Building Energy Codes in Arizona: Best Practices in Code Support, Compliance, and Enforcement

Jeff Schlegel and Beth Troncone

Prepared for and funded by:
North American Insulation Manufacturers Association

August 2007

Southwest Energy Efficiency Project
2260 Baseline Road, Suite 212
Boulder, Colorado 80302
www.swenergy.org

Table of Contents

EXECUTIVE SUMMARY

Arizona recently surpassed Nevada as the fastest growing state in the U.S. This surge of population growth has rippling effects throughout the state's economy and industries. Rapid growth in energy demand is one effect, and is an area of significant concern. Home energy use places the second largest demand on the electrical system. Therefore, it is imperative that Arizona accommodates the influx of new residents by building homes that use energy efficiently. This will reduce the need for costly new energy infrastructure and will save money for residential consumers by lowering their energy bills.

Building energy codes are one crucial policy for significantly reducing the energy use of new homes. Currently, Arizona does not have a state-wide energy code. Arizona is a home-rule state where municipalities decide individually which codes to adopt and implement within their communities. This lack of continuity creates problems in the production of new homes as each local area has differing requirements for the homebuilding industry.

In recent years, individual municipalities in Arizona have been updating their building energy codes on their own initiative, generally adopting recent versions of the International Energy Conservation Code (IECC). While this is an important and valuable step forward, there are questions regarding the level of compliance with and enforcement of the recently adopted building energy codes. Prior experience and studies in other states have found that code compliance and actual installations in the field substantially lagged behind the requirements of recently adopted codes. In addition, the level of compliance was uneven, with significant variations across the municipalities.

There is an opportunity to increase building energy efficiency in Arizona by: (1) identifying the best practices in energy code support, compliance, and enforcement, and (2) promoting and replicating those best practices in other municipalities across Arizona.

To address this opportunity, the Southwest Energy Efficiency Project (SWEEP) conducted this study by interviewing building code officials in

municipalities that currently have an energy code in place. By learning how these departments adopt and implement the building energy code, SWEEP identified and documented the best practices for energy code support, compliance, and enforcement.

SWEEP began with three primary objectives:

1. To understand and document the current status of building energy codes in Arizona and the code support and compliance practices in the municipalities;
2. To identify the best practices of local building energy code support, compliance, and enforcement in different municipalities; and
3. To disseminate a report focusing on best practices and recommendations for municipalities and building code officials.

These objectives were pursued through personal interviews with building code officials using a pre-constructed interview guide with key questions aimed at identifying the factors that created a successful energy building code environment in different municipalities. Data collected was then analyzed and interpreted to lay a foundation of the current status of code implementation and support. From this foundation, the best practices were identified to document the effective and innovative approaches used to implement and enforce the building energy codes.

Findings

The interviews with local building officials provided insight into how the departments adopted and enforced the building energy code. Common factors in the municipalities where the building energy code has been implemented most successfully include:

- Education and training, initially and in an ongoing manner, for building code planning and inspection staff, and for the building industry and its contractors.

- Positive interaction with and involvement of the building industry, supported by effective communication.
- A committed and dedicated energy champion within the building code department, particularly the chief building code official.

Best Practices

Building on the above findings, the best practices of building departments in effective energy code enforcement and support are identified in a variety of areas. First, education and training for both the building industry and for code officials and inspectors is an essential practice in municipalities with successful implementation of building energy codes. Training should extend to the contractors who are responsible for installing insulation, heating and cooling equipment, and HVAC ducts.

Second, regular interaction between the building code department and the building industry is important for exchanging information regarding code updates, code compliance options, and innovative construction techniques. Part of this interaction should include adequate notice regarding any code changes. This interaction and information exchange can occur at training sessions, meetings of home builders or contractors associations, and building industry or Arizona Building Officials conferences

Third, leading building departments make it easy for their inspectors to enforce codes through practices such as providing inspectors with software and other practical tools, simple checklists of key features that must be present to comply with the code, and of course regular training.

Fourth, it is important to have an “energy code champion” within the building code department. An energy champion directly influences the local community by pushing the envelope and pursuing optimal energy codes and enforcement strategies. If there is no energy champion, energy codes tend to fall in relative importance and municipalities end up with below-standard enforcement and building practices.

Fifth, and often with the support and advocacy of an energy champion, leading building departments have taken the codes one step further and promoted voluntary beyond code construction practices. These efforts generally promote compliance with either ENERGY STAR or green building programs, which in turn result in greater energy savings than just meeting minimum codes.

Finally, there are many benefits of energy-efficient construction and energy code compliance. Highlighting the benefits of energy efficiency in support of the building energy code makes it more appealing to builders and turns them into allies rather than opponents in the implementation and acceptance of the code.

Recommendations:

Arizona energy code stakeholders can take action in many ways to support the replication of the best practices identified in this study. One priority is to organize high quality and regular educational and training sessions targeted to both building code officials and the building industry. These sessions should take a number of forms including sessions at local or statewide meetings, as well as on-site training for builders and their employees and contractors. Training should include information on the best practices identified in this report, such as use of checklists and promotion of beyond code voluntary standards. As education and training occurs, energy efficiency champions will arise who will help to spread the word on the benefits of energy-efficient construction and code compliance. This will lead to greater acceptance of and support for building energy codes. The involvement of the wide array of stakeholders throughout the educational process will increase communication between building officials and the building industry, thereby fostering relationships that can encourage individuals and groups to work together toward the common goal of building an energy-efficient Arizona.

INTRODUCTION

Population in the western states has been projected to grow at a steady rate through 2007 (ASU Insight 2006). Arizona population is expected to increase by 3.47 percent annually equaling almost 200,000 new residents. Western states will most likely exceed the national growth rate of about 1 percent and stay steady at around 3 percent through the next few years (ASU Insight 2006). State population growth for the 1990s ranged from a high of 66 percent in Nevada to a low of 0.5 percent in North Dakota (U.S. Census Bureau 2005). Following Nevada, the fastest growing states were Arizona with a 40 percent increase, Colorado with a 31 percent increase, Utah with a 30 percent increase, and Idaho with a 29 percent increase (U.S. Census Bureau 2005). Arizona recently surpassed Nevada as the fastest growing state.

Consequently, homes are being built in Arizona to keep pace with the burgeoning population increase. In 2005 alone, 101,511 new housing units were permitted in Arizona, including 85,073 single family homes. The building industry is responding to accommodate the increase in home building and faces challenges over the next few years as nearly 200,000 more people are expected to move to Arizona in 2007 (ASU Insight 2006). While the housing market has slowed since 2005, people are still moving to Arizona; and the state saw nearly 60,000 single family homes permitted in 2006, and housing forecasts estimate about 50,000 single family homes will be permitted in 2007.

Phoenix alone has a booming population. The greater Phoenix population has increased by 39% since 1995, compared to the U.S. rate of only 12% over the same time period (GPEC Information Center 2006). The region's population is expected to double in the next 25 years (U.S. Census Bureau 2005).

Arizona's energy consumption is rising to meet this ever-increasing demand, causing stress on the electrical and transportation networks across the state. To provide for this demand, the building industry will have to take great strides to accommodate not only the housing needs of the incoming population but also to provide basic services to existing residents. To achieve this,

policymakers will need to expand energy supplies or reduce per capita energy demand. Energy efficiency can be used to reduce demand on the electrical supply and assist states and municipalities in meeting their electricity needs.

Energy efficiency is the lowest cost energy resource – only 2 to 3 cents per kWh saved. Energy efficiency can reduce customers' energy bills by 10% to 50%, energy efficiency would create over 12,000 new jobs in Arizona by 2025, and finally energy efficiency would keep more of the energy expenditures in Arizona. According to the Arizona Department of Commerce, Arizona is currently spending $10 billion on energy annually, and of that over $6 billion leaves the state to purchase energy from other areas. Strategies to increase the adoption of energy efficiency measures in municipalities include: designing and implementing cost-effective programs in the utility sector; adopting goals and funding mechanisms to support utility programs; adopting appliance and equipment standards; upgrading building codes and supporting code implementation; adopting energy conservation practices in public buildings; promoting highly-efficient new buildings; adopting utility rates, pricing, and market reforms; and incorporating energy efficiency in air pollution control strategies. Further, energy efficiency has emerged as a selling point to buyers of new and previously owned homes. It is therefore paramount that the building industry and code community recognize their roles in the next few years and embrace the idea of building new houses to the building energy code standards.

At the federal level**,** the government has programs already in place for the building industry to follow or take advantage of. The Building Energy Codes Program administered by the U.S. Department of Energy (DOE) provides mentoring and technical assistance for other government agencies, state and local jurisdictions, national code organizations, and industries to promote stronger building energy codes and help states adopt, implement, and enforce those codes. The areas of action in the DOE's program include: fostering the development of improved national model energy codes; improving federal building energy codes; distributing easy-to-use compliance tools and materials; providing financial and technical assistance to help states adopt, implement, and

enforce building energy codes; collaborating with stakeholders to address industry needs and provide information on compliance products and training; and disseminating energy code-related news (DOE 2007). Further, the DOE's Office of the Energy Efficiency and Renewable Energy's (EERE) Building Technologies Program interacts with the building industry and manufacturers to conduct research and development on technologies and practices for energy efficiency. The Department also promotes energy and money-saving opportunities to builders and consumers and works with state and local regulatory groups to improve building codes and appliance standards (DOE 2007). The federal government supports ENERGY STAR©, a program that helps businesses and individuals purchase ENERGY STAR products with high quality energy-efficient designs. In 2006, ENERGY STAR products saved $6 billion and enough energy to power 10 million homes (DOE 2007).

Arizona currently enforces building energy codes on a voluntary basis with local jurisdictions choosing whether or not to adopt or follow the state's building energy code. The baseline for voluntary compliance is the 2000 IECC for residential buildings and the 1999 ASHRAE for commercial buildings. Builders can report their compliance via online software programs REScheck and COMcheck (Arizona Legislature 2007). However, this is on a voluntary basis. Several municipalities have adopted more recent building energy codes, including IECC 2003 and IECC 2006.

By understanding how building code officials have adopted and enforced energy codes, this research aimed to identify the best practices of energy code enforcement with the prospect of assisting those communities without an energy code, or with a poorly implemented or enforced energy code, in transitioning to a level of energy efficiency that will wisely serve the needs of Arizona homeowners today and in the future.

SUSTAINABLE BUILDING

From a worldview, a strong consensus exists within the science community that humankind needs to dramatically reduce carbon emissions if it is

to avoid radically changing the climate (Intergovernmental Panel on Climate Change 2005). This has triggered a shift in the points of view consumers and politicians that action must be taken to reduce U.S. energy consumption. Building officials in many municipalities have embraced the idea of sustainable development and have created programs in pursuit of this idea. The Brundtland Commission's Report in 1987 defined a framework for sustainability: Today's economy should meet the needs of the present generation without compromising the ability of future generations to meet their own needs (Brundtland 1987). This shift will eventually include nearly all industries and political figures as the country attempts to reduce energy consumption

The building industry can be a major catalyst for such a transition. Consumer electrical consumption to heat or cool private homes is the second largest consumer of energy following transportation (Energy Information Administration 2005). By addressing this issue through taking action to reduce problems in energy code implementation and enforcement, Arizona has the potential to avoid 64,238 tons of pollution annually (Building Codes Assistance Project 2004). Further, by consuming less energy, Arizona businesses and consumers can save $3.8 million in energy costs and 31 million gallons of water every year, reducing energy demand by 17 MW (Building Codes Assistance Project 2004). Other research has shown that Arizona residents can decrease their annual energy bills by 20 percent if their home is built to IECC 2000 standards (Southwest Energy Efficiency Project 2003). Furthermore, the incremental increase in the cost of building an energy-efficient home in Arizona can be paid off in as little as 3.9 years (Southwest Energy Efficiency Project 2003).

As necessary as such a shift is it is certain to encounter obstacles, not the least of which will be a natural human resistance to change. This is a major roadblock in Arizona, as Arizona is a "home rule" state where each municipality adopts building codes at their own discretion, and there is no statewide building code for residential or commercial buildings. The political make-up in Arizona is changing rapidly. With such a large increase in population, the historically

conservative state is experiencing an increase in all areas of political support. Following a national trend for both major parties to support sustainable policy initiatives, there is growing support for clean energy policies. One example of the evolving situation is that there is very strong support in the legislature for local control and home rule building codes, yet there is strong support among local building official communities for the implementation of a statewide building code, including a building energy code, and more interaction between municipalities and the legislature to ensure efficient implementation and use of building code legislation.

If residents and the building industry both understand that the advantages of energy efficiency are profound and necessary, they will hopefully decide to move swiftly towards alleviating the stress of energy consumption in homebuilding and remodeling. This transition will require a better understanding of how different building departments successfully enforce the building code. In learning the best practices of energy code enforcement in Arizona, these ideas can be replicated and encouraged throughout the state.

OBJECTIVES AND SIGNIFICANCE

The three primary objectives of this study are to:

1) Understand and document the current status of building energy codes in Arizona and the code support and compliance practices in the municipalities;

2) Identify the best practices of local building energy code support, compliance, and enforcement in different municipalities throughout Arizona; and

3) Disseminate a report focusing on best practices and recommendations for municipalities and building code officials.

The researchers conducted in-depth interviews in 11 Arizona municipalities in pursuit of these objectives.

As discussed, global climate change gives urgency to using energy efficiently and wisely. The Arizona state government could make use of this research to spearhead changes in energy code requirements and it also could be used at local levels by municipalities to increase the adoption and enforcement of building energy codes.

The study is a starting point for future action on the part of all involved in both the energy industry and the building industry. The survey also reaches beyond the building industry world to governments, planners, policy makers, citizens, and other industries involved in building and energy efficiency. For example, government agencies at all levels can use the information to better plan for and manage an increase in population and housing. Citizens will benefit from this research, as it will encourage the adoption of policies and programs that are responsive to their energy needs in a sustainable manner.

METHODS OF INVESTIGATION

This is a state-scale study of the best practices in enforcement and implementation of building energy codes in local municipalities across Arizona. This study involved working alongside the Arizona Department of Commerce Energy Office with a parallel survey that the Energy Office is currently administering. The Energy Office survey addresses many similar issues in building energy codes, but focuses on the commercial arena of the building industry. The Energy Office is currently collecting data by emailing surveys to all building officials in the state and puts no emphasis on whether a current code is in place or not. For this study, SWEEP created additional and different interview questions to further examine the intricacies of the building officials and building communities in Arizona and to pursue the objectives.

This research included an interview guide to stimulate conversation between the building official and interviewer on the varying issues involved in building energy code adoption and implementation. Using in-person interviews whenever possible, phone interviews, and email interviews, the researchers conducted in-depth interviews with 11 code officials in Arizona, supplemented with one interview in Colorado and one in Utah.[1] The in-depth interviews were preceded by initial scoping interviews with about a dozen individuals representing the energy code and building industry. The initial scoping interviews helped determine which code officials to interview. The interview sample was created using data from the Energy Office to determine influential factors such as existing building energy codes, current population, recent increase in population, and the number of housing starts each year. The full interview guide can be found in Appendix A.

[1] Interviews are a popular research device to understand the opinions and attitudes of respondents and to provide information for decision-making (Bradburn and Sudman 1988). Interviews provide accurate information for decision-makers at all levels and are a way to ascertain opinions regarding conditions and are a systematic way to collect and analyze data on some aspect of an area or group. To address this specific research, the researchers created the objective of the interview, then designed and administered the questionnaire, and finally interpreted the results (Dillman 2000).

Objectives of the Interview

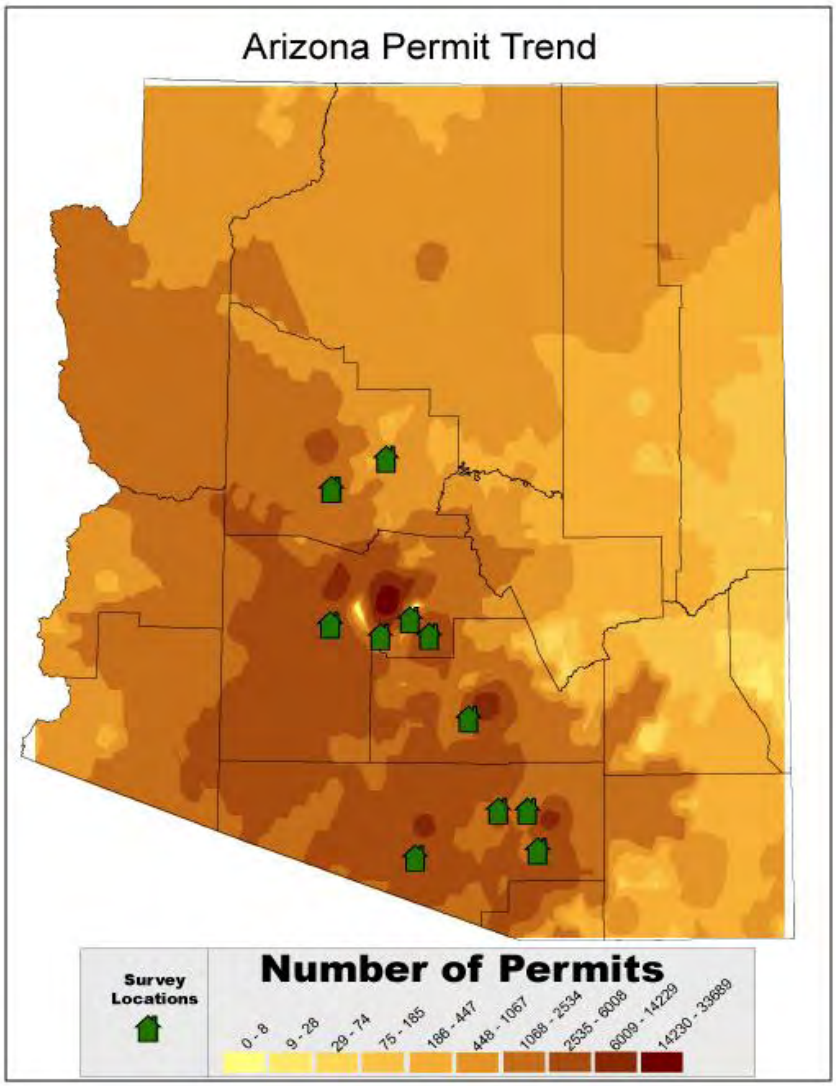
The purpose of this study is to understand the current status and best practices of energy code implementation and enforcement in Arizona. SWEEP undertook the assignment of interviewing building officials in communities with an energy code in place. The data collected during the interviews covered the topics of current codes in a municipality, awareness of the building energy code, energy code compliance methods and processes, the perceived importance of codes for building components, barriers to energy code adoption and implementation, overcoming barriers to code implementation, energy code support and training, and background information. Each section of the interview guide posed specific questions pertaining to different aspects of building and energy code enforcement and attempted to create a holistic view of the process. Towards that goal, the three primary objectives of this study are: 1) to understand and document the current status of building energy codes in Arizona and the code support and compliance practices in the municipalities; 2) to identify the best practices of local building energy code support, compliance, and enforcement in different municipalities throughout Arizona; and 3) to disseminate a report focusing on best practices and recommendations for municipalities and building code officials.

SAMPLE DESIGN

The sample for this research was selected under the ideas of purposive or judgmental sampling. In this case, it was appropriate to select a sample on the basis of knowledge of a population or topic, its elements, and the purpose of the study. Because the researchers aimed at studying a representative subset of building officials in the larger population of building officials, non-probability sampling was used by selecting the interviewees to be observed on the basis of informed judgment about which ones would be the most useful or representative (Babbie 2004). The conditions that set the selection standard for this research were: (1) officials in communities that were doing something above the baseline requirements in building energy code implementation and enforcement, and (2)

officials from communities where high numbers of homes were being built. The map in Figure 1 illustrates the number of permits issued by municipalities across the state of Arizona, with the houses on the map showing the location of municipalities that were interviewed in the study.

Figure 1. The Number of Permits Issued in Arizona in 2005, and the Municipalities Interviewed in the Study.[2]



[2] The dark shaded area and green house in the center of Pima County represents all of Pima County and the interview of the Pima County building official.

DESCRIPTION OF THE SAMPLE

Eleven Arizona building code officials participated in the survey. Two interviews of Colorado and Utah officials were also included, as the two officials in those areas are well known for having effectively implemented a building code. The code officials varied in their experience in the building industry and education.

Years of experience is important to understanding the building code officials as it provides an outlook on a person's experience and the ability to adapt to new issues that arise over a person's career. All but one respondent had more than ten years of experience, and 50 percent of those interviewed have more than 20 years of experience. The years of experience often include stints in the construction industry as well as the code official positions.

The average response of education in the industry was a college degree; one interviewee had a Master's Degree and one had a Doctoral Degree.

RESULTS OF THE INTERVIEWS

ASSESMENT OF EXISTING BUILDING CODES

As previously stated, the building energy code in Arizona follows a home-rule status and therefore different communities have different or no energy building codes. Tables 1, 2, and 3 outline the current trends in building residential homes in Arizona and number of homes permitted in 2005 in municipalities with a building energy code in place.

Table 1. Arizona Housing Units Permitted by Year

	2003	**2004**	**2005**	**2006**
Single Family	65, 649	83, 253	85,073	59, 638
Other Residential	14, 067	16, 182	16, 438	15, 722
Total Residential	79, 716	99, 435	101, 511	75, 360

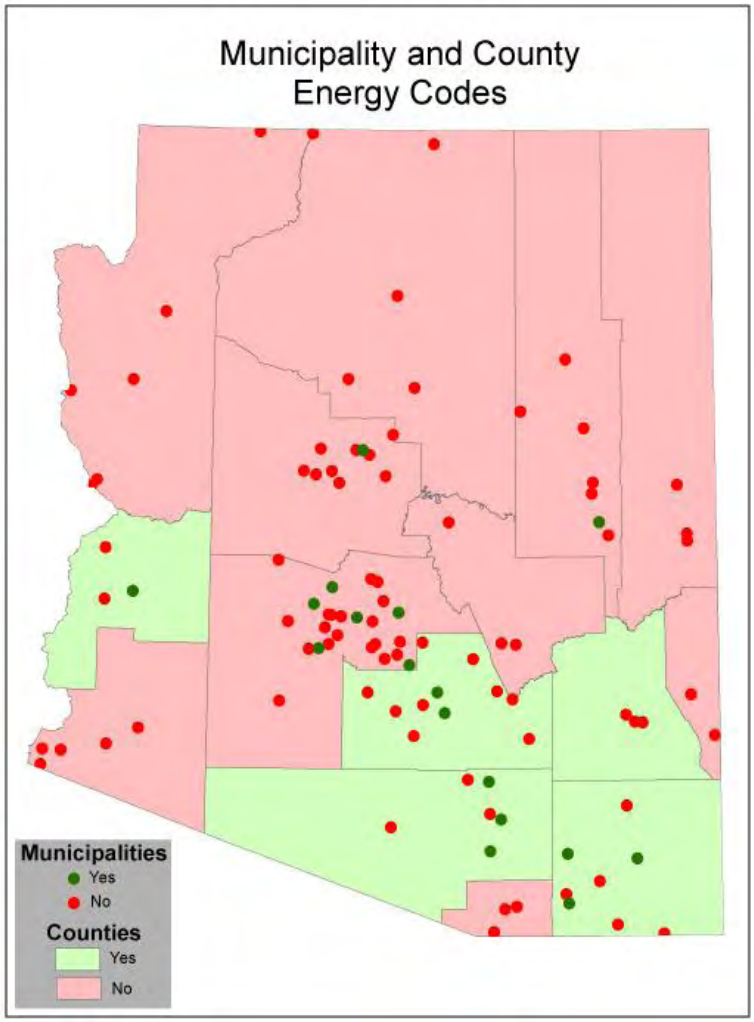
Table 2. Arizona Building Permit Location, 2005.

	Number of Permits	**Percentage of Permits**
Homes built in Maricopa and Pima Counties	68,411	67%
Homes built outside Maricopa and Pima Counties	33,100	33%
Total	101,511	100%

Table 3. Arizona Building Permits in Municipalities with or without IECC, 2005.

IECC Codes in Place	Number of Permits	Percentage of Permits
Home permits in municipalities with IECC	37,240	37%
Home permits in municipalities without IECC	64,271	63%
Total	101,511	100%

Figure 2. Municipalities and Counties with an Energy Code in Place, 2005.



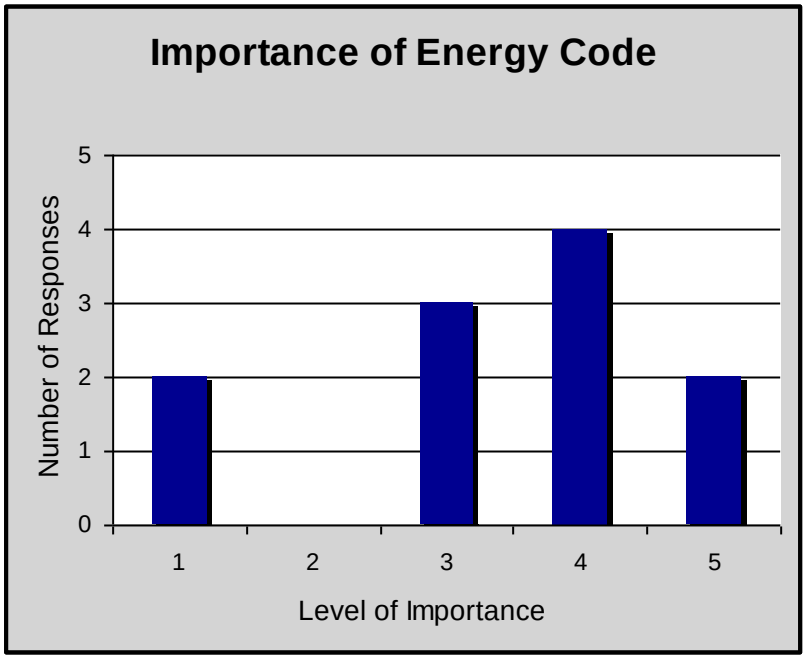
To outline the eleven municipalities interviewed in this study, the table below shows the current energy codes in place in those areas.

Table 4. Municipalities Interviewed and Current Energy Codes in 2007.

Municipality	IECC Code Year Currently in Place	Adopting the 2006 IECC in 2007
Clarkdale	2003	No
Florence	2000	Yes
Fountain Hills	2003	Yes
Marana	2006	Yes
Oro Valley	2003	Yes
Phoenix	2003	Yes
Pima County	2006	Yes
Prescott	2003	No
Scottsdale	2006	Yes
Surprise	2000	Yes
Tucson	2003	Yes

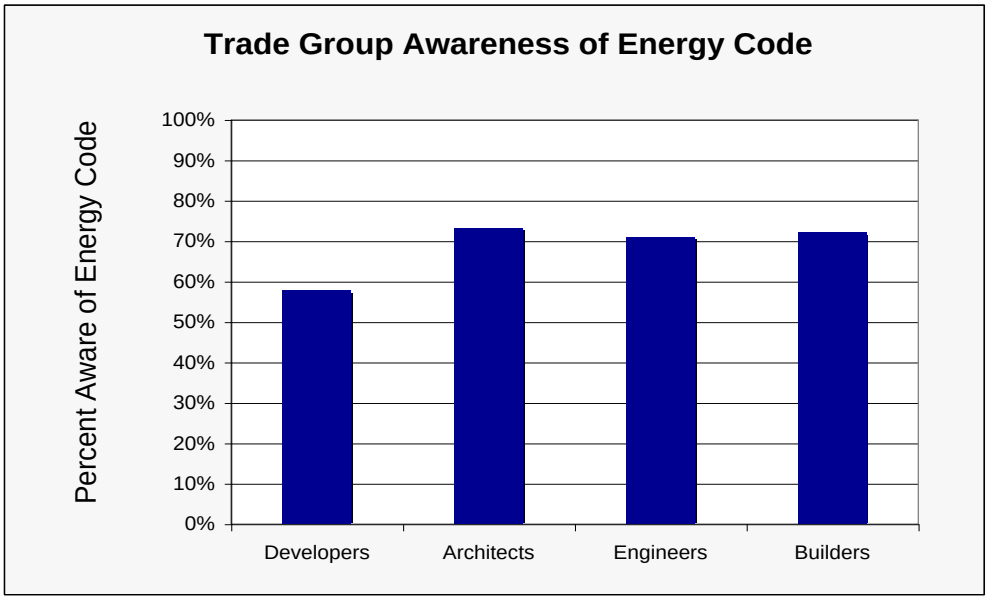
Importance of the energy code during the inspection processes was also addressed during the interview. On a scale of 1 to 5, respondents were asked to rate the level of importance of the energy code in reference to the other building codes enforced in the departments. The average importance of the energy code was 3.36 with the most frequent response of 4. Below is a chart displaying the responses of the interviewed building officials.

Figure 3. Importance of the Energy Code.



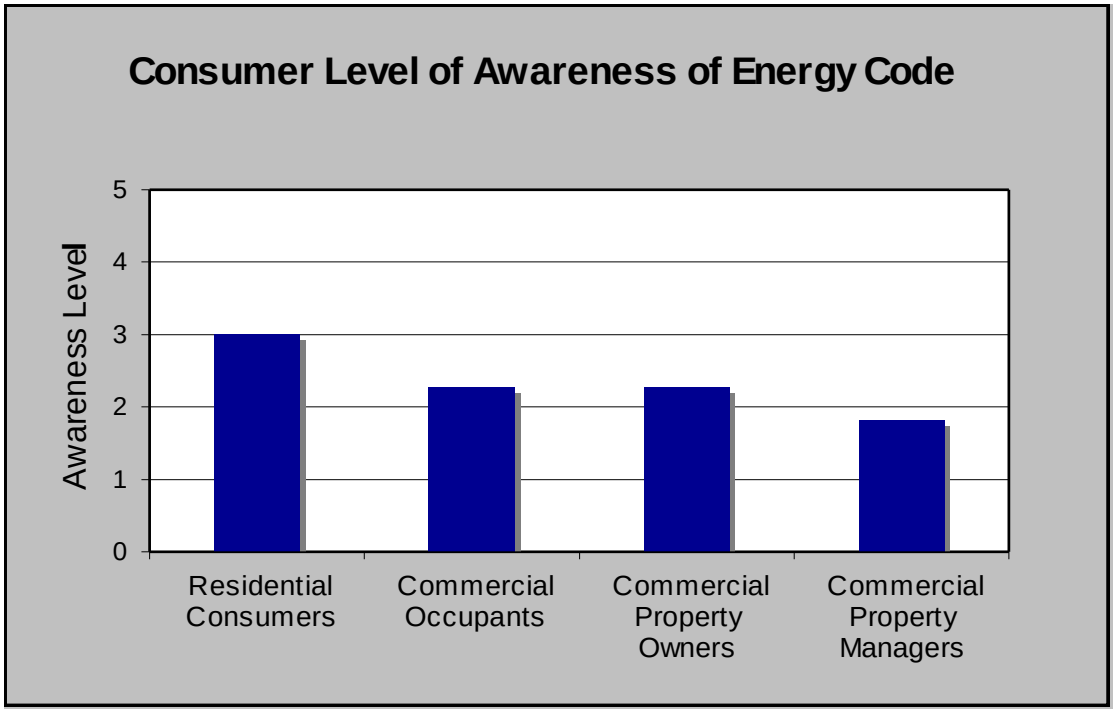
Further, the officials were asked to rate the level of awareness of the energy code by different trade groups in the building industry in order to assess how this knowledge is used to create buildings.

Figure 4. Trade Group Awareness of Energy Code.



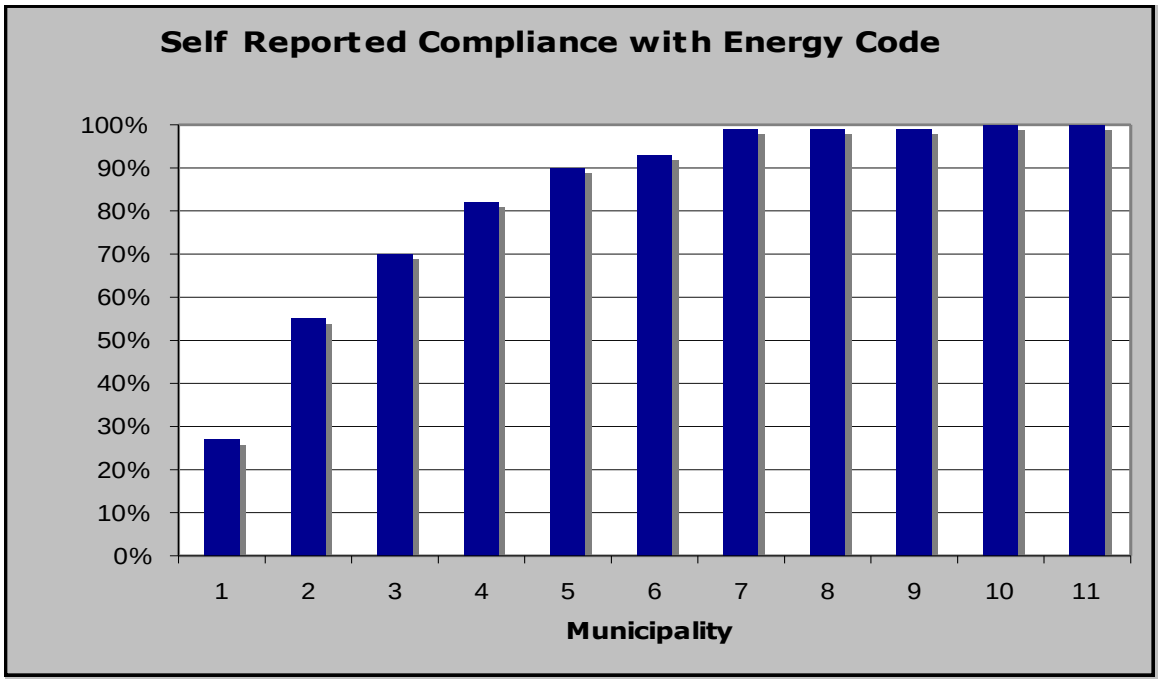
Code officials were also asked about the level of awareness amongst consumers, be they homeowners or renters, of building energy codes. In the chart below the average responses are presented based on a scale of 1-5, where 1 is no awareness and 5 is very aware.

Figure 5. Consumer Level of Awareness of Energy Code.



The next questions dealt with the percentage of buildings built in compliance with the energy code. Of the interviewed municipalities, 83 percent of residential buildings were built to the standards of the code and 86 percent of commercial buildings were in compliance. Compliance is much higher for those departments that have a long history with an energy code, in contrast with those municipalities that have recently adopted the energy code. Below is a chart displaying the responses from all municipalities interviewed for compliance of residential buildings with the energy code.

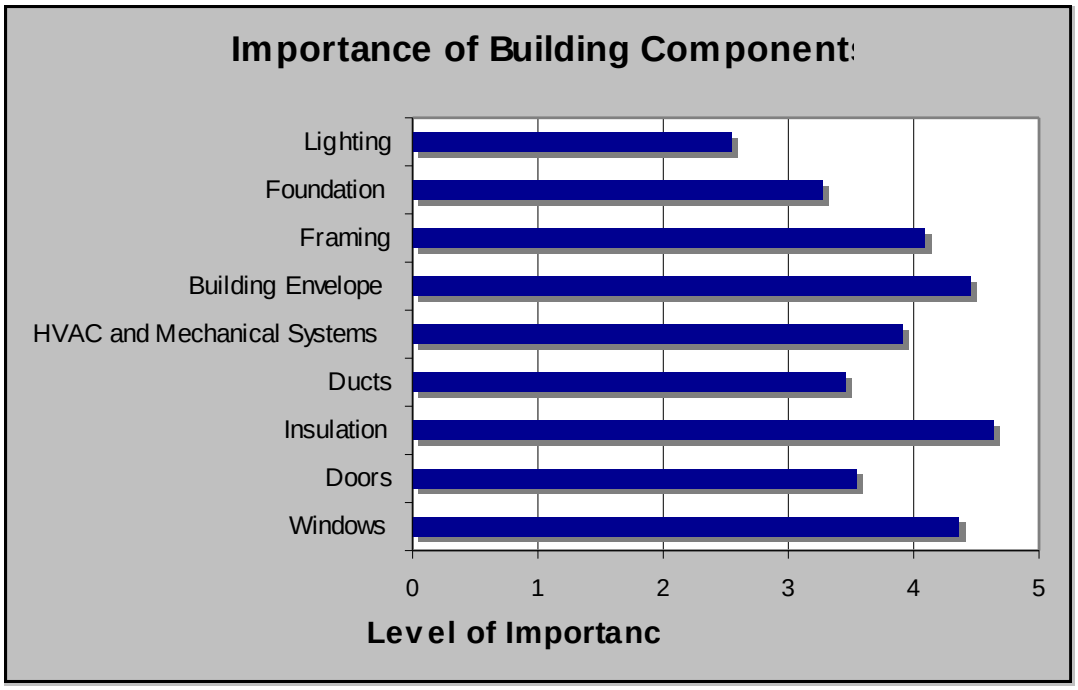
Figure 6. Self-Reported Compliance with Energy Code.



The officials were then asked to discuss the efficiency of the process of enforcing the energy code. A majority of those interviewed felt that the process occurs efficiently, but 27 percent felt that there were problems with the process and it wasn't efficient.

Next, officials were asked to rate the components of a residential building by their importance relating to energy efficiency, on a scale of 1-5, where 1 is not important and 5 is very important. The importance level was based on the areas that each particular department focused on per their local environment. Factors that influenced these opinions were differing climates, consumer preference, and local lighting codes.

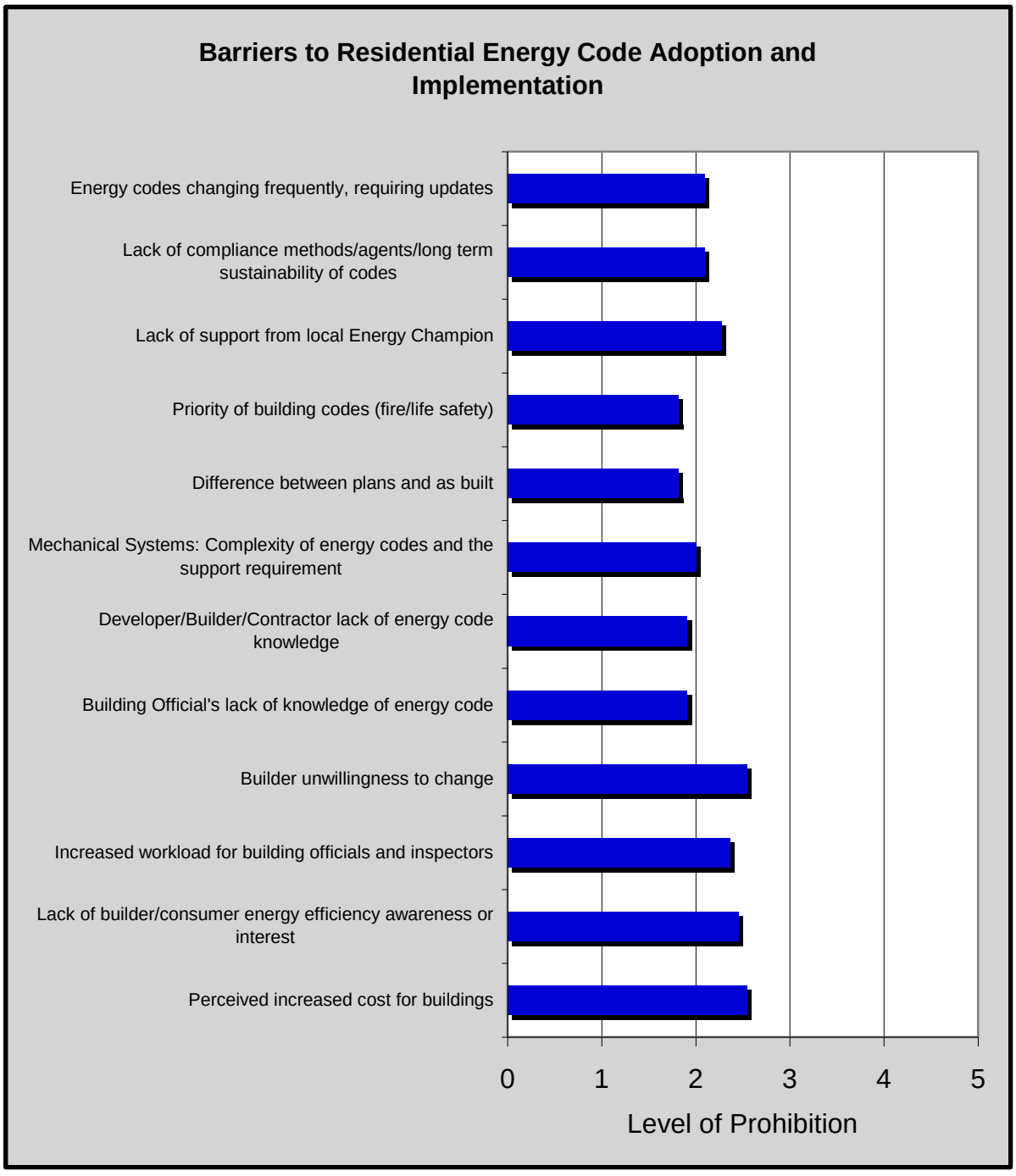
Figure 7. Importance of Building Components.



From the above data, insulation is the most important aspect of a building during the inspection process. This ties directly to the energy code as insulation plays a major role in the building process and in using energy efficiently.

Respondents were then asked to rank barriers to residential energy code adoption and implementation, where 1 is not a factor at all (not prohibitive) and 5 is a major factor (very prohibitive) to the adoption and implementation of the energy code.

Figure 8. Prohibitive Barriers to Energy Code Enforcement.



CASE STUDIES

Three municipal case studies are provided in this section: Parker, Colorado; Scottsdale, Arizona; and Fountain Hills, Arizona. The case studies provide an in-depth, integrated, and complete look at the building energy code training and enforcement practices in these three cities.

CASE STUDY #1:

Ensuring High-Performing New Homes:
Parker, Colorado's Approach to Energy Code Inspection

In January 2004, the city council of Parker, Colorado adopted the 2003 International Residential Code and the 2003 International Energy Conservation Code. With this act, Parker took an important step toward ensuring that new residential construction in the town would be well-built and energy-efficient.

Codes alone don't ensure quality construction. While they establish regulations that new construction must meet regarding life, safety, energy use, and other issues, it takes more than regulation to improve construction techniques and increase the performance of new homes.

Working to solve that puzzle was Gil Rossmiller, hired in spring 2003 as Parker's chief building official.

A fast-growing suburban community, Parker is located about 20 miles southeast of Denver. The city's 2005 population of 41,600 is expected to reach nearly 72,000 by 2030. Housed in the city's Community Development Department, the building division, which inspected some 550 new homes in 2006 and 1,100 in 2005, staffs the chief building official, 5 field inspectors, 1 senior inspector, 1 plans examiner, and 3 permit technicians.

Rossmiller, a 30-year construction industry veteran, describes the building division as a "service-oriented enforcement agency." It enforces the building regulations while working tirelessly to build the capacity within the local contractor community to produce high-performance homes.

Parker's adoption of the "I" codes was an important milestone in Rossmiller's effort to change the course of the city's code enforcement program. Another milestone came on September 1, 2004, when he gave builders in Parker a one-year heads-up: Starting in September 2005, building permits would not be issued for homes or home models that had not completed an Air Conditioning Contractors of America Manual J worksheet, did not include a mechanical plan showing the size and locations of furnaces and ducts, and which did not provide testing to verify that the systems included in the home actually worked as designed. Builders were required to test such things as duct leakage, static pressure, and total system flow at rough inspection, and static pressure, total flow, and room-to-room flows at final inspection.

To assist builders in adapting to the new requirements, a contractor training program was developed. Industry experts on such topics as proper flashing techniques, insulation installation, and HVAC design and installation provided training. As Rossmiller explains it, "Our mantra is train, train, train, and that's what we did during the year-long ramp-up period. Then we began inspecting for the expectations set by the industry and our local builders. The building codes provide our guidance."

Training opportunities were also extended to Parker's inspectors, giving them a chance to learn the difference between industry standards and what the code actually requires – as well as the confidence to raise these issues out in the field. "As a result, 'fudging it' is no longer an option for our builders," says Rossmiller.

The resulting trickle down effect, between the code department's testing requirements, code enforcement policy, and ongoing contractor training, is that builders are now accepting nothing less than quality work and installations from their sub-contractors. "Because we enforce and test, builders pay for the correct installation of building products, not for shoddy construction work or installations that negatively impact system performance," adds Rossmiller. "They're getting their money's worth, and so is the homeowner."

Contractor trainings continue to be a critical component of the code program, with training sessions held at least monthly with area builders. While no formal training program has been instituted for enforcement staff, employees are encouraged to pursue outside training opportunities through such organizations as the International Code Council.

Rossmiller also engages with the building community when it comes to making local amendments to the building code. Two examples worth mentioning include adding a weather resistive barrier requirement to the 2003 IECC (now included in the 2006 version of the code), and a 2006 IRC amendment requiring all homes to provide continuous whole-building ventilation with outdoor air. “Individual builders, trade associations, etc., are all encouraged to assist us with any code amendment efforts,” says Rossmiller. “We want their buy-in from the get-go.”

As for the actual inspections themselves, Parker’s field inspectors have developed “Top 10” lists for the various inspections they conduct. While this assists them in focusing on known problem areas, inspectors look at everything in the course of the 20 to 70 inspections they complete each day. “We inspect from top to bottom,” says Rossmiller.

Contractor training, inspector training, enforcement of the code, testing requirements – what does it all add up to? In short, above-code homes have become the *de facto* standard in Parker.

In an effort to gauge the success of Parker’s approach, Rossmiller recently had ratings done on several newly-constructed homes. Of the six homes tested, one from each of the major production builders working in Parker, five qualified for ENERGY STAR, with the sixth home just missing the mark. All this without beyond-code regulatory mandates or financial incentives for builders. “The builders were pleasantly surprised on how well their house performed, simply by installing products as they were intended,” says Rossmiller.

Rossmiller suggests putting monetary and other resources into builder training, rather than reducing permit fees or other such strategies to incent higher-performing construction. Again, the emphasis is placed on building

expertise in the contractor community, and then demanding performance through code enforcement.

The secret to Parker's success, then, is rather simple: Keep your codes up-to-date (the 2006 IRC and IECC will become effective in Parker in 2007); enforce the code; require testing protocols; and train your contractor community on quality control and high-performance design and construction techniques. It's an iterative process, one that while needing both the stick and the carrot, breeds success through collaboration.

It also helps that code compliance – and building safe, comfortable, and energy-efficient homes and neighborhoods – is a high priority of Parker's elected and appointed leadership.

Rossmiller has also begun to focus on Parker's commercial sector construction. He admits that commercial construction standards need a push, and he's committed to beginning a conversation with the city council and community about how to make that happen.

In the meantime, single family home construction will remain Parker's bailiwick, and thus Rossmiller's prime attention area. With Parker's population set to nearly double over the next 25 years, his work will clearly leave a lasting legacy.

Source: Personal communication with Gil Rossmiller, December 4, 2006. Mr. Rossmiller can be reached at the Parker Building Division by calling 303-841-1970.

CASE STUDY #2:

Energy Code Enforcement, Green Buildings, and Best Practices: Scottsdale, Arizona

Scottsdale, Arizona is known as a very progressive municipality in many ways, one being their dedication to energy efficiency and green buildings. In July 2007, the city council of Scottsdale will adopt the 2006 International Energy Conservation Code (IECC). Energy codes development and adoption in Scottsdale follows many standard practices of code development. As the building codes are revised and updated internationally every 3 years, it takes Scottsdale about a year and a half to adopt the most recent code.

Anthony Floyd is a registered architect and LEED Accredited Professional. He is the City of Scottsdale's Green Building Program Manager, oversees energy code enforcement, and is the Sustainable Building Specialist. He heads Scottsdale's Green Building Program and he qualifies green residential projects and serves as coordinator for the design and construction of LEED Gold-certified city buildings. Floyd is a past president of the Arizona Chapter of the International Conference of Building Officials and past Chairman of the Maricopa Association of Governments Building Codes Committee. He holds a civil engineering and architecture degree from Penn State University and a master's degree in public administration from Arizona State University.

Like the rest of Arizona, Scottsdale has experienced unprecedented growth over the last 20 years. The 2003 population estimate of Scottsdale is 217,989 according to the U.S. Census Bureau. The population increased by 7.6% between 2000 and 2003. Notably, the population increased 55.8% between 1990 and 2000 (U.S. Census 2007). In 2005, Scottsdale issued 2,306 residential building permits.

The Green Building Program (GBP) is used as a voluntary standard, an incentive and an educational vehicle for local residents and those in the building industry. A building meeting the GBP standard must be 15% more energy efficient than the base building code (IECC). The GBP takes a holistic approach

through design and building techniques to reduce the environmental impact of buildings and reduce the energy consumption of the building over the long term. The GBP also emphasizes the importance of paying attention to energy efficiency and its contributions to the health of a building's occupants.

Floyd explained that even with a progressive program like the GBP, there are still many problems to be addressed when implementing the building energy code. Floyd echoes other Arizona building officials in frustration with poor quality insulation installation. In Scottsdale, insulation codes weren't followed at all before 2001 and Floyd admitted that widespread cheating existed. Under the GBP, Scottsdale is ahead of the game in most aspects of efficient building – and insulation installation is one area of great advancement.

The GBP sponsors lectures and expos to spread the word to the building community and local residents. In 2007, the GBP will host lectures with such topics as Home Improvements and Green Remodeling, Building Science: The System Approach to Energy Efficiency, Interiors and Indoor Environmental Quality, Water Efficiency in the Sonoran Desert, Innovative Green Built Projects in the Scottsdale area, and Green Feng Shui. In the green building community, 30-50 people attend the GBP monthly lectures. According to Floyd, the Green Building Expo in Scottsdale, an annual event sponsored by the GBP, has 5 – 6,000 attendees every year.[3]

To be a Green Builder, those involved are required to attend one GBP lecture per calendar year. This isn't a highly regulated task and Floyd would like to increase the number of lectures and learning opportunities available to the local building community.

Following the good-faith practices of the GBP, Floyd stated that incentives of any kind should not be awarded prior to actual installation, but should reward those after-the-fact for following through on the code or green standard. This would help alleviate 'catch me if you can' building practices. The codes are not sacrificed but corners are cut in many cases where the builder will wait for the inspector to catch mistakes. This raises the bar for the building inspector to be

[3] The 2007 Scottsdale Green Building Expo is scheduled for October 5-6, 2007.

sharp enough to catch these mistakes. Incentives based on post-installation inspection help discourage builders and contractors from cutting corners.

In addition to builders and contractors, real-estate professionals also have opportunities to get connected to energy issues. The EcoBroker certification program assists real estate agents in staying current with the growing consumer demand for green housing, by exposing agents to innovative energy, environmental, and green building marketing strategies and tools (EcoBroker 2007).

Floyd outlined some problems specific to Scottsdale. Scottsdale has a higher per capita income than other Phoenix area communities and this creates different energy situations than those that occur in less affluent areas. Very large homes (some over 6,000 square feet) are common. Floyd spoke of a home with a catwalk and spotlighting that required special attention on the part of the lighting inspector.

Floyd takes advantage of the free online software offered on the Department of Energy's (DOE) website for compliance checks in Scottsdale. Scottsdale uses REScheck (for residential buildings) and COMcheck (for commercial buildings). Scottsdale also uses energycodes.gov and subscribes to web casts that are held regularly on the DOE website. Floyd thinks that the web casts are incredibly helpful and would like to see increased use by building officials statewide. Floyd reinforced the idea that training and comprehension are vital to better code compliance.

Floyd identified that a large turnover of staff is problematic for the building community in efficiently and regularly enforcing the code. This is a challenge for both the building community and building code inspectors.[4]

Addressing on-site workmanship, Floyd would like to see required testing of builder's employees such as the insulation installers. In the state of Arizona, an installer can become licensed in insulation installation. However, once

[4] This statement was backed up by the experience in Southern Arizona where three interviews in different building departments produced three different interim building officials.

licensed, he or she can hire as many employees as needed, and none are required to be tested in the proper techniques of correct insulation installation.

Floyd is a progressive leader in energy efficiency and building inspections. He is a champion of fostering a community in support of energy codes and green buildings, and he has found effective and industrious ways of interacting with and positively influencing his community.

Source: Personal communication with Anthony Floyd, March 12, 2007. Mr. Floyd can be reached at the Scottsdale Green Building Program by calling 480-312-7080.

CASE STUDY #3:

Championing Energy Code Enforcement and Compliance:
Fountain Hills, Arizona

Peter Johnson, the chief building inspector in Fountain Hills, Arizona has taken thoughtful and purposeful steps toward keeping the building department in Fountain Hills on the cutting edge of building energy codes and code compliance. He began this transformation by adopting the 2003 IECC codes as soon as he was hired by the city a couple of years ago. He has been vigilant in continuing to keep Fountain Hill's codes up to date and the city will be adopting the 2006 IECC codes within the next 6-12 months.

Johnson came to Fountain Hills from Park City, Utah, where he worked in a very progressive department. Johnson learned the building code adoption, enforcement, and education methods of Park City's building department when he worked as a builder in Utah for many years. He continues to build homes in Fountain Hills.

Fountain Hills is a growing suburban community, located about 30 miles northeast of Phoenix. The city's 2005 population was 23,105. The city's building division staff, which inspected 466 new homes in 2005, includes the chief building official, 3 field inspectors, 2 plans examiners, and 2 permit technicians.

Fountain Hills is a wealthy community with an above average new home building size. Coupled with the large square footage of the homes and the number of custom built homes in the area, Johnson saw a need and an opportunity to implement energy codes and channel the wave of construction that is occurring in the community. Since he is also a home builder himself, Johnson set about building his own home for his family in a way to show local builders the ease and benefits of building an energy-efficient home. He and his family now live in an above-code home and he is building another home that will be above the 2006 IECC codes. He said, "I like to stay one step ahead of the building industry in building top of the line, above-code homes."

Beyond his own personal commitment to sustainable building, he has brought awareness into his building department. He has purchased educational materials in various formats to allow his employees to learn the codes, stay updated on them, and enforce them in a consistent manner. He uses reading materials, a video, and regular meetings with his staff to educate them on building codes with a major emphasis on the energy code. He has also reached out to the local building industry and attends regular industry meetings and gatherings to educate building participants about the current codes and ways to incorporate them into building activities. Johnson brings an added level of credibility to his lectures as he is part of the building industry as well as being the chief code official, gaining him a higher level of respect from the builders and contractors who attend the meetings.

To address the community's need for sustainable building practices and code compliance, he personally takes phone calls and information requests from consumers that are interested in learning about building energy-efficient homes, or who want to learn about green building.

To further encourage his building department staff to inspect homes in a consistently high-quality manner, he has developed checklists for both the builders and the code inspectors. By presenting a basic checklist for the builder to go through, he has focused area builders' attention on code compliance and created a simple way to keep the builder on task to complete the building as

mandated by code. To inspect if the builder followed the checklist, and thereby the energy code, Johnson's inspectors have a checklist of their own to focus on the areas that are crucial to energy code compliance. One such crucial area is that of building insulation. Johnson developed a three-stage inspection process for insulation to check at various steps of the building process to ensure that the insulation is installed correctly and up-to-code.

The combination of the training and education of staff and those participating in the local building industry, plus the streamlined enforcement methods, create a healthy environment of communication and dedication of all parties to quality-built homes that comply with the building codes, including the energy code.

Johnson offers that increased education in all parts of the building industry is key to energy code enforcement. He suggests insulation training, certifications, and constant updates on the builder's part to ensure high-quality installation of insulation.

Johnson emphasizes that keeping the energy codes up-to-date, enforcing the code with a streamlined and simplified process, and educating the building department and industry is the key to success in Fountain Hills.

Source: Personal communication with Peter Johnson, April 12, 2007. Mr. Johnson can be reached at the Fountain Hills Building Safety Department by calling 480-816-5111.

BEST PRACTICES

During the interviews with building officials in municipalities actively involved in building energy codes, the best practices in code support, compliance, and enforcement were identified and documented. The questions pertaining to these practices addressed methods of overcoming the barriers discussed in the above data tables, other potential methods or approaches that could have been successful, types of code support and information that could help increase energy code compliance in their community, the level of interest in training on building energy codes and energy code issues, types of training that would be useful for the adoption, implementation or enforcement of an energy code in their communities, actions that would help them improve enforcement of the building energy code, and what is needed for the overall building community to encourage energy-efficient practices in buildings in Arizona.

These questions were written to establish both the baseline of active involvement and illuminate the areas and practices that best assist communities in implementing energy codes. Methods that have been applied to overcome the barriers in enforcing the energy code are creative and innovative. Different officials used specifically tailored methods of overcoming the barriers discussed in the above data tables.

Below is a description of the best practices identified in the study with examples of each practice.

EDUCATION AND TRAINING

The building officials stated again and again how important education is in the area of code enforcement but also how important *continuing* education is. Training is important for both the building industry and for code officials and inspectors.

Training for Code Officials and Building Inspectors

The Fountain Hills building department purchased a video for employees of the department to watch and learn about codes and enforcement. They found that learning by video was another way of addressing the lack of understanding of the codes. Educating code officials through a variety of approaches goes a long way to increasing the overall level of knowledge in the department.

Scottsdale opted to use online web casts provided by the Department of Energy for staff training. Online resources have become commonplace in the industry. Keeping the staff updated on current issues involving codes, specifically the energy codes, means they are better prepared to do their job effectively. Pima County also uses support and education for staff training from multiple online sources including DOE, ENERGY STAR, ICC, and local utilities.

Oro Valley sends officials to building science workshops. Many departments have informal education sessions with interested parties or individuals that wish to learn about the codes and green building concepts. Prescott also offers educational materials for interested parties.

The Phoenix department also has in-house training sessions for employees to keep them all up to date on current requirements of codes and their role in enforcing them. This requires vigilance on the official's part in keeping on top of the level of staff involvement and education and addressing the areas that need attention by education. Like Phoenix, the Town of Parker, Colorado has in-house training sessions that teach inspectors the difference between industry standards and what the code actually requires.

Training for the Building Industry

Many departments have set up training seminars that are well attended by the local building community. Some departments have offered sessions specifically targeted to the building industry. Phoenix has had two public meetings over the last year and each drew more than 100 people for the session.

In attendance were builders, developers and contractors. Phoenix is planning a late summer 2007 session to go over new codes and to focus on local amendments. They invite presentations and have a question and answer portion to finish the meeting.

Parker, Colorado developed a contractor training program where training was provided by industry experts on topics like proper flashing techniques, insulation installation, and HVAC design and installation. Their contractor training program was so successful the Colorado state energy office and a local NGO copied and webified the process for other building departments in the state.

As outlined in the Wish List section of this report, many of the interviewed officials stressed the importance and success of the current efforts of educating on-site with the building industry.

MEET WHERE INDUSTRY MEETS -- LOCATION OF EDUCATION

Another creative way of addressing education is to place the education module literally *where* the building industry and involved parties gathers. Officials have found that by being present at local building community functions, working together has become much easier. In Fountain Hills, the Association of Licensed Contractors meets regularly and invites speakers to come to meetings and share information on various related topics. By creating the least amount of trouble for those who need to be educated in the industry, success rates and level of education increases greatly. From these early existing examples of going out of the way to find places where industry gatherings are already taking place, officials have found great success with developing effective relationships.

INVOLEMENT OF AND INPUT FROM THE BUILDING INDUSTRY

In Parker, CO, the building department encourages individual builders, trade associations, and others to assist them with code amendment efforts. The officials also invite input in code development and enforcement. Including the

industry in the process has fostered joint efforts in streamlining the review process. If the contractors help develop the code, they are more apt to enforce it on-the-job and accept nothing less than up-to-code work on their projects.

PROVIDING ADEQUATE NOTICE

Builders are more willing to cooperate and are more successful at complying with a new code when they have adequate notice of upcoming changes. In Parker, CO, the chief building official gave builders a one-year heads-up: starting in September 2005, building permits would not be issued for homes or home models that had not completed an Air Conditioning Contractors of America (ACCA) Manual J worksheet, did not include a mechanical plan showing the size and locations of furnaces and ducts, and did not provide testing to verify that the systems included in the home actually worked as designed. Parker combined this advance notice with training to assist the builders in adapting to the new requirements. Training was offered on a wide range of topics during the one-year period leading up to the implementation of the new requirements.

In Marana, the 2006 IECC was recently adopted and the building industry had until May 31, 2007 to prepare to comply with the new codes. By communicating the new codes and offering materials to builders to use to learn the new code, Marana expects a smooth transition to upgrading their codes.

ENERGY CHAMPIONS

Having an energy champion in the area is also very beneficial. These champions in Arizona include local utilities, local builders, code officials, and the State Energy Office. Further, energy advocacy groups such as the Southwest Energy Efficiency Project, the Sierra Club, and the Grand Canyon Trust actively engage with the energy industry.

The Arizona utilities (APS, SRP and TEP) have incentive programs for energy-efficient design and implementation in their service territories. These programs promote energy-efficient new construction and offer financial incentives and technical assistance to builders.

In the area of Florence, a new community called Anthem is being built by Pulte Homes. Pulte offers a choice of a homes built to ENERGY STAR requirements as an option for prospective homebuyers. This option created awareness on the part of the consumer and helped Florence to increase energy code acceptance in the local community.

The form of an energy champion takes on many roles and is often found in the building code officials themselves, as they are inspirational in their own pioneering efforts of energy code implementation. Of their own accord, officials in Parker, CO, Pima County, Fountain Hills, and Surprise have all created new avenues from which to champion energy code enforcement.

In Parker, CO, the chief building official works tirelessly to build the relationships and workmanship within the local building community and thereby produces high-performance homes. In Pima County, the chief building official has personally created programs to encourage and enforce above-code homes. He has pursued working with certification programs such as LEED and ENERGY STAR to increase the performance of homes in his area. In Fountain Hills, the chief building official began the process of adopting current energy codes by deciding himself to increase the baseline level of performance of his building community. He also runs a personal contracting business and enjoys setting a higher example of how to build and profit from building homes with high performance standards.

Another champion is the chief building official in Surprise, where a building official is not only handling a regular work load but is also heavily involved in state-wide committees. By immersing himself in working with officials from all over the state, a sense of community is created and can be used to spread

information and best practices among officials. This networking is a great way to increase awareness among code officials.

The State Energy Office also plays a role as an energy champion by putting on seminars for officials from across the state to attend and learn the new codes and ask questions.

In the absence of an energy champion within the building department the energy code is not looked upon as important as the other building codes, enforcement is reduced, conflicts arise between builders and building officials, and the overall process is not as efficient as when an energy champion is resident in the department.

BEYOND-CODE STANDARDS AND GREEN BUILDINGS

An effective approach to embracing energy-efficient building design in a municipality is the Green Building Program. In Scottsdale, the Green Building Program has been very successful. The Green Building Program (GBP) is used as a standard, an incentive, and an educational vehicle for local residents and those in the building industry. The GBP takes a holistic approach through design and building techniques to reduce the environmental impact of buildings and reduce the energy consumption of the building over the long term. The GBP also pays attention to energy efficiency and its contributions to the health of a building's occupants.

Building industry participants in the Green Building Program receive incentives including an expedited plan review, and they must attend at least one Green Building workshop within a calendar year. An official from Surprise offered, "Green is a rallying point and inspires communities to jump on the band wagon." In Pima County code officials are implementing the Green Building Program to more aggressively pursue energy requirements. When these enter the mainstream they will ratchet up baseline code requirements to yet higher levels for energy conservation. There is community awareness in the form of the local AIA and USGBC groups who contribute to investigating how we can move

toward a zero carbon footprint. Pima County is attempting to partner with the USGBC in a pilot program where Pima County would certify structures to LEED, thereby reducing compliance costs to local participants and increasing educational promotion of sustainability. An official in Surprise follows the idea of bringing in sustainability at all levels as he sees that they are all tied together forcing him to think past energy and understand ideas of a carbon footprint and land disturbance among others. In Fountain Hills, the building department assists interested parties with a personal educational session on energy codes and the Green Building Program.

Pima County is targeting more aggressive voluntary energy standards wrapped into sustainability or green building programs. The City of Tucson has a Sustainable Energy Standard (SES) that is about 25% more energy-efficient than IECC 2003 and requires some use of solar energy. The SES is applied in the Civano development and other green building projects, and is also used for city buildings. The SES may also be used as a voluntary standard of increased energy efficiency by developers or builders in other projects.

An official in Park City, Utah, requires homes to be built to the LEED threshold, which also meets the ENERGY STAR threshold requirements. However, he does not require a LEED or ENERGY STAR certification because of its expense. This builds a level of trust between builders and contractors with the building department. Utah has modeled its programs to mirror the Colorado Built Green® Program.

Further, Parker, CO requires that a mechanical plan show the size and location of furnaces and ducts, and verifies that the systems included in the home worked as designed. Parker requires builders to test duct leakage, and static pressure and total flow at rough inspection, and room-to-room flows at final inspection.

In Fountain Hills, the building official developed additional inspections on the home dealing with 3 different steps in inspecting insulation to ensure consistency. The first step addresses the dry end/strap and shape before the

windows are installed. The second step focuses on insulation to ensure that the thermal requirements are met. The final step looks at any alterations or areas that need to be sealed.

Utility energy efficiency programs are also important because a significant portion of new homes in Arizona are committed to participate in the expanding utility DSM programs in the near future. For example, there are over 30,000 new homes committed to participate in the Arizona Public Service (APS) and the Salt River Project (SRP) utility DSM new construction programs in the Phoenix metro area alone. Therefore, compliance with IECC is only part of the story of increasing energy efficiency in new homes in Arizona.

CREATIVE SOLUTIONS

To approach enforcing an energy code, many officials have developed creative enforcement tactics and ideas. An official in Oro Valley developed an agreement with the local fire department to use their thermal imaging device to locate hot spots in buildings to ensure that the insulation was installed correctly and completely. Further, Oro Valley is attempting to bring in programs that encourage the sustainable use of water and solar energy. Activities like these display that building officials are creative in their approach to enforcement.

EMPHASIZE THE BENEFITS

Another point of view to approach the energy code is to “follow the money trail,” as quoted from an official. If builders and contractors can be shown the financial benefits of building green and architects can specialize in green building to create a niche for themselves, embracing the ideas of green building or building to the code can prove to be financially beneficial to all parties. Building an economic argument for the building code seems challenging at first but if the idea can be pitched rationally and earnestly, the barrier of assumed increased costs could be alleviated. An official in Pima County offered that education

regarding the marketability of high-efficiency structures as well as good stewardship for the long-term sustainability of the region was a selling point in building energy efficient projects.

WISH LIST

The above existing best practices only begin to paint a picture of the optimistic and dedicated people involved in the building industry. Code officials in all interviews had great ideas and plans for better use, implementation, and activities to ensure consistent and progressive energy code enforcement. Ideas as groundbreaking as creating college courses for architects and engineers on building codes and green building were offered from officials. Other educational supplements included licensing third-party installation workers. Figuring out that a major leak in the system of applying the energy code to builders and contractors was a major finding. By not having requirements *at all* for third-party installers, literally anyone off the street can work at the base level of where the energy code begins: insulation. If an apprenticeship program or actual state mandated licensing process could be implemented, code specifications could be met at a much higher rate and level of quality consistently.

At the level of code creation, a desire for making the codes as simple as possible was shown by the officials. An official from Clarkdale offered an idea that he would like to see a package that would dovetail with the 2006 ICC codes, or amendments to the 2006 ICC energy code that could be adopted at the same time as the code. Along with a simple code, Clarkdale thought that incentives could be tied to reward those showing leadership in the code enforcement area.

Because of the proven success of on-site training, many officials supported (and some are currently attempting to implement) the idea of seminars that would occur at the actual building site where those workers would be trained in their specific areas that day. This requires little or no effort on the part of the builder and workers to seek out training and makes it much easier to train more people than those that are willing to travel, pay for, and take time off for attending

other workshops currently provided. Oro Valley came up with the idea of a program called “Train the Supers,” that would include a mobile training unit that would travel to the job sites and offer *free* training. The State of Utah already has an innovative way of providing ‘free’ training for builders and contractors; 1% of the building permit fee goes into a fund at the Code Commission for creating training opportunities and other activities that have proved to be successful for them. This is mandated at a state level and departments apply for funding for various activities.

CONCLUSION

The niche of energy-efficient building design, building energy codes, and code compliance is a small but important piece of our nation's energy puzzle. Adopting and effectively implementing up-to-date building energy codes will reduce our nation's reliance on fossil fuels, reduce the need for costly new energy infrastructure, and reduce pollutant emissions including the pollutants causing global warming. The building community is becoming more aware of these issues.

The best practices outlined above demonstrate that education and training, awareness, communication, and passion are all important factors in the effective enforcement of and compliance with building energy codes. Seeking out educational opportunities for employees and offering training to the building community are key attributes of the leading municipal building departments. Building awareness is another key factor. Just as education fosters communication and the spreading of ideas and best practices, disseminating information increasing awareness helps to foster code compliance and efficient code implementation. Finally, from the building inspectors interviewed, passion and commitment also play a key role. The leading cities with respect to code compliance tend to have a passionate, dedicated chief building official.

Arizona building code officials can take action in many ways to embrace and replicate the best practices found in this study. One priority is to organize high quality and ongoing educational sessions that consistently involve both building officials and the building industry. Training should include information on the best practices identified in this report, such as use of checklists and promotion of beyond code voluntary standards. Training should take place at both local and regional meetings of the building industry, and through on-site training for builders, their employees, and their contractors. As education and training occurs, energy efficiency champions will arise who will help to spread the word on the benefits of energy-efficient construction and code compliance. This will lead to greater acceptance of and support for building energy codes. The

involvement of the wide array of stakeholders throughout the educational process will increase communication between building officials and the building industry, thereby fostering relationships that can encourage individuals and groups to work together toward the common goal of building an energy-efficient Arizona.

REFERENCES

Arizona Corporation Commission. 2007. http://www.cc.state.az.us/about/index.htm (last accessed June 21, 2007).

Arizona's Economy. 2007 http://ebr.eller.arizona.edu/azeconomy/azeconomy.aspx?issue=AZE07SUMre (last accessed July 23, 2007).

Arizona Legislature. 2007. http://www.azleg.gov/ (last accessed June 21, 2007).

ASU Insight. 2006. Arizona State University News. http://www.asu.edu/news/stories/200602/20060207_growth.htm. (last accessed May 23, 2007).

Babbie, Earl. 2004. The Practice of Social Research. Thomson Wadsworth. Belmont, California.

Bruntland, G. (ed.). 1987. *Our common future: The World Commission on Environment and Development*. Oxford: Oxford University Press.

Building Codes Assistance Project. 2004. http://www.bcap-energy.org/home.php (last accessed June 21, 2007).

Clarkdale, Arizona Building Inspector. "Re: BuildingCodeInterviewGuide040607." 17 May 2007. Personal e-mail.

Department of Energy. 2007. www.doe.gov (last accessed June 21, 2007).

Energy Information Administration. 2007. http://www.eia.doe.gov/ (last accessed July 1, 2007).

Florence, Arizona Building Inspector. Personal interview. 20 April 2007.

Fountain Hills, Arizona Building Inspector. Personal interview. 12 April 2007.

GPEC Information Center. 2006. www.gpec.org/infocenter/Topics/Demographics/HistoricalPopulation.html (last accessed June 21, 2007).

Intergovernmental Panel on Climate Change. 2005. www.ipcc.ch/index.htm (last accessed June 21, 2007).

Marana, Arizona Building Inspector. Personal interview. 06 April 2007.

Oro Valley, Arizona Building Inspector. Personal interview. 06 April 2007.

Phoenix, Arizona Building Inspector. Personal interview. 02 May 2007.

Pima County. 2007. http://www.pimaxpress.com/Building/PDFs/Green/Sustainability_Resolution_2007-84.pdf (last accessed May 29, 2007)

Pima County, Arizona Building Inspector. "Re: Building Code Survey." 20 April 2007. Personal e-mail.

Prescott, Arizona Building Inspector. Personal interview. 26 April 2007.

Scottsdale, Arizona Building Inspector. Personal interview. 15 February 2007.

Southwest Energy Efficiency Project. 2003. *Increasing Energy Efficiency in New Buildings in the Southwest. Energy Codes and Best Practices* http://www.swenergy.org/ieenb/index.html (last accessed June 21, 2007).

Surprise, Arizona Building Inspector. Personal interview. 23 April 2007.

Tucson, Arizona Building Inspector. Personal interview. 06 April 2007.

U.S. Census Bureau. 2005. www.census.gov (last accessed June 21, 2007).

Valentin, Anke and Joachim H Spangenberg. 2000. A guide to community sustainability indicators. *Environmental Impact Assessment Review*. 20: 381-392.

APPENDIX A

SURVEY USED TO COLLECT DATA

Building Energy Code Survey/Interview Guide

The Department of Commerce Energy Office and Southwest Energy Efficiency Project (SWEEP) are conducting a survey of building code officials in Arizona. The purpose of this study is to document building code practices in local communities in Arizona and to identify best practices in code support and compliance.

Your responses will be kept completely confidential unless you consent to your information being shared as an example of best practices.

Current Codes- Energy Code Development and Adoption

1. What are the current building energy codes used for your municipality?

2. How are building energy codes adopted in your community? Are new codes and updates reviewed and recommended through your office? Is the city council involved?

3. How is your personal input and feedback considered in building energy code decision-making by local government?

4. From your perspective, what value does an energy code provide the homeowner or occupant? A commercial business owner?

5. How important is the energy code during the building and inspection process? In reference to the importance of other codes?

Awareness of the Building Energy Code

6. Can you estimate the percentages of the following trade groups that are aware of and knowledgeable about the energy code? Residential versus Commercial?

		Residential	Commercial
Developers		%	%
Architects		%	%
Engineers		%	%
Builders		%	%

7. Rate the consumer's level of awareness of building energy codes.

		Not Aware 1	2	3	4	Very Aware 5
Residential Consumers		1	2	3	4	5
Commercial Occupants		1	2	3	4	5
Commercial Property Owners		1	2	3	4	5
Commercial Property Managers		1	2	3	4	5

Energy Code Compliance

8. Can you estimate the percentage of residential buildings that are in compliance with the energy code?

9. Can you estimate the percentage of commercial buildings that are in compliance with the building energy code?

What percent of projects are in compliance?

What percentage of the square footage in new commercial projects is in compliance?

10. How are you estimating or quantifying the energy code compliance in questions 9 and 10? What is the basis of your estimate?

Compliance Methods and Process

11. How is the building energy code implemented into the building code and inspection process? What compliance methods and tools do you use? Do you use REScheck or COMcheck, or any other tools?

12. How much time is spent on building energy code compliance throughout the process?

13. Do you feel that the process occurs efficiently? If not, what are some of the inefficiencies?

Importance of Codes for Building Components

14. Of the following components of a building, please rate their importance during inspections of a residential building on a scale of 1-5, where one is not important and 5 is very important.

	Not Important 1	**2**	**3**	**4**	**Very Important 5**
Windows	1	2	3	4	5
Doors	1	2	3	4	5
Insulation	1	2	3	4	5
Ducts	1	2	3	4	5
HVAC and mechanical systems	1	2	3	4	5
Building envelope	1	2	3	4	5
Framing	1	2	3	4	5
Foundations	1	2	3	4	5
Lighting	1	2	3	4	5
Others:	1	2	3	4	5

Barriers to Energy Code Adoption and Implementation

15. Of the following factors, please indicate how much of a barrier to energy code adoption and implementation each is, where 1 is not a factor at all (not prohibitive) and 5 is a major factor (very prohibitive) prohibiting the adoption and implementation of the code.

Residential		**Not Prohibitive 1**	**2**	**3**	**4**	**Very Prohibitive 5**
Perceived increased cost for buildings		1	2	3	4	5
Lack of builder/consumer energy efficiency awareness or interest		1	2	3	4	5
Increased workload for building officials and inspectors		1	2	3	4	5
Builder unwillingness to change		1	2	3	4	5
Building official's lack of knowledge of energy code		1	2	3	4	5
Developer/builder/contractor lack of knowledge of energy code		1	2	3	4	5
Mechanical Systems: Complexity of energy codes and the support requirement		1	2	3	4	5
Difference between plans and as built		1	2	3	4	5
Priority of building codes		1	2	3	4	5

(fire/health/safety)						
Lack of support from local energy champion		1	2	3	4	5
Lack of compliance methods/agents/long term sustainability of codes		1	2	3	4	5
Energy codes changing frequently, requiring updates		1	2	3	4	5
Others:		1	2	3	4	5

Commercial:		**Not Prohibitive** **1**	**2**	**3**	**4**	**Very Prohibitive** **5**
Perceived Cost		1	2	3	4	5
Lack of builder/consumer energy conservation awareness		1	2	3	4	5
Increased official's workload		1	2	3	4	5
Builder unwillingness to change		1	2	3	4	5
Builder designer code knowledge/awareness		1	2	3	4	5
Builder code knowledge/requirements		1	2	3	4	5
Contractor code		1	2	3	4	5

knowledge						
Difference between plans and as built		1	2	3	4	5
Complexity of codes and ease of installation		1	2	3	4	5
Difference between plans and actual		1	2	3	4	5
Lack of community/county/state support		1	2	3	4	5
Material shortage in the area		1	2	3	4	5
Others:		1	2	3	4	5

Overcoming Barriers to Code Implementation

16. Given the barriers you above, what methods have you tried to overcome these barriers? What level of success have you had?

17. Are there other potential methods or approaches that you would like to try but haven't done so yet? Are you aware of where these methods have been tried, and are you aware of examples of successes?

Energy Code Support and Training

18. What types of code support and information would help increase energy code compliance in your community?

19. Would there be any interest in a local training on building energy codes and energy code issues? If so, who would be the best target audience(s): code officials, commercial developers, homebuilders, contractors, who?

20. What type(s) of training would be useful for an adoption, implementation or enforcement of an energy code?

21. What actions would help you personally to better enforce the building energy code?

22. What is needed for the overall building community to encourage energy efficient practices in buildings?

Background Information

23. Can you give a little background on your education and experience in the building industry?

24. How many employees work in the building inspection process here in your department?

25. What is the average square footage of new home construction in your area?

Wrap Up

26. Can you recommend other building officials or code inspectors who we should talk to in other communities?

APPENDIX B

ARIZONA ENERGY OFFICE DATA FROM ARIZONA STATE UNIVERSITY RESEARCH AND DATA COLLECTION

TABLE A:

Housing Units Permitted in Arizona, by county, 2005

TABLE B:

2005 ENERGY STAR® Homes Market Penetration, selected states, 2005

TABLE A

ARIZONA HOUSING UNITS AUTHORIZED
January to December 2005

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
APACHE COUNTY							Yes	2000	No	EX-IECC		
Eager	30	19	0	0	0	49	Yes	2000	No	EX-IECC	49	0
St. Johns .....**	2	4	0	0	0	6	Yes	2000	No	EX-IECC	6	0
Springerville .....**	7	5	0	12	0	24	Yes	2006	No	EX-IECC	24	0
Unincorporated .....**	88	126	0	0	0	214					214	0
Total, Apache County	127	154	0	12	0	293	3 yes communities					
Percent Change,										**Total**	293	0
Previous Year	3	45	-	100	-23		yes county					

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
COCHISE COUNTY							Yes	2003	Yes	2003		
Benson .....**	0	8	0	0	0	8	Yes	2003	Yes	2003		8
Bisbee .....**	3	1	0	0	0	4	No	No	No	No	4	
Douglas .....**	71	1	0	0	65	137	No	No	No	No	137	
Huachuca City .....**	3	0	0	0	0	3	No	No	No	No	3	
Sierra Vista .....**	401	12	0	0	0	413	Yes	Yes	Yes	2003		413
Tombstone	N/R	N/R	N/R	N/R	N/R	N/R	No	No	No	No		
Unincorporated	572	383	0	0	0	955	Yes	2003	Yes	2003		955
Willcox .....**	1	8	0	0	0	9	Yes	2003	No	EX-IECC	9	
Total, Cochise County	1,051	413	0	0	65	1,529	4 yes communities					
Percent Change,							4 no communities			**Total**	153	1376
Previous Year	-3	-11	-	-	-50	-9	yes county					1529

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
COCONINO COUNTY							No	No	No	No		
Flagstaff	360	49	6	3	261	679	Yes	2003	No	EX-IECC	679	0
Fredonia	8	4	0	0	0	12	No	No	No	No	12	0
Page	37	16	0	0	0	53	No	No	No	No	53	0
Sedona .....**	69	6	0	0	0	75	Yes	2003	No	EX-IECC	75	0
Unincorporated	336	197	0	0	0	533	No	No	No	No	533	0
Williams .....**	51	0	6	4	6	67	Yes	2000	No	EX-IECC	67	0
Total, Coconino County ...	861	272	12	7	267	1,419	3 yes communities				1419	
Percent Change, Previous Year	-17	-25	-14	-63	2,327	-2	3 no communities			**Total**	1419	
							no county					

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
GILA COUNTY							No	No	No	No		
Globe	7	1	0	0	0	8	No	No	No	No	8	
Hayden	N/R	N/R	N/R	N/R	N/R	N/R	No	No	No	No		
Miami	N/R	N/R	N/R	N/R	N/R	N/R	No	No	No	No		
Payson .....**	215	26	0	0	113	354	Yes	2003	No	EX-IECC	354	
Unincorporated	128	158	0	0	0	286					286	
Total, Gila County	350	185	0	0	113	648	1 yes communities					0
Percent Change, Previous Year	26	33	-	-	-52		3 yes communities			**Total**	648	
							no county					

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
GRAHAM COUNTY							Yes	2003	Yes	2003		
Pima .....**	271	1	4	0	0	276	No	No	No	No	276	0
Safford .....**	31	24	0	0	0	55	No	No	No	No	55	
Thatcher .....**	26	3	0	8	0	37	No	No	No	No	37	
Unincorporated .....**	62	62	0	0	0	124					124	
Total, Graham County	390	90	4	8	0	492						
Percent Change, Previous Year	596	38	100	0	-246		3 no communities			**Total**	492	
							yes county					

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
GREENLEE COUNTY							No	No	No	No		
Clifton	N/R	N/R	N/R	N/R	N/R	N/R	No	No	No	No		
Duncan .....**	0	1	0	0	0	1	No	No	No	No	1	
Unincorporated	7	7	0	0	0	14					14	
Total, Greenlee County ...	7	8	0	0	0	15						
Percent Change,										**Total**	15	0
Previous Year	600	100	-	-	-200		2 no communities no county					

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
LA PAZ COUNTY							Yes	2003	Yes	2003		
Parker	N/R	N/R	N/R	N/R	N/R	N/R	Yes	2003	No	EX-IECC	0	0
Quartzsite	1	74	0	0	0	75	Yes	2003	No	EX-IECC	75	
Unincorporated	50	255	0	0	5	310	Yes	2003	Yes	2003		310
Total, La Paz County	51	329	0	0	5	385						
Percent Change,										**Total**	75	310
Previous Year	4	19	-	-	-94	-6	3 yes communities yes county					

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
MARICOPA COUNTY							Yes	2003	No	EX-IECC		
Avondale	1,469	0	0	0	336	1,805	Yes	2003	No	EX-IECC	1,805	
Buckeye .....**	4,202	17	0	0	0	4,219	No	No	No	No	4,219	
Carefree	61	0	0	8	65	134	No	No	No	No	134	
Cave Creek .....**	78	1	0	0	0	79	Yes	2003	No	EX-IECC	79	
Chandler	2,618	0	0	8	450	3,076	Yes	2003	No	EX-IECC	3,076	
El Mirage	294	90	0	0	0	384	Yes	2003	No	EX-IECC	384	
Fountain Hills	303	0	44	16	130	493	Yes	2003	Yes	2003		493
Gila Bend .....**	12	4	0	0	0	16	No	No	No	No	16	
Gilbert	3,060	0	0	0	1,262	4,322	Yes	2003	No	EX-IECC	4,322	
Glendale	557	0	12	0	85	654	Yes	2003	No	EX-IECC	654	
Goodyear	2,756	0	0	0	0	2,756	Yes	2003	Yes	2003		2756
Guadalupe	N/R	N/R	N/R	N/R	N/R	N/R	No	No	No	No	N/R	
Litchfield Park	85	0	10	0	56	151	Yes	2003	No	EX-IECC	151	
Mesa	1,497	622	2	180	328	2,629	Yes	2006	No	EX-IECC	2,629	
Paradise Valley	106	0	0	0	0	106	Yes	2003	No	EX-IECC	106	
Peoria	3,038	91	0	36	395	3,560	Yes	2003	Yes	2003		3560
Phoenix	12,145	0	296	210	2,497	15,148	Yes	2003	Yes	2004		15148
Queen Creek	1,329	2	0	0	0	1,331	Yes	2003	Yes	2003		1331
Scottsdale	1,320	0	42	30	250	1,642	Yes	2003	No	EX-IECC	1,642	
Surprise	6,500	11	0	42	313	6,866	Yes	2003	Yes	2003		6866
Tempe	147	0	2	0	649	798	Yes	2003	No	EX-IECC	798	
Tolleson .....**	7	0	0	0	0	7	Yes	2003	No	EX-IECC	7	
Unincorporated	5,026	594	36	0	148	5,804	Yes	2003	No	EX-IECC	5,804	
Wickenburg .....**	9	0	0	0	0	9	Yes	2003	No	EX-IECC	9	
Youngtown .....**	150	0	0	0	0	150	Yes	2003	No	EX-IECC	150	
Total, Maricopa County ...	46,769	1,432	444	530	6,964	56,139						
Percent Change,						56,139	20 yes communities			**Total**	25985	30154
Previous Year	-7	17	50	-49	17	-5	4 no communities					56139
							yes county					

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
MOHAVE COUNTY							Yes	2003	No	EX-IECC		
Bullhead City	808	264	4	11	30	1,117	Yes	2003	No	EX-IECC	1,117	
Colorado City .....**	0	0	0	0	0	0	Yes	2003	No	EX-IECC	0	
Dolan Springs	39	80	0	0	0	119	No	No	No	No	119	
Kingman Area	306	140	4	0	0	450	Yes	2003	No	EX-IECC	450	
Kingman City .....**	795	0	20	0	0	815	Yes	2003	No	EX-IECC	815	
Lake Havasu Area	61	14	0	0	0	75	Yes	2003	No	EX-IECC	75	
Lake Havasu City .....**	747	4	74	0	28	853	Yes	2003	No	EX-IECC	853	
Mohave General	443	161	0	0	0	604	Yes	2003	No	EX-IECC	604	
Mohave Valley South	709	268	10	0	0	987	Yes	2003	No	EX-IECC	987	
Sacramento Valley	136	231	0	0	0	367	Yes	2003	No	EX-IECC	367	
Total, Mohave County	4,044	1,162	112	11	58	5,387						
Percent Change, Previous Year	15	24	-49	-76	-32	12	9 yes communities 1 no community yes county			**Total**	5,387	0

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
NAVAJO COUNTY							No	No	No	No		
Holbrook	5	6	0	0	6	17	No	No	No	No	17	
Pinetop-Lakeside	152	7	2	0	64	225	No	No	No	No	225	
Show Low .....**	290	95	0	13	304	702	Yes	2003	Yes	2003		702
Snowflake	N/R	N/R	N/R	N/R	N/R	N/R	No	No	No	No	N/R	
Taylor	36	9	0	0	40	85	Yes	2003	No	EX-IECC	85	
Unincorporated	614	217	8	0	0	839	No	No	No	No	839	
Winslow	16	2	0	0	0	18	No	No	No	No	18	
Total, Navajo County	1,113	336	10	13	414	1,886						
Percent Change, Previous Year	28	21	-71	-70	350	43	2 yes communities 5 no communities no county			**Total**	1184	702 1886

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
PIMA COUNTY							No	No	No	No		
Marana	1,771	10	0	0	0	1,781	Yes	2000	No	EX-IECC	1,781	
Oro Valley .....**	312	0	0	0	54	366	Yes	2003	Yes	2003		366
Sahuarita .....**	1,516	5	0	0	0	1,521	Yes	2003	Yes	2003		1521
South Tucson	N/R	N/R	N/R	N/R	N/R	N/R	Yes	Yes	No	EX-IECC	N/R	
Tucson	2,423	0	186	65	116	2,790	Yes	2003	Yes	2003		2790
Unincorporated	5,014	792	0	8	0	5,814	No	No	No	No	5,814	
Total, Pima County	11,036	807	186	73	170	12,272						
							5 yes communities			**Total**	7595	4677
Percent Change, Previous Year	15	1	8	74	-80	7	1 no community no county					12272

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
PINAL COUNTY							Yes	2000	Yes	2000		
Apache Junction	144	269	0	0	0	413	Yes	2006	No	EX-IECC	413	
Casa Grande	1,741	47	0	20	0	1,808	No	No	No	No	1808	
Coolidge .....**	687	6	0	0	0	693	No	No	No	No	693	
Eloy .....**	51	4	10	4	0	69	Yes	2003	No	EX-IECC	69	
Florence	79	17	0	0	0	96	Yes	2000	Yes	2000		96
Kearny	N/R	N/R	N/R	N/R	N/R	N/R	No	No	No	No	N/R	
Mammoth	N/R	N/R	N/R	N/R	N/R	N/R	No	No	No	No	N/R	
Maricopa	N/R	N/R	N/R	N/R	N/R	N/R	Yes	2000	No	EX-IECC	N/R	
Superior	24	1	0	0	0	25	No	No	No	No	25	
Unincorporated	9,603	0	6	91	5	9,705	Yes	2000	Yes	2000		9705
Total, Pinal County	12,329	344	16	115	5	12,809						
							5 yes communities			**Total**	3008	9801
Percent Change, Previous Year	23	31	-60	-20	-96	21	5 no communities yes county					12809

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
SANTA CRUZ COUNTY							Yes	2003	No	EX-IECC		
Nogales	N/R	N/R	N/R	N/R	N/R	N/R	No	No	No	No		
Patagonia	2	1	0	0	0	3	No	No	No	No	3	
Unincorporated	819	0	10	7	60	896	Yes	2003	No	EX-IECC	896	
Total, Santa Cruz County .	821	1	10	7	60	899						
Percent Change, Previous Year	72	-80	150	-30	-40	51	1 yes community 2 no communities yes county			**Total**	899	0

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
YAVAPAI COUNTY							Yes	2003	No	EX-IECC		
Camp Verde .....**	186	59	0	0	0	245	Yes	2003	No	EX-IECC	245	
Chino Valley	305	55	0	0	14	374	Yes	2003	No	EX-IECC	374	
Clarkdale	N/R	N/R	N/R	N/R	N/R	N/R	Yes	2003	Yes	2003		
Cottonwood	112	40	0	0	9	161	Yes	2003	No	EX-IECC	161	
Jerome	N/R	N/R	N/R	N/R	N/R	N/R	No	No	No	No	N/R	
Prescott	592	23	2	10	0	627	Yes	2003	No	EX-IECC	627	
Prescott Valley	1,146	43	34	9	8	1,240	Yes	2003	No	EX-IECC	1240	
Unincorporated	1,833	563	22	4	0	2,422	Yes	2003	No	EX-IECC	2422	
Total, Yavapai County	4,174	783	58	23	31	5,069						
Percent Change, Previous Year	22	23	-45	-36	-82	16	7 yes communities 1 no community yes county			**Total**	5069	0

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total	ICC Code in Place	Year	IECC in place	Year	HNBTEC	HBTEC
YUMA COUNTY							Yes	2003	No	EX-IECC		
San Luis	234	14	0	0	0	248	No	No	No	No	248	
Somerton .....**	167	0	0	0	0	167	No	No	No	No	167	
Unincorporated	929	273	0	0	0	1,202	Yes	2003	No	EX-IECC	1202	
Wellton .....**	35	1	0	0	16	52	No	No	No	No	52	
Yuma .....**	585	11	4	0	0	600	Yes	2003	No	EX-IECC	600	
Total, Yuma County	1,950	299	4	0	16	2,269	2 yes communities					
Percent Change, Previous Year	-21	5	100	-	-96	-28	3 no communities yes county			**Total**	2269	0

	One Family	Mobile Homes	Duplex	3-4 Family	5 or More	Total
TOTAL, ARIZONA	**85,073**	**6,615**	**856**	**799**	**8,168**	**101,511**
Percent Change, Previous Year	2	13	-6	-43	2	2

	No IECC	IECC
State Totals	**54,491**	**47,020**
		101,511
	53.68%	46.32%

N/R: No Report

** Incomplete data: One or more months not available

Note: A dash indicates that a percent change could not be calculated because at least one period had no activity

Source: Arizona Real Estate Center, Arizona State University's Polytechnic campus

TABLE B

State	2005 ENERGY STAR Qualified New Homes[1]	2005 One-Unit Housing Permits[2]	2005 ENERGY STAR Market Penetration
Alaska	1,391	1,653	84%
Arizona	17,102	80,762	21%
California	18,604	153,236	12%
Connecticut	1,314	8,511	15%
Delaware	1,507	6,715	22%
Hawaii	1,853	6,641	28%
Iowa	5,308	12,791	42%
Massachusetts	2,315	14,223	16%
Nevada	16,100	37,546	43%
New Hampshire	638	6,388	10%
New Jersey	7,965	22,100	36%
New York	-	-	14% [3]
Rhode Island	430	1,808	24%
Texas	51,266	166,088	31%
Vermont	459	2,360	19%

2 Source - http://www.census.gov/const/C40/Table2/tb2u2005.txt