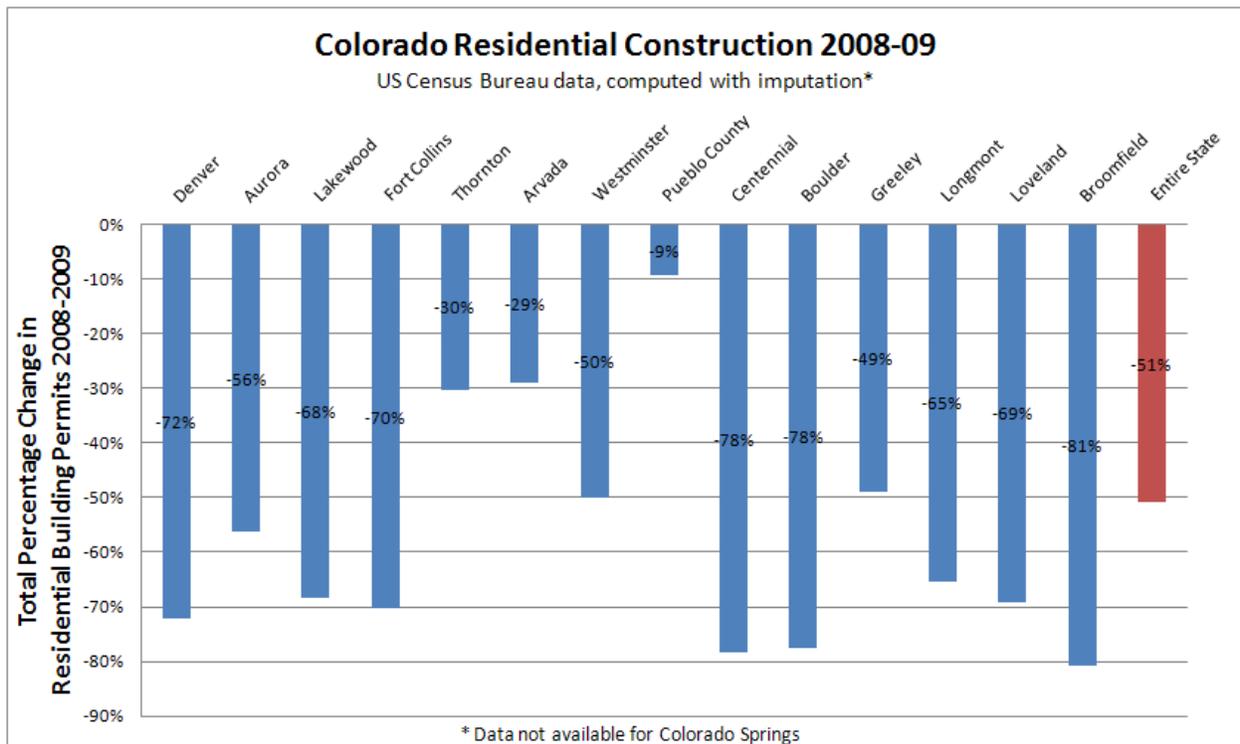
Building departments usually incorporate energy code enforcement into the established inspection process outlined above, rather than set up a specific energy track. In larger cities and towns, particularly along the I-25 corridor, efficiency experts interviewed believe that energy code enforcement is generally stronger than in smaller rural communities, however no statewide study has confirmed this conviction with data. However, it might be a moot point, as the consensus among the experts interviewed is that enforcement practices vary greatly among jurisdictions and that the majority of building departments—both urban and rural—do not yet enforce the code sufficiently to achieve compliance.

Our findings indicate that the most commonly cited barrier to proper energy code enforcement is a lack of priority. Code officials stress that in most jurisdictions, the energy code is a relatively new requirement, and many policymakers and code officials alike view it as a secondary concern compared to the more traditional life, health, and safety codes. Building officials who do not value the code as integral to occupant health and safety are less likely to integrate the code into their established routines, particularly if their superiors take a similar view. Support—in the form of funding—for proper energy code enforcement ultimately comes from city council members, town administrators, and other local decision makers, many of whom see the energy code as a politically convenient “green” initiative, but lack the conviction to support its implementation.

A related concern of building departments is a lack of resources for energy code enforcement. Local inspection departments collect building permit fees, which return to them in one of two ways: either they enter into a general fund from which the city budget is determined or they go directly to the inspection department as enterprise funds, meaning that they department receives only what it collects in any given year. Under the first system—the more common arrangement in Colorado—most inspection departments traditionally receive a smaller percentage of funds than they bring in. Determining the appropriate percentage of funds for inspection departments’ budgets depends on a host of variables and must be examined on a case-by-case basis. Still, it is crucial to note that budgeting, more than any other indicator, demonstrates commitment from jurisdictional leadership to prioritize energy code implementation.

The variable nature of the economy and construction market compounds this concern. Even before the housing bubble burst nationwide, Colorado had begun to experience a sharp decline in residential

Figure 4.



building permits per year after many years of extensive building, as well as a decrease in commercial development, particularly for larger, more expensive projects. In 2009, local jurisdictions issued almost 80 percent fewer permits than in 2004 and 2005, including a 51 percent drop across the state from 2008-2009 alone (Figure 4 above). This decline greatly reduced inspection departments' workloads and budgets, and many have had to reduce staff while giving remaining staff additional responsibilities. In our interviews, we repeatedly heard that when understaffed and overworked, energy code enforcement is often the first area local inspection departments deemphasize or disregard.

Another barrier is familiarity with code provisions, which ranges greatly among code officials in the state. Despite the best efforts of a number of stakeholders, many code officials lack the requisite training on the energy code, the building science behind it, and its proper application in the field. The vast majority of inspectors come from the design and building sectors. They tend to focus on the areas of construction with which they are the most familiar. Since few, if any, come from an energy efficiency background, they lack experience with the provisions of the code and how to enforce it. In addition, new provisions in the 2009 IECC require performance testing equipment, such as blower doors and duct testing equipment, with which most code officials and builders are largely unfamiliar.

Finally, distance is a barrier for energy code outreach and training. With over 50 percent of the population in the Denver metro area—and over 80 percent along the I-25 corridor—energy code activities are naturally centered there. For code officials who live outside of the region, the logistics of traveling long distances limits access to these events. GEO, DOLA, and other groups have done an admirable job of trying to bridge this gap by holding energy code trainings in regional centers around the state. Yet the inevitable consequence of a large state with a concentrated population center is that stakeholders outside of that center will simply have less exposure to the messages, techniques, and tools they need.

Certification

Local jurisdictions are responsible for setting code official certification, as the state does not have statewide procedures in place. Most jurisdictions require ICC building inspector and/or plans examiner certification at a minimum, either as a de facto or official policy, and some encourage further certifications. A few jurisdictions—mostly in rural areas where the code official has multiple roles—decline to set requirements. The CCICC does not set certification requirements for membership. According to the ICC, there are 75 code officials in Colorado with energy inspector certifications.⁶⁷

Training and CEUs

Colorado does not have a standard for maintaining certification through Continuing Education Units (CEUs). Still, inspection departments that require ICC certification also require code officials to receive the minimum number of ICC-mandated CEUs to maintain certification, though this is for all codes and does not necessarily include energy efficiency training. As with other implementation issues, some departments are more proactive in encouraging code officials to earn as many certifications and CEUs as possible.

In recent years, there have been ample opportunities across Colorado for code officials to receive energy code training and fulfill CEU requirements. Every March, CCICC hosts a weeklong training workshop, one track of which is on energy efficiency. Moreover, in 2008, GEO undertook a statewide training effort in support of the promulgation of HB 1146 and the push to adopt and enforce the latest model energy code. GEO offered 30 no-cost workshops on the 2003 and 2006 IECC for code officials and building professionals in cities around the state, featuring full day training conducted by ICC trainers that covered the commercial and residential requirements of the codes. GEO offered a similar training in 2009 on the 2009 IECC in over 20 cities. As part of these training sessions, GEO also distributed 2009 IECC codebooks free of charge.

Through funding from the Recovery Act, the state is putting together a more comprehensive and ambitious adoption and implementation program for late 2010 and 2011. After a competitive process, DOLA awarded the grant to a collaborative team from CCC, the ICC, and EnergyLogic. The overarching goals of the program will be to provide customized energy code adoption and implementation support to local jurisdictions and create local energy code champions that will continue advancing codes. With such a wide range of adopted codes, attitudes, practices, and resources across the state, DOLA feels that each community will benefit the most from state-level support tailored to fit its particular needs, rather than a one-size-fits-all approach.

The program will begin with a survey for code officials to determine each municipality's baseline and areas of focus. Staff will deliver one of three levels of no-cost code training, depending on the code adopted and the level of energy code expertise in each jurisdiction. The third level will consist of program staff making on-site visits to examine plans, go over checklists, cover on-site inspections, and evaluate existing enforcement practices and infrastructure. In jurisdictions with a code other than the 2009 IECC—or no code at all—program staff will also support model code adoption. Finally, the program will conduct outreach at various municipal conferences and create state-specific resources to support builders in the field.

Third Party Infrastructure

The state has a well-established third party infrastructure, stemming in part from the state's history with green and above-code building. In 1995, OEMC started the first third party energy rating organization in the state, E-Star Colorado (E-Star), with funding from DOE. E-Star was an accredited HERS provider and energy efficiency advocacy organization that performed thousands of home energy ratings. After state funding for the program ended, E-Star became a non-profit organization and eventually merged with the Smart Energy Living Alliance in the late 2000s. Much like Built Green, though, E-Star was a pioneer that opened the door for third party rating organizations around the state.

Inspection departments are generally receptive to "voluntary" third party inspections. Many feel that recognized third party organizations provide quality inspections for code and above-code compliance verification. They also recognize that working towards achieving an above-code rating improves overall energy code compliance, as well as gives builders a useful marketing tool, which further advances the market for above-code construction. Some jurisdictions accept third party testing documentation for

compliance, although this is not universal. In interviews, a number of code officials said that they still conduct their own energy code inspections on top of third party work. They also stressed that they would prefer to keep third party verifications voluntary—as opposed to code—and provide additional rebates to builders as a way to increase their usage in the future.

The Residential Energy Services Network (RESNET) provides federally recognized third-party rating standards for building energy performance. Its website allows homeowners to learn about energy audits and rating processes, as well as easily locate certified energy auditors, raters, and qualified contractors and builders. According to RESNET, there are currently 36 organizations certified as HERS raters in Colorado.⁶⁸ Raters must complete the required RESNET energy training to be included on this list. In addition, the ENERGY STAR website lists 43 companies and organizations that employ qualified raters in the state, although many companies are on both lists.⁶⁹

Local Implementation Spotlight

Increasingly, jurisdictions understand the benefits of the energy code, make it more of a priority, and take advantage of training opportunities around the state. Even so, inspection departments are still figuring out how to incorporate it into the existing enforcement process in such a way that compels the building and design industries to comply, yet maintains flexibility regarding the practical limits to achieving full compliance in the short-term.

The Town of Parker, an exurb in the southeastern corner of the Denver metro area, provides an excellent example of how to improve energy code compliance incrementally through persistent outreach, adequate training, and consistent enforcement. What's unique about Parker is not its energy codes process so much as its attitude towards codes—and it's follow through. Starting with the inspection department staff and extending to the city council and town administrator, decision-makers in Parker have made energy code adoption and enforcement a priority. Since 2003, Parker has worked with the design and building industries to clearly outline expectations they must meet to receive a permit. Parker has also required its inspection staff to attend multiple trainings and apply their knowledge in the field. Moreover, Parker policymakers have given the inspection department sufficient funds to maintain energy code enforcement efforts and the leniency to accomplish their mission over the course of several years.

Parker officials stress that they started slowly. For example, the inspection department worked with its staff and building professionals alike to bring each group up to speed before ratcheting up expectations. Likewise, Parker first focused on energy code compliance for residential construction before turning to the commercial side. Officials also stress that proper energy code enforcement requires constant vigilance, as any leniency sends signals to the industry that it is acceptable to cut corners. Finally, Parker officials note that outreach, training, and enforcement are constant processes, rather than one-time efforts, as the actors on both the enforcement and compliance sides change periodically and the code is a moving target. Still, Parker officials are supportive of and active in the state's upcoming implementation efforts, as the myriad funding opportunities presented by the Recovery Act will jump-start serious implementation efforts in cities and counties across the state.

Design/Construction Community

The design and construction community—made up of designers, architects, engineers, developers, builders, and subcontractors—are in charge of conceiving and constructing the built environment. It is ultimately their responsibility to comply with the requirements of the adopted energy codes. However, state and local agencies, energy code advocates, and other stakeholder groups share in this responsibility. They should provide the training, tools, educational materials, and support to understand and be able to comply with the code, including how to correctly install materials and use testing equipment. They should also work with the design and construction community to establish a workable compliance process that is accountable, yet flexible, and accommodates local practices and circumstances.

Overview of Design/Construction Community Infrastructure

The Colorado Association of Home Builders (CAHB) is the state chapter of the National Association of Homebuilders (NAHB). Membership in each organization is automatic upon joining one of the fifteen local chapters across the state. CAHB represents the interests of contractors, developers, and other industry professionals on the state level. It is not involved in local energy code issues, though it does hold an annual conference for members. The local home builder chapters participate in the local energy code adoption and implementation process. The HBA of Metro Denver, the Housing and Building Association of Colorado Springs, and the HBA of Northern Colorado serve the state's large population centers on the I-25 corridor.

The American Institute of Architects, Colorado component (AIA Colorado) and its four regional chapters (Denver, North, South, and West) represent the interests of architects and other design professionals around the state. AIA Colorado and the regional chapters sponsor training workshops on building codes and building science issues, including energy, as well as other events for members and outreach to the public.⁷⁰ The Rocky Mountain ASHRAE and Pikes Peak ASHRAE chapter represent engineers and other building science professionals. Both offer members monthly meetings, activities, and alerts for important information on training and seminars. Rocky Mountain ASHRAE runs an annual technology conference with an exhibit section and multiple tracks for speakers. The 2010 conference's theme was building sustainability in the context of green building.⁷¹

As covered above, Colorado's housing market declined sharply over the past few years. The design and construction industries have struggled to cope with the fallout. Many businesses have gone bankrupt, and many firms have had to lay off staff. The trade association chapters have also suffered, and many have had to reduce staff and services to constituents. Even in times of economic prosperity, some building professionals are wary of—or opposed to—energy codes, even in a state with a fairly strong history of energy-efficient construction. But when building professionals are focused on keeping their businesses afloat by cutting costs wherever possible, energy code training and compliance are often the first casualties, even though BCAP's Incremental Cost Analysis study found that building to the model energy codes is affordable.⁷²

Somewhat paradoxically, though, many of the residential builders who have survived and begun to stabilize have done so by becoming ENERGY STAR for Homes partners and prioritizing funds to train their employees on building to this standard. This sets them apart in the marketplace. These builders must bring in HERS raters and other third party inspectors at their own cost, but are able to recoup the additional investment through a higher sale price for consumers who want a better quality home with lower operational costs. Design firms have found similar success with LEED and GA, and for many large commercial builders, green building has become the standard, especially in the Denver metro area. Although residential and commercial builders are beholden to the demands of their clients, they can take the initiative to build to higher standards and influence their clients' priorities.

Regarding compliance, many design and construction professionals respond to the local inspection departments' interest in energy code enforcement. In jurisdictions where compliance is expected, they seek out training for their staff and work with plans examiners and building inspectors to follow the letter and intent of energy code provisions. According to our findings, in jurisdictions that do not place as high of a priority on energy codes, building professionals follow their lead and comply with the code only to the extent necessary, if at all. As might be expected, compliance with code provisions is generally, though not always, stronger among building professionals in urban areas than rural ones, as the attitude towards many forms of regulation is often more relaxed in rural areas.

Obviously, these are broad generalizations. Some building professionals adhere to or exceed energy code requirements for any number of reasons: desire to produce quality structures, financial incentives, environmental or indoor air quality concerns, or simply because they are the law in a given jurisdiction. Others disregard energy codes as unnecessary and/or costly regulations regardless of local or state pressure, encouragement, or incentives. Many in the middle would be more receptive to energy code compliance, but lack training on the codes or do not understand how they are integral to building and occupant life, health, and safety. Overall, however, authorities on both sides of the issue cite a strong causation between strict, consistent enforcement practices and improved compliance, as well as a willingness among most building professionals to work with code officials on energy code issues as needed.

Licensing

Colorado regulates professional licensing for a number of design and construction vocations. CSEB, CEBC, and the DORA Board of Licensure for Architects, Professional Engineers, and Professional Land Surveyors oversee state licensure requirements for electricians and electrical contractors, plumbers, architects, and professional engineers, respectively. Although each process varies somewhat, in general, applicants must present proof of experience and either pass a state-administered examination or provide equivalent endorsement from another state.⁷³

The state does not require licensing for commercial developers, contractors, and all non-electrical and -plumbing subcontractors. These professionals must verify local requirements with each city or county (for unincorporated area) where they plan to work. All major cities (population of 100,000 and higher) in the state except Westminster require licensing for contractors, which usually includes proof of

experience, references, and a written examination.⁷⁴ As a less stringent alternative, Westminster and a number of other smaller cities and towns in the state require contractors to register with the city, which generally does not require as much documentation or an examination, but still gives the jurisdiction the ability to regulate the industry as necessary. A few counties in Colorado also require contractor licensing, but it is much less common at the county level because the General Assembly only granted the power to license contractors to statutory counties in 2007.⁷⁵ Many counties are considering the possibility of requiring contractor licensing in the future.

Local HBA chapters do not require any form of certification or licensing for membership, although members must work in construction or a related field. AIA Colorado and its regional chapters have multiple categories of membership. They require proof of licensure for membership as an Architect, whereas Associate and New Graduate designations require only academic records where applicable and Professional Affiliate requires licensure in another field where such requirements exist.

Training and CEUs

Following previous code cycles, the larger local home builder association chapters sponsored training workshops on the new codes, including the IECC, as well as ENERGY STAR for Homes. However, more recently, the entire local home builder associations have had to cut services to their constituents, training included.

Training for Westminster Residents

With EECBG funding from the Recovery Act, the City of Westminster offered a series of energy code training workshops free of charge for building professionals and homeowners who live and work in Westminster. Participants received CEUs for attending.

Still, building professionals in Colorado have had other opportunities to receive energy codes training. Some have taken advantage of the aforementioned GEO-sponsored energy code training workshops in 2008 and 2009. Although the upcoming DOLA-sponsored workshops are designed specifically for code officials, building professionals are also encouraged to attend. In 2010, GEO also sponsored a series of webinars and trainings in multiple cities around the state on high

performance building practices and issues. The remaining webinars—on ventilation strategies and the energy-water nexus—are scheduled November and December.⁷⁶

Furthermore, the International Building Performance Simulation Association (IBPSA-USA), an international trade association for building simulation professionals, and RMI, a well-respected environmental “think-and-do tank” with offices in Snowmass and Boulder, offered a full-day workshop in early November on energy modeling for ASHRAE Standard 90.1-2007 and LEED.⁷⁷

Building professionals also have a number of options for ENERGY STAR training. The Northern Colorado ENERGY STAR Homes Program hosted a free training workshop in October 2010, presented by EnergyLogic staff.⁷⁸ GEO ENERGY STAR New Homes Program also hosted a series of inexpensive one-day training workshops in Loveland, Denver, Frisco, Eagle, Grand Junction, and Durango in November 2010.⁷⁹ Finally, Affordable Comfort, Inc., a national home performance non-profit, held the Colorado ENERGY STAR Summit in Denver in December 2010.⁸⁰

Finally, the Colorado State Energy Sector Partnership (SESP) provides workforce training and education in the energy efficiency and renewable energy sectors. The SESP offers scholarship grants to workers for classes that will lead to certifications from organizations such as the USGBC, the Building Performance Institute (BPI), and the North American Board of Energy Practitioners (NABCEP). Trainings, conducted by CleanEdison, will be available in Denver, Boulder, Colorado Springs, and Grand Junction.⁸¹

The state boards for electricians, plumbers, architects, and engineers do not require CEUs for license renewal.

Compliance Measurement and Verification

With energy codes becoming ever more stringent, it is increasingly important for the enforcement and building communities to take extra steps beyond code to ensure that compliant buildings achieve their predicted energy savings, as many buildings fall short of their potential. The solution to underperforming buildings is measurement and verification, or the process of measuring energy performance and verifying that it matches the expected outcome. On the micro level, this process—known as commissioning for large commercial construction and performance testing for residential construction—involves blower door tests, duct blaster tests, and other performance measurements. On the macro level, it can involve state agencies, utilities, building science professionals, advocacy organizations, and other stakeholders compiling and analyzing building performance statistics to measure compliance and gauge implementation effectiveness.

Past and Current Activities

In 2002, the City of Fort Collins released a report on a residential energy code compliance study conducted by Fort Collins Utilities and the Fort Collins B&Z. The study analyzed a random sampling of homes built from 1994 to 1999, including homes built before and after the 1996 adoption of an energy code based on the 1995 MEC. After conducting inspections for new construction, utility bill analysis, energy modeling, and/or performance testing for completed homes, the researchers identified several outcomes, among them:

- Compliance rates for individual code provisions ranged greatly
- The lowest compliance rates were for duct sealing, slab-on-grade insulation, air sealing between the house and garage, and water heater standby loss
- Designs for crawl spaces and air sealing and insulation practices improved the most after code adoption
- Enforcement of energy code provisions was inconsistent
- Discrepancies existed between builder documentation and actual construction practice
- Builders were concerned with receiving sufficient training on the energy code and performance testing procedures⁸²

These findings greatly informed energy code stakeholders in the Fort Collins area of the on-the-ground realities of enforcement and compliance. The report is credited with educating code officials and design

and construction professionals on how to improving energy code compliance. Fort Collins Utilities and B&Z followed up the study with a similar, but abbreviated, internal study in 2007 on new construction, which they used as a gauge for progress since the first study's release.

GEO is currently in the planning stage of a measurement and verification project for a number of its residential energy efficiency projects, including its energy code compliance efforts with DOLA. The project, funded by the Recovery Act, will hire contractors to measure energy savings in a representative sample of buildings and then compare building performance against self-reported compliance. GEO views the program not as a referendum on local compliance, but rather as a way to measure where local jurisdictions and building professionals are at and then identify how to help them become more comfortable with the process. The project is set to officially launch near the end of the 2010, and field work will begin in 2011.

Implementation Summary

Current Best Practices

More so than many other states, energy code advocates in Colorado are aware of the challenges to achieving compliance and identify where the state falls short. Colorado is beginning to build the knowledge base and infrastructure it needs to reach 90 percent compliance with the model energy codes. While it still faces an uphill climb, the state has already made significant advances and should be encouraged by the early fruits of this labor.

With their recent work advancing energy code implementation, GEO and DOLA have taken the lead on providing support to local inspection departments, building professionals, and other interested parties. GEO has allocated significant resources from the Recovery Act for energy code work at the state and local level. Its previous two training workshop series went beyond the prototypical statewide training effort in scope and reach, and the upcoming DOLA training workshop series promises to provide even more value to local code officials. Moreover, their partnership strengthens state-local relations, which makes future collaboration and support easier. The current ENERGY STAR New Homes Program has been nationally recognized as an excellent state-led initiative that works with local stakeholders to tailor the program to local and regional needs.⁸³

The support of GEO's predecessor, OEMC, for E-Star was also an early success for improving residential compliance and home performance, while Built Green was a clear leader in above-code construction and a model for other programs. Finally, DOLA's enforcement of manufactured and modular housing helps to protect citizens by assuring affordability well past the point of purchase.

On the local level, cities such as Parker and Aspen provide examples of how sustained commitment to energy code implementation leads to stronger compliance, while Thornton demonstrates a model for outreach, particularly to the design and construction communities. The many training sessions available to enforcement, design, and construction professionals ensure that they have a better understanding of the importance of codes, their provisions, and their application in the field. Regional inspection departments take advantage of shared resources to improve services for constituents and increase

building code consistency across larger areas in which smaller communities might not have sufficient resources to enforce building codes on their own. Finally, Fort Collins' work on measurement and verification was a pioneering endeavor and could inform other city or state efforts in the future.

Recommendations

State Enforcement

Gap: Many local jurisdictions struggle to enforce energy codes.

Recommendation #22: Even in a firmly entrenched home rule system, GEO and DOLA should increase their energy code activity to support local jurisdictions, particularly for smaller jurisdictions. The state could use remaining Recovery Act funding or find another source, such as a small tax on permit fees, to establish voluntary enforcement services, which would advantage of either DORA's or DOLA's pre-existing enforcement infrastructures.

Gap: Smaller jurisdictions with fewer resources and code officials struggle to fund and carry out energy code enforcement.

Recommendation #23: The state could offer optional third party energy code enforcement services for towns below a minimum size that choose to opt in to the program. Such a program could leverage the state's scale to provide cost-effective services. Adoption of building codes and the statewide minimum energy code could be a pre-requisite for participation. New Mexico and Wisconsin have similar models in which larger municipalities can opt out of state enforcement.

Related Recommendation: Alternatively, the state could support mechanisms at the local level to hire third party inspectors to perform plan review and inspection. It could also facilitate agreements at the local level between smaller communities to share energy code implementation tasks.

Related Recommendation: The state could provide matching funds for permit fees inspection departments either keep or receive back from the general fund to support stronger enforcement (Adoption of the statewide minimum code could be a prerequisite).

Gap: The state has three departments that enforce state-level building codes.

Recommendation #24: The state could consider combining state-level building code implementation under one agency to streamline the enforcement process, which is currently housed under three departments: DORA (plumbing and electrical), DOLA (manufactured and modular, hotels, motels, and multifamily in unincorporated areas), and OSA (public buildings). The state could evaluate the potential of each agency to house all state-level implementation activities. While this option may turn out to be politically difficult or logistically infeasible, it is worth exploring.

State Implementation Support

Gap: Most local jurisdictions require more resources and support for energy code implementation.

Recommendation #25: One crucial role the state plays is as an advisor and supporter for local inspection departments and policymakers. The state is limited in its ability and desire to set local policy, but it should expand the information, technical support, and incentives it already provides to influence behaviors at the local level. For example, the state should review DOE’s new guidelines on measuring energy code compliance and disseminate this information to local jurisdictions with suggestions for how to adopt DOE’s recommendations given the realities on the ground in any particular community.⁸⁴ Another low-cost option would be to direct local jurisdictions to the recent DOE/ICC *Building Energy Codes Resource Guide* for code officials, which offers a multitude of useful resources.⁸⁵ Appendix A offers a list of other DOE and PNNL energy code resources.

GEO and DOLA should also create and distribute materials tailored for code officials, design professionals, and contractors on the 2009 IECC, such as code guides and compliance checklists. These documents should summarize key provisions of the energy code, identify changes from the previous code, discuss the intent of major requirements, highlight proper installation techniques, and generally clarify and expand upon the code itself. The state can work with local jurisdictions and especially trade associations to adapt materials to fit each audience.

Related Recommendation: The state could subsidize the purchase of handheld tools for building departments to streamline inspections and help facilitate the integration of energy code inspections into the building code enforcement process, which would reduce inefficiencies. It could also subsidize duct blaster and blower door equipment and training for communities that request these services.

Related Recommendation: The state should consider advising and working with jurisdictions to establish regional building departments where feasible to allow jurisdictions, particularly with small or understaffed building departments, to take advantage of combining resources for enforcement.

Gap: Many local jurisdictions lack an energy code champion who can lead efforts to improve energy code implementation.

Recommendation #26: Through its statewide reach and perspective, the state should identify and encourage local energy code champions who can lead efforts to improve energy code implementation policies and practices.

Gap: Most local jurisdictions do not offer policies that encourage energy code compliance.

Recommendation #27: The state should encourage local jurisdictions to set policies that reward building professionals for achieving compliance with the energy code or above-code standards, such as expedited permitting, reduced permit fees, or matching funds for permit rebates.

Related Recommendation: Alternatively, the state should also dissuade non-compliance by encouraging local jurisdictions to require change orders and re-reviews for energy code site plan violations and issue stop orders for energy code construction violations.

Gap: Local jurisdictions have different standards for energy code implementation.

Recommendation #28: The state should use its reach and influence to encourage uniformity for energy code implementation requirements and practices, which would reduce the patchwork nature of energy codes and practices in the state that add confusion to the market and reduce compliance.

Related Recommendation: The state could also encourage local jurisdictions and trade associations to establish uniform CEU requirements for energy code training and minimum certification requirements for code officials and building professionals.

Gap: Some local jurisdictions do not have an approval policy in place for third party inspections from recognized third party providers as verification of compliance.

Recommendation #29: The state should encourage all local jurisdictions to establish approval policies for third party inspections from recognized third party providers as verification of compliance.

Local Implementation Activities

Under the current political system, local jurisdictions cannot rely solely on state support for energy code implementation activities, and some jurisdictions do not want it.

Gap: Many local jurisdictions have not considered or taken appropriate steps to improve energy code implementation.

General Recommendation: Local jurisdictions should initiate on their own or work with the state to initiate many of the recommendations above that deal with state support or encouragement of local policies.

Gap: Many local jurisdictions do not make energy codes a priority.

Recommendation #30: Local jurisdiction decision-makers should examine or reevaluate where energy codes stand in their list of priorities.

State Measurement and Verification

Fort Collins' work on measurement and verification of its adopted energy code raised awareness of compliance issues and provided valuable insights for decision-makers into how to improve enforcement and compliance practices and techniques.

Gap: The state has not conducted a statewide measurement and verification study.

Recommendation #31: The state could consider leveraging this local expertise by devoting additional Recovery Act funds to build upon the planned statewide measurement and verification study for its residential energy efficiency projects. For consistency, the state might also consider conducting the study once more municipalities have adopted the 2009 IECC. Should the state not be able to fund such an ambitious effort, it could consider a partnership with utilities in the state that would benefit from learning more about building design, construction, and enforcement practices in their districts. Such a study should examine both residential and commercial construction.

Gap: No other local jurisdiction has conducted a comprehensive measurement and verification study.

Recommendation #32: All local jurisdictions should consider conducting a comprehensive measurement and verification study to better understand and improve energy code enforcement and compliance practices and techniques. This is particularly important for jurisdictions with more new construction. In the absence of sufficient funding, jurisdictions should consider collaborating with local utilities.

Training

Knowledge is crucial to code officials' and building professionals' desire and ability to enforce, comply with, and stay up-to-date on the requirements of adopted energy codes. As indicated above, the state's recent training efforts have been commendable. As part of the New Energy Economy, the state is also working to strengthen job training and continuing education in energy-related fields, such as the SESP and the GA-Community College partnership. However, additional and ongoing training is critical for all code officials and building professionals, particularly as the model energy codes increase in stringency and the use of even more stringent codes and standards becomes more prevalent.

Gap: More energy code and building science training is needed to ensure that enforcement officials and design and building professionals have the knowledge and skills needed to understand the provisions of the model energy codes and their application in the field, as well as green and above-code standards.

Recommendation #33: The state should build on the existing infrastructure by supporting and collaborating with community colleges, technical schools, and the state university system to increase training for energy efficiency professionals with expertise in building science and energy codes.⁸⁶ The state could also subsidize tuition for energy efficiency-related training and classes.

Additional Recommendations: The state should consider the following recommendations when planning its upcoming training series:

- Emphasize the building science behind energy codes so that attendees understand the interrelated nature of building systems and employ an integrated approach to design, construction, and enforcement
- Deliver the message that energy codes are integral to life, health, and safety and should, therefore, be viewed as an equal priority
- Get attendees out of the classroom and onto construction sites as much as feasible to demonstrate the practice application of code requirements, proper compliance techniques, and common errors
- Encourage all code officials to attend, even if they have participated in the previous two statewide training workshop series

Utilities

Utilities have an interest in reducing energy use and peak loads, improving system reliability, and avoiding the costly construction of future generating capacity. Significantly, utilities usually have

available resources, as well. In many cases, they also have obligations to state utility boards that they can meet through energy code support.

Gap: Utilities do not take a more active role in promoting and supporting energy code implementation.

Recommendation #34: Utilities should do more to support energy code implementation by beginning or expanding their outreach efforts on energy efficiency and energy codes to consumers and businesses. Utilities can develop messaging and marketing campaigns that connect their targeted audiences to resources that make energy efficiency an easy and practical tool for saving energy and lowering rates.

Additional Recommendation: Utilities should participate in large-scale customer engagement campaigns to motivate customers to change behaviors.

Gap: Utilities do not combine resources to deliver clear, consistent messaging to the public and offer uniform energy efficiency programs and incentives.

Recommendation #35: Utilities should explore the option of creating a shared fund to promote energy efficiency programs and incentives, possibly following the model of the Energy Trust of Oregon.⁸⁷

Gap: Utilities do not do more to promote and incentivize green and above-code construction.

Recommendation #36: Utilities should promote and incentivize green and above-code construction through programs such as Nevada Energy’s Energy Plus Homes Program, which is twice as stringent as ENERGY STAR for Homes requirements.⁸⁸

New Partnerships

Gap: The state has not tapped into its full potential for building a broad energy codes coalition.

Recommendation #37: The state should expand its role as facilitator by working with non-local actors, such as SWEEP, utilities, trade associations, manufacturers, environmental organizations, and others, to build a stronger coalition of interested parties that can influence changes that lead to stronger energy code implementation. Pressure—and incentives—from multiple parties, coordinated at the state level, can motivate the enforcement, design, and construction professionals in ways that the state cannot achieve through mandates.

Gap: Most consumers are largely unaware that most buildings fall short of adopted energy code requirements—or even that there are adopted requirements in most jurisdictions.

Gap: Most consumers are largely unaware of the magnitude of energy and financial savings available to them through lower operating costs in buildings that are compliant.

Gap: Consumers are not a driving market force for better energy performance in the built environment.

Recommendation #38: GEO and DOLA should consider how to engage consumers through a campaign to promote energy code awareness. Working with consumers groups and other interested parties, they could give consumers knowledge and tools to make informed purchasing decisions and create demand

for energy-efficient construction. They could also continue to work with real estate representatives, appraisers, and lenders to properly value energy-efficient construction and operating costs in the market. Creating consumer demand and proper valuation will give the design and construction communities a more powerful incentive to comply with the adopted codes than the state could provide. One interesting potential partner is Ecobroker, a Colorado-based company that provides green certifications for real estate professionals.⁸⁹

Gap: Manufacturers in Colorado do not play a large enough role in energy code implementation support.

Recommendation #39: Colorado manufacturers can play a much greater role in supporting energy codes and energy-efficient products. For companies that continually improve their products, more stringent energy codes and greater compliance will benefit their business, as the use of these products will become the standard for construction in the state.

Related Recommendation: The state should develop partnerships with national retailers to ensure that energy-efficient products and services are available across the state, particularly once the state updates its minimum energy code to a more stringent edition. Retailers can also promote energy-efficient features behaviors to consumers and businesses.

Conclusion

Building energy codes are one of the easiest and most cost-effective ways for Colorado to secure its energy future. Compliance with the code not only helps consumers and businesses save money on their energy bills, it also reduces pollution and peak loads, resulting in a cleaner environment and a more stable and diverse energy supply. In many jurisdictions in the state, energy codes are already an accepted policy tool. Promoting adoption in locations without an energy code or an outdated code, supporting energy code implementation on the local level, and creating demand for code compliance will help Colorado continue in the right direction toward greater energy efficiency in the built environment.

Working with local governments and the many energy code advocates and stakeholders in the state, GEO and DOLA play a pivotal role in raising awareness of energy efficiency issues and promoting the uniform adoption of the model energy codes in jurisdictions across the state. They can also provide the state-level coordination, resources, expertise, and training necessary to support local enforcement professionals and the design and construction communities and keep them up-to-date with the model energy code and its requirements. The state can also analyze gaps in state-level enforcement to find ways in which to improve compliance for all types of construction in Colorado. Even with a local-first political system, there is much the state can do to ensure that its citizens benefit from the widespread adoption and successful implementation of the model energy codes.

The recommendations made in this gap analysis, summarized below in Table 4, are meant to guide state officials and other Colorado stakeholders as they work to support improved code adoption and implementation and begin the process of developing a compliance action plan. Though some recommendations may require increased funding over an extended period, a careful, comprehensive action plan that leverages existing infrastructure and provides the state with realistic funding mechanisms will help ensure that new construction in the state achieves 100 percent compliance with the model energy codes now and in the future.

Table 4. Recommendations Table

Adoption
State Policy
Adopt the 2009 IECC as a statewide, mandatory energy code or set it as the minimum energy code (p. 30)
Establish a regular review and update cycle for future iterations of the energy code (p. 31)
Update legislation to prohibit compliance through the IRC and weakening amendments (p. 31)
GEO/DOLA should expand role supporting local adoption, including green/above-code programs (p. 31-32)
Include energy codes as integral part of New Energy Economy and climate change mitigation strategies (p. 32)
Local Policy
Adopt building codes, including the most recent model energy codes (p. 32)
Establish regular review and update cycle for future iterations of the energy code (p. 33)
Implementation
State Enforcement and Implementation Support
Increase its own enforcement services for communities without building codes, as well as consider combining its three state-level enforcement activities under one agency (p. 50)

Explore policy solutions to traditional funding and enforcement issues the local level (p. 51)
Provide clarity, guidance, and resources to local jurisdictions to support implementation (p. 51)
Encourage policy changes at local level to promote uniformity and incentivize energy code compliance (p. 51-52)
Local Implementation Activities
Initiate or work with state to initiate policies and programs highlighted in recommendations (p. 52)
Measurement and Verification
Conduct a statewide M&V study/expand planned study, building on Ft. Collins' previous work (p. 52-53)
Training
Create knowledgeable energy efficiency professionals for the New Energy Economy through job training and continuing education (p. 53)
Ensure that upcoming training workshop series emphasizes building science on on-site training (p. 53)
Utilities
Take a more active role in promoting energy code implementation, green and above-code programs, and conducting outreach to consumers (p. 53-54)
New Partnerships
Engage utilities, consumer groups, real estate/appraisal/lending communities, manufacturers, and retailers with presence in CO to encourage greater outreach efforts and involvement in energy code work (p. 54-55)

Acknowledgments

We would like to acknowledge the financial support of the Department of Energy, which made this report possible. State officials also collaborated in the creation of this report, providing comprehensive background information, local stakeholders contacts, and ongoing review of our work. In particular, we would like to acknowledge the aid of Conor Merrigan and Jamil Dillon with the Governor’s Energy Office and Rick Hanger at the Department of Local Affairs. We would also like to acknowledge the many code officials, design and construction professionals, utility and trade association representatives, and other interested parties across the state who provided us with crucial insights that contributed to our efforts to document and analyze energy code issues in Colorado.

In addition, George James and Terry Logee at the Building America program of the US Department of Energy; Joe Nebbia with Newport Partners LLC; Eric Makela at Pacific Northwest National Laboratory; Jack Barnette and Jonathon Passe at the US Environmental Protection Agency's ENERGY STAR program, and Nancy Bakeman at the Energy & Environmental Building Alliance (EEBA) contributed information to the Green and Above-code sections.

Cover page image of Cobett Lake in Grand Mesa National Forest courtesy of Flickr Creative Commons, user [ecksunderscore](#).

Appendix A

The Department of Energy (DOE) provides a number of useful resources that can assist states and local governments in their efforts to achieve code compliance. Many of these resources are available at Energycodes.gov. Materials include training presentations and background on DOE-sponsored software programs, *Rescheck* and *Comcheck*, which evaluate compliance for residential and commercial buildings, respectively. These software programs, which present prescriptive code requirements and calculate compliance tradeoffs, simplify the process of evaluating a building's code compliance. By explaining requirements, these software programs can help designers, builders, and code officials streamline efforts to achieve code compliance.

Resource Guides for Code Officials

1. ICC/DOE BECP Resource Guide for Code Officials: a comprehensive and easy to read collection of the best resources available from ICC and DOE.
<http://www.energycodes.gov/publications/resourceguides/>

Energy Code Compliance Training Materials:

1. Commercial PowerPoint Training with links to videos
http://www.energycodes.gov/becu/documents/Commercial_90_Percent_Eval_Inspect_Training.pdf
2. Residential PowerPoint Training with links to videos
http://www.energycodes.gov/becu/documents/Residential_90_Percent_Eval_Inspect_Training.pdf
3. DOE Guidance for State Compliance Measurement Efforts
<http://www.energycodes.gov/arra/documents/MeasuringStateCompliance.pdf>

Primer on *Rescheck* and *Comcheck*

1. Commercial Compliance
<http://www.energycodes.gov/comcheck/>
2. Residential Compliance
<http://www.energycodes.gov/rescheck/>

Available Downloads

1. Commercial Basic Requirements Download
<http://www.energycodes.gov/comcheck/download.stm>
2. Residential Basic Requirements Download
<http://www.energycodes.gov/rescheck/download.stm>

Users Guides

1. COMcheck Software Guide
http://www.energycodes.gov/comcheck/documents/com_software_users_guide_2004_2006_and_2009_IECC.pdf

2. REScheck Software Guide
http://www.energycodes.gov/rescheck/documents/rescheck_users_guide_1008.pdf

Plan Check and Field Inspection

1. Commercial Plan Review Quick Reference Guide
http://www.energycodes.gov/training/pdfs/comm_review_guide1.pdf
2. Residential Plan Review Quick Reference Guide
http://www.energycodes.gov/rescheck/documents/res_review_guide.pdf
3. Code Notes
<http://www.energycodes.gov/help/notes.stm>

References

- ¹ http://tonto.eia.doe.gov/energyexplained/index.cfm?page=us_energy_use
- ² <http://www.census.gov/statab/hist/HS-35.pdf>, <http://www.census.gov/statab/ranks/rank29.html>
- ³ <http://www.census.gov/prod/2001pubs/c2kbr01-2.pdf>
- ⁴ <http://quickfacts.census.gov/qfd/states/08000.html>
- ⁵ <http://www.census.gov/const/www/permitsindex.html>
- ⁶ http://www.uli.org/~media/Documents/ResearchAndPublications/EmergingTrends/Americas/2011/ET_US2011.a.shx
- ⁷ http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=CO
- ⁸ <http://www.nrel.gov/docs/fy09osti/43021.pdf>
- ⁹ http://www.eia.doe.gov/cneaf/solar/renewables/page/state_profiles/r_profiles_sum.html
- ¹⁰ This value was calculated by multiplying the average annual number of new single-family residential permits from 2005-2009 by the median energy savings if the home is built to the 2009 IECC. These savings assume 100 percent code compliance: <http://www.energycodes.gov/publications/techassist.stm>
- ¹¹ BCAP Code Estimator tool
- ¹² http://bcap-ocean.org/sites/default/files/publ_109-058.pdf
- ¹³ <http://bcap-ocean.org/energy-policy-act-epact-compliance-residential>
- ¹⁴ http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_bills&docid=f:h1enr.pdf
- ¹⁵ <http://www.energy.gov/colorado.htm>
- ¹⁶ http://rechargecolorado.com/index.php/programs_overview/american_recovery_and_reinvestment_act/
- ¹⁷ <http://www.ccionline.org/>
- ¹⁸ Stilwell, Jason and Robert W. Gage. "Colorado." *Home Rule in America: A Fifty-State Handbook*. Ed. Dale Krane, Platon N. Rigos and Melvin B. Hill Jr. Washington, D.C.: CQ Press, 2001. 69-76.
- ¹⁹ <http://rechargecolorado.com/>
- ²⁰ <http://dola.colorado.gov/cdh/codes/index.htm>
- ²¹ http://www.leg.state.co.us/clics/clics2009a/csl.nsf/fsbillcont3/56DAD78B9D26BD5187257539006E7FF9?open&file=1149_enr.pdf
- ²² http://www.leg.state.co.us/CLICS/CLICS2010A/csl.nsf/fsbillcont3/7F972C539E9610D6872576BE0079EE23?Open&file=1358_enr.pdf
- ²³ <http://dola.colorado.gov/cdh/codes/index.htm>
- ²⁴ <http://dola.colorado.gov/cdh/codes/index.htm>
- ²⁵ http://www.leg.state.co.us/clics/clics2007a/csl.nsf/fsbillcont3/8EFE2CB5022F6CF687257251007C22D3?Open&file=051_enr.pdf
- ²⁶ <http://www.chps.net/dev/Drupal/node/37>,
- ²⁷ http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CO35R&re=1&ee=1
- ²⁸ <http://www.cdphs.state.co.us/ic/coloradoclimateactionplan.pdf>
- ²⁹ <http://www.westernclimateinitiative.org/index.php>
- ³⁰ <http://www.westernclimateinitiative.org/component/remository/func-startdown/255/>
- ³¹ <http://www.epa.gov/oagps001/greenbk/ancl.html>
- ³² <http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx>
- ³³ <http://www.usgbccolorado.org/green-buildings/green-buildings.html>
- ³⁴ http://www.energystar.gov/index.cfm?fuseaction=NEW_HOMES_PARTNERS,
<http://www.energystar.gov/index.cfm?fuseaction=qhmi.showHomesMarketIndex>
- ³⁴ <http://www.aceee.org/press/2010/09/18-state-led-energy-efficiency-programs-recognized-best>

35 http://www1.eere.energy.gov/buildings/building_america/about.html, various above-code building experts listed in the Acknowledgements section

36 http://www1.eere.energy.gov/buildings/building_america/about.html, various above-code building experts listed in the Acknowledgements section

37 http://apps1.eere.energy.gov/buildings/building_america/cfm/project_locations.cfm

38 <http://www.greenadvantage.org/about-overview.php>

39 <http://www.greenadvantage.org/greengov-coloradomodel.php>

40 [http://rechargecolorado.com/images/uploads/pdfs/Attachment_C -
MLS Improvement Recommendations.pdf](http://rechargecolorado.com/images/uploads/pdfs/Attachment_C_-_MLS_Improvement_Recommendations.pdf)

41 2009 U.S. Census Bureau estimates from Dept. of Local Affairs Demography Office

42 http://www.pprbd.org/rbd_history.html

43 <http://www.pprbd.org/codes/2009%20IECC%20Review%20Notes.pdf>

44 <http://censtats.census.gov/cgi-bin/bldgprmt/bldgsel.pl>

45 Dept. of Local Affairs survey, July 2010

46 http://usgbccolorado.org/committees/documents/COLORADOINITIATIVES_000.pdf

47 http://www.bouldercolorado.gov/files/Environmental%20Affairs/climate%20and%20energy/cap_final_25sept06.pdf

48 http://www.fcgov.com/climateprotection/pdf/climate_action_plan.pdf

49 <http://www.greenprintdenver.org/>

50 <http://www.greenprintdenver.org/docs/DenverClimateActionPlan.pdf>

51 <http://www.usmayors.org/climateprotection/ClimateChange.asp>

52 <http://www.iclei.org/index.php?id=global-members>

53 http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=208&Itemid=489#CHANGES

54 <http://www.eaglecounty.us/EnvHealth/Sustainability/Eco-Build/>

55 <http://www.aspenpitkin.com/Living-in-the-Valley/Green-Initiatives/Energy-Efficiency/>

56 <http://www.practitionerresources.org/cache/documents/673/67398.pdf>

57 <http://www.globalgreen.org/docs/publication-164-1.pdf>

58 <http://www.swenergy.org/programs/buildings/zeh/projects.htm>

59 <http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=CO>

60 <http://reca-codes.org/>

61 <http://ase.org/associates>

62 <http://www.naima.org/main.html>, <http://www.pima.org/index.aspx>

63 <http://www.cityofthornton.net/Departments/CityDevelopment/Development/Pages/Building%20Code%20Advisory%20Board.aspx>

64 <http://www.xcelenergy.com/Colorado/Company/Pages/Home.aspx>

65 <http://www.environmentcolorado.org/eehq/eetips>

66 <http://www.dora.state.co.us/#>

67 <https://av.iccsafe.org/eweb/DynamicPage.aspx?Site=ICC&WebKey=b7afd990-2e14-4013-a186-aeb405641a95&FromSearchControl=Yes>

68 <http://resnet.us/directory/auditor/co/89/home-energy-raters-hers-raters/1>

69 http://www.energystar.gov/index.cfm?fuseaction=NEW_HOMES_PARTNERS.showStateResults&s_code=CO

70 <http://www.aiacolorado.org/>

71 <http://www.rockymtnashrae.com/>, <http://www.pikespeakashrae.com/>

72 <http://bcap-ocean.org/incremental-cost-analysis>

73 <http://www.dora.state.co.us/Licensing.htm>

74 Multiple building inspection department websites

75 http://www.state.co.us/gov_dir/leg_dir/olls/digest2007a/GOVERNMENTCOUNTY.htm#07-1078

-
- 76 http://rechargecolorado.com/index.php/commercial_and_public/workshops_and_webinars
77 <http://www.rockymtnashrae.com/wp-content/uploads/2010/10/IBPSAfler-Denver-Nov-20102.pdf>
78 <http://www.nocoenergystarhomes.org/BookingRetrieve.aspx?ID=7155>
79 <http://www.coloradoenergystarhomes.com/index.php/events/>
80 <http://energystarsummit.org/>
81 <http://www.colorado.gov/cs/Satellite/CDLE-EmployTrain/CDLE/1251579652720>
82 http://www.coloradoenergy.org/tips/builders/fort_collins_study.pdf
83 <http://www.aceee.org/blog/2010/09/state-program-goes-local-colorado-energy-star-new-homes>
84 <http://www.energycodes.gov/arra/documents/MeasuringStateCompliance.pdf>
85 <http://www.energycodes.gov/publications/resourceguides/>
86 <http://coloradoenergycareers.blogspot.com/2008/07/schools-other-training-providers.html>
87 <http://energytrust.org/>
88 <http://www.nvenergy.com/saveenergy/business/incentives/energyplus.cfm>
89 <http://www.ecobroker.com/>