U.S. DEPARTMENT OF ENERGY

PNNL-21963

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

An Analysis of Statewide Adoption Rates of Building Energy Code by Local Jurisdictions

KA Cort
RS Butner

December 2012

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Pacific Northwest National Laboratory
Richland, Washington 99352

Summary

The purpose of this study is to quantify the energy code adoption rate by local jurisdictions from a sample set of 21 states. Some of the states within this sample have statewide energy codes, while others do not. Using construction starts and weighting results by localities that have or have not adopted energy codes, the findings can suggest a means of identifying which states have "effectively" adopted state-wide codes through local adoption and enforcement.

There are currently 42 states in the United States that have adopted some form of a statewide building energy code. The remaining eight states have not adopted statewide energy codes; however, local municipalities and/or counties within those states are not precluded from adopting local building energy codes. In all cases, the energy code is effectively implemented at the local jurisdiction (county or city) where building construction and permitting take place. There are many thousands of these local jurisdictions and currently no comprehensive statistics have been gathered on jurisdiction-level code adoption activities.

For each of the states in this study, the residential energy code adoption process and code status were examined at the local level. Information was gathered for approximately 2,800 jurisdictions, which effectively covered approximately 80 percent of the new residential building construction in each of the 21 states. The study found that states without statewide residential energy codes have a significantly lower effective code adoption rate by jurisdiction than states with a statewide energy code. On average, states with no statewide energy codes have a jurisdictional adoption rate of 52 percent, while states with statewide codes were found to have an adoption rate of approximately 88 percent. When examining a subset of states that have statewide energy codes in place, but also have more flexibility built into the jurisdictional adoption process (e.g., jurisdictions have the choice as to whether or not to adopt a statewide code due to the legislative structure, home-rule charter or traditions of the given state), the average statewide adoption rate drops to 78 percent.

Despite the overall low local adoption rates of states that do not have statewide energy codes, in many cases the most populous municipalities have in fact adopted mandatory energy codes. As such, their state's effective jurisdictional adoption rates are comparable with and sometimes exceed the average adoption rates of states with statewide energy codes. The most prominent examples of this are seen in Arizona, Missouri, and North Dakota.

Sixteen of the 21 states included in the sample are considered "home-rule," which means the state constitution grants cities, municipalities, and/or counties the ability to pass laws to govern themselves as they see fit. The study found that a state's home-rule status does not necessarily imply a lower likelihood of adopting a statewide code or a lower effective jurisdictional adoption rate. Home rule in and of itself is not all encompassing or absolute, and how these states implement their home-rule charters in terms of local government structure, autonomy, and authority varies; thus the jurisdictional adoption flexibility that is permitted for these states will vary as well.

Acronyms and Abbreviations

BECP	Building Energy Codes Program
IECC	International Energy Conservation Code
REEO	Regional Energy Efficiency Organizations
MEEA	Midwest Energy Efficiency Alliance
NEEA	Northwest Energy Efficiency Alliance
NEEP	Northeast Energy Efficiency Partnerships
SEEA	Southeast Energy Efficiency Alliance
SPEER	South-Central Partnership for Energy Efficiency as a Resource
SWEEP	Southwest Energy Efficiency Project

Acknowledgements

The authors would like to acknowledge the efforts and contributions of the researchers who collected municipal energy code information for this report. They spent numerous hours conducting research, sending e-mails, and conducting telephone interviews. These researchers include:

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- Addison Rutz, University of Idaho.

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1.0 Introduction

There are currently 42 states in the United States that have adopted some form of a statewide building energy code. The remaining eight states have not adopted statewide codes; however, local municipalities and/or counties (referred to hereafter as local jurisdictions) in those eight states are not precluded from adopting local building energy codes. For all states, the building energy code is effectively adopted and enforced at the jurisdictional level where building construction and permitting take place. The manner in which states go about adopting and accepting codes at this level may vary by state and jurisdiction, depending on legislative and governmental structures, budgetary considerations, regional policies, political will, economy, tradition, and any number of regional influences. Although the U.S. Department of Energy's Building Energy Codes Program (BECP) currently tracks the status of statewide building energy code adoption,[1] there are currently no comprehensive statistics gathered on the status of local jurisdictional adoption rates, as this would involve the tracking of many thousands of jurisdictions throughout the nation. As a result, it is difficult to conclude whether the "effective" adoption rate of building energy codes at the jurisdictional level varies significantly from one state to another and whether the absence of a statewide energy code significantly impacts the level of jurisdictional energy code adoption.

This study was conducted to inform BECP of the local adoption rates for a sample of states, in order to develop a clearer picture of effective building energy code adoption rates in states that may or may not have a statewide code. The study also characterizes some of the possible influencing factors on these jurisdictional adoption rates based on legislative characteristics, energy code adoption history, and code adoption information gathered for each jurisdiction. To carry out the study, information was examined related to the status of building energy code adoption for approximately 2,800 local jurisdictions within 21 states, which covered 80 percent of the new residential building construction for each of the states. A combination of states with and without statewide energy codes was selected, representing all six of the Regional Energy Efficiency Organizations (REEO).[2]

The study approach was designed to develop the following information:

1. Estimate the effective adoption rate for a large sample of jurisdictions within each state
2. Compare the effective adoption rate between states that have statewide energy codes to those that do not
3. Characterize any key findings related to effective and average adoption rates and identify potential factors influencing the statistic from state to state.

[1] See http://www.energycodes.gov/adoption/states.

[2] REEOs are collaborative non-profit organizations that promote and advance energy efficiency in particular regions throughout the United States. There are six REEOs currently in place. (see Figure 2.1 of this report) including the Midwest Energy Efficiency Alliance (MEEA), the Northeast Energy Efficiency Partnerships (NEEP), Northwest Energy Efficiency Alliance (NEEA), the Southeast Energy Efficiency Alliance (SEEA), the Southwest Energy Efficiency Project (SWEEP), and South-Central Partnership for Energy Efficiency as a Resource (SPEER).

2.0 Methodology

In the United States, building energy codes are adopted at the state and local levels. To assess the code adoption activity at the local jurisdictional level, this study examined a sample of jurisdictions from each state that would effectively cover 80 percent of the residential construction activity. For each of the jurisdictions sampled, the energy code status was determined based on internet searches and personal contact with representatives from the REEOs, states and local jurisdictions.

2.1 Scope

A cross-sectional sample of states throughout the United States with various building energy code adoption legislation and policies was selected based on input from BECP staff and members of the REEOs. Figure 2.1 identifies the states that were included in the study. To simplify the collection process, data was gathered only on residential building energy code adoption; information on commercial code adoption was not included. The study also focused exclusively on code adoption and did not consider issues related to compliance or code enforcement. The jurisdictions were selected based on their contribution to current and historical construction activity in the states. No effort was made to project future construction activity or code activity by jurisdiction. Upon evaluating all the data gathered, the results of the study reflect the future status of energy code adoption as of July 2012 and, thus reflect a snapshot in time.

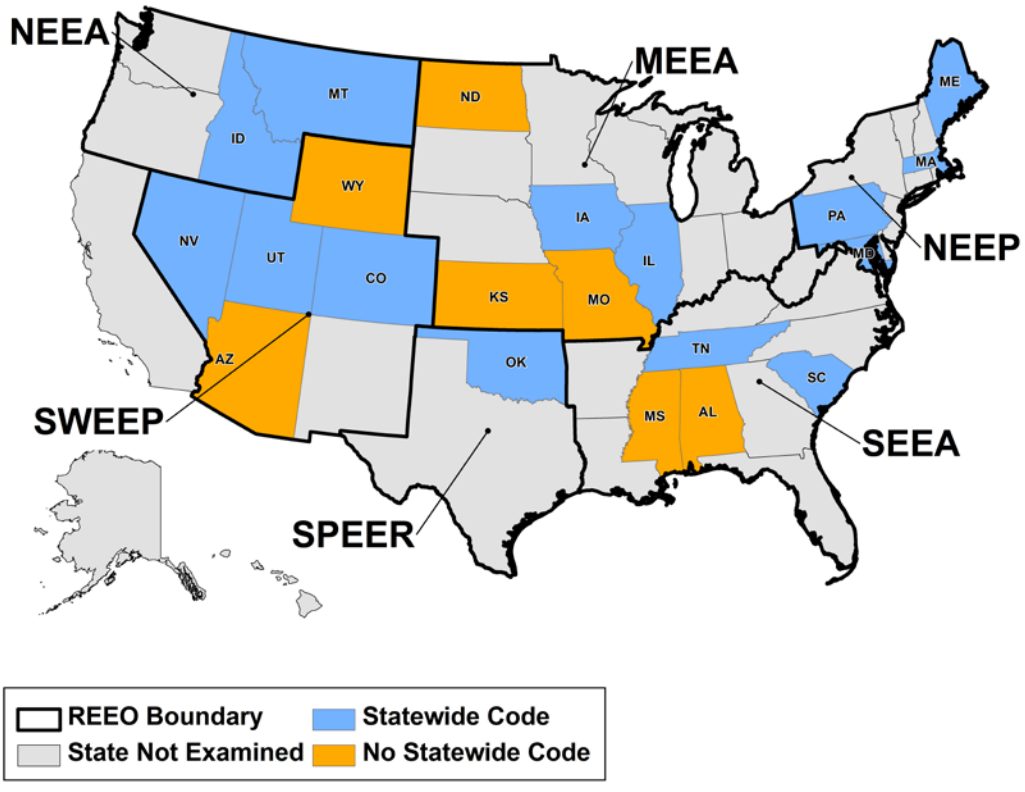

Figure 2.1. States Examined in Study

2.2 Sample Design

A cross-sectional sample of 21 states was selected throughout the U.S. with varied building energy code adoption policies, based on input from BECP program management and their partners in the REEOs. In total, this list contained 10,097 municipal jurisdictions in states from all regions of the contiguous United States. A sample of 2,822 municipal jurisdictions taken from this list was selected for in-depth investigation based on the level of new residential construction estimated for each jurisdiction. Table 3.1 lists the states included in the study, the number of municipal-level jurisdictions examined in each state, and the REEO of which they are a member.

To identify appropriate jurisdictions for each state, this study used the ArcMap[1] software, in conjunction with Census block group and city limit geospatial data from the U.S. Census Bureau (USCB 2010), to determine the number of new homes built in a city. The source of data on new construction was the 5-year American Community Survey (ACS) for the years 2006 to 2010 (USCB 2010). Construction is reported in the ACS at the Census block group level (a subset of county-level information) but not by jurisdiction. Housing vintage data from the 5-year ACS was joined with their corresponding block group boundaries, and a spatial join (a process in which the attributes of one data set are added to another data set based upon their geographic location to one another) was performed between the block group data and the city jurisdiction data to assign a city name for every block group that was located within city limits.

From this information, an estimate of the number of homes built since 2005 within each city's limits was calculated as well as their share of new relative to the total built throughout the state. For each state, a sample of cities representing approximately 80 percent or more of all homes built since 2005 was selected based on ACS estimates (USCB 2010).

This study uses a nonprobability sampling of state jurisdictions where the lowest population jurisdictions with the least amount of housing growth are not included. This technique was employed to capture the vast majority of new housing starts in a state over a 2-month time period with limited investigative resources. Because a nonprobability sampling technique was employed, sampling errors cannot be calculated and there are limits on how much information can be provided about the entire state. However, because the sample size was large for each state (and approximately 80 percent of each state's new residential stock is represented by the sampling scheme), adoption ranges for each state can be extrapolated from the sample within a band of 20 percent or less. These ranges and an explanation of how sample statistics are extrapolated to the state level are found in the Appendix.

2.3 Data Gathering

The data gathering effort took place over a 2.5 month period from June through August 2012 and involved a combined approach of internet and literature searches as well as telephone and e-mail communications with municipal and county-level contacts. A list of approximately 2,800 jurisdictions was provided to researchers who then investigated each jurisdiction (either through direct e-mail or telephone contact, or indirect methods such as consulting the city's official website) to determine if any code was in place within that city's limits. If a residential building energy code was in effect, the code and year were identified and recorded. Overall, there were over 500 voice-mail and/or e-mail contacts made during the process. The results of this data gathering exercise are compiled in Table 3.1 and the Appendix.

[1] ArcMap is a geospatial processing program produced by the Economic and Social Research Institute.

3.0 Key Findings

The percentage of new residential construction in sampled jurisdictions covered by an energy code ranged from 8 percent in Wyoming to 100 percent in Massachusetts. Table 3.1 lists the estimated statewide adoption rate for the sampled jurisdictions by state. Figure 3.1 provides a graphical representation of the rate of residential energy code adoption for sampled jurisdictions within each state. Figure 3.2 provides a geographic mapping of these same statistics.

Table 3.1. Summary Sample Statistics and Findings by State

State	REEO	Statewide Code?	% of New Residential Building Stock Covered by Sample	Number of Jurisdictions Examined	% of Sampled Jurisdictions with Code	Fraction of housing with energy code (based on sample)	Predominant Residential Code
AL	SEEA	No[(a)]	83%	148	12%	17%	2009 IECC
AZ	SWEEP	No	87%	34	97%	99%	2006 IECC
CO	SWEEP	Yes	83%	38	95%	99%	2009 IECC
IA	MEEA	Yes	81%	91	49%	81%	2009 IECC
ID	NEEA	Yes	81%	28	89%	97%	2009 IECC
IL	MEEA	Yes	82%	178	65%	83%	2009 IECC
KS	MEEA	No	83%	49	22%	39%	2009 IECC
MA	NEEP	Yes	85%	153	100%	100%	2009 IECC
MD	NEEP	Yes	81%	151	97%	99%	2009 IECC
ME	NEEP	Yes	73%	119	54%	78%	2009 IECC
MO	MEEA	No	80%	179	92%	88%	2009 IECC/IRC
MS	SEEA	No	80%	123	16%	47%	2006 IRC
MT	NEEA	Yes	85%	103	39%	74%	2009 IECC
ND	MEEA	No	83%	18	72%	67%	2009 IECC/IRC
NV	SWEEP	Yes	94%	15	93%	98%	2006 IECC and 2009 IECC
OK	SPEER	Yes	81%	64	42%	52%	2009 IECC/IRC
PA	NEEP	Yes	80%	783	84%	91%	2009 IECC
SC	SEEA	Yes	80%	273	74%	89%	2006 IECC
TN	SEEA	Yes	80%	182	92%	98%	2006 IECC
UT	SWEEP	Yes	83%	60	82%	90%	2006 IECC and 2009 IECC
WY	SWEEP	No	91%	33	3%	8%	2003 IECC
Average of all States			83%		65%	76%	
Average of States with Code			83%		75%	88%	
Average of States without Code			83%		45%	52%	

(a) As of October 2012, Alabama has adopted a statewide code; however, during the data gathering period for this study, this state was categorized as having no statewide code.

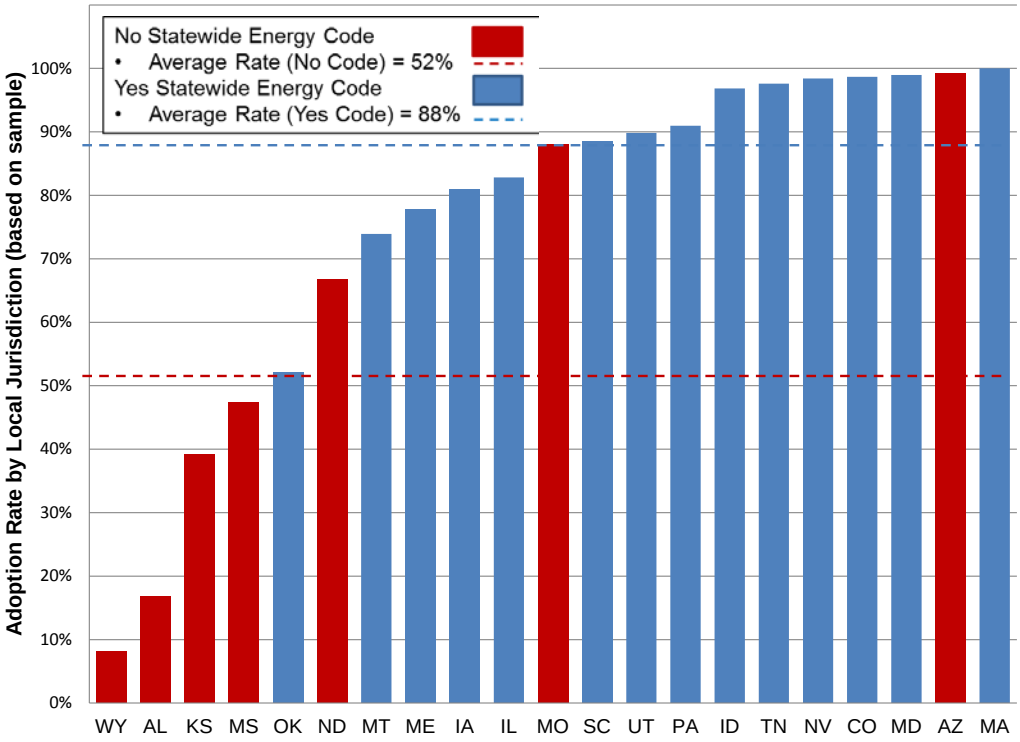

Figure 3.1. Sample-Wide Adoption Rates for Each State

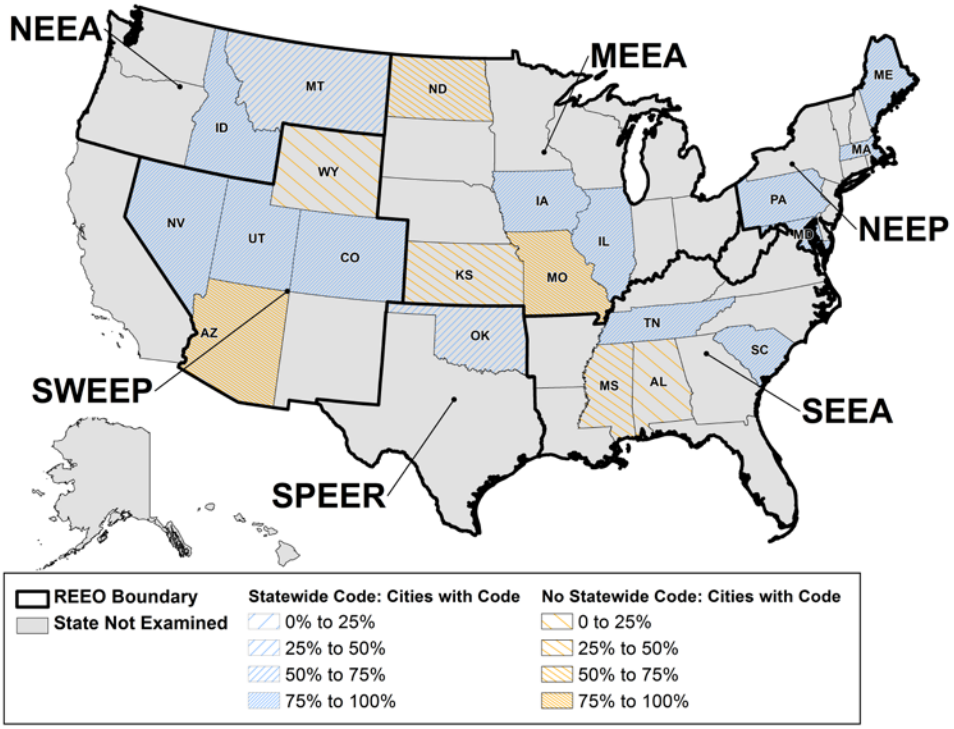

Figure 3.2. Sample-Wide Adoption Rate Ranges by State

Not surprisingly, the average adoption rate for the sampled jurisdictions within the states that have a statewide energy code is significantly greater than the average jurisdictional adoption rate of states that do not have a statewide energy code—88 percent compared with 52. There are, however, exceptions in both categories. Oklahoma, which has a mandatory statewide residential energy code in place, has only 52 percent of the housing stock covered by a jurisdictional energy code based on the sampled jurisdictions. Conversely the data suggests that Arizona, which does not have a statewide energy code in place, has 99 percent of its housing stock covered with by a residential energy code.

The legislative structure, traditions, and individual circumstances in Oklahoma and Arizona largely explain their outlier statuses. For example, Oklahoma recently adopted a statewide residential energy code (effective July 2011) for the first time in its history. Prior to 2009, the state did not even have an agency with authority to review or adopt codes (BCAP 2012). Thus, the adoption of energy codes is a new process, and it is reasonable to assume that many of the jurisdictions are likely still in the process of figuring out how to adopt and implement energy codes at the local level. In the case of Arizona, the state is considered a "home-rule" state, which means the state constitution grants cities, municipalities, and/or counties the ability to pass laws to govern themselves as they see fit (so long as they obey the state and federal constitutions). Having home-rule legislation is not unique to Arizona, as over three-quarters of U.S. states have some form of a home-rule charter in place, including 16 of the 21 states included in this study (Coester 2004). Arizona, however, has a fairly strict interpretation of home rule in which municipalities have the exclusive authority to adopt building energy codes within their communities. Yet despite this tradition, Arizona has had a relatively active history of advocating for energy codes. Over the past decade, the state has adopted voluntary energy efficiency codes for private construction and mandatory building energy efficiency requirements for state-owned buildings.[1] Thus, the lack of a statewide energy code in Arizona does not translate into lack of interest or political will related to energy codes, but is rather the result of how it applies its home-rule charter.

From a simplistic perspective, these states can be categorized into those that have or do not have statewide building energy codes; in reality, however, the code adoption and implementation processes can vary significantly from state to state and potentially impact local jurisdictional adoption rates. To further explore this issue, the 14 states with statewide mandatory codes (and corresponding statistics) are broken into two subsets, defined as follows:

Statewide Code with Jurisdictional Adoption Flexibility

Some of the states with mandatory statewide codes appear to have jurisdictional flexibility built into the adoption process, either through legislative language, including exemptions for certain jurisdictions, or through their legislative structure and tradition of the given state. For this study, the states that fall into this category are listed below along with a brief explanation regarding why they are characterized as having jurisdictional adoption flexibility.

- **Colorado** has a long history of being a home-rule state in which there is a well-defined relationship between state and local governments, including separate and concurrent powers for each outlined in the state constitution and through established legal rulings. Although it has adopted the 2003 IECC as the residential energy code statewide, it allows local municipalities to decide individually which

[1] BECP "Status of State Energy Code Adoption," http://www.energycodes.gov/adoption/states/arizona, accessed on October 18, 2012.

codes to adopt and implement within their communities (BCAP 2010). As a result, the predominant code among Colorado's jurisdictions is in fact the 2009 IECC.

- **Iowa** also is a home-rule state in which each city and county is given the authority to adopt an energy code. The Iowa energy code legislation focuses primarily on cities with a population of 15,000 or more. These cities can adopt and enforce either their own code that has been developed by a nationally recognized code organization, or enforce the statewide building energy code. Informally, smaller jurisdictions in Iowa that have a code enforcement function in place are mandated to enforce the adopted statewide energy code; rural areas of the state are also technically required to implement the code, but there are little to no enforcement bodies in these areas.[1]
- **Illinois**, like Colorado, has a long history of being a strong home-rule state. Only recently (i.e., in 2010) did the state legislature, with House Bill 3987, relax the home-rule authority related to residential building energy codes.[2]
- **Maine** is a home-rule state that has historically had a mandatory statewide energy code; however, in 2011 the state legislation was modified such that code adoption is optional for communities with populations less than 4,000.[3]
- **Montana** is a home-rule state in which the purpose of the statewide code is to provide reasonably uniform standards and requirements, but each jurisdiction is given the authority to adopt. Like Iowa, statewide implementation efforts focus on more populous jurisdictions.
- **Oklahoma** implemented a statewide mandatory code in July 2011. Technically, no exceptions are granted to jurisdictions, and no adoption flexibility was written into the law. However, prior to adoption it did not even have an agency with authority to review or adopt codes (BCAP 2012). For the purposes of this study, Oklahoma is considered to be in a state in transition, in which jurisdictions are still in the beginning stages of setting up an energy code adoption process.

Mandatory Statewide Code

The remaining states in the study with statewide energy codes appear to have mandatory codes with regulations that require the local jurisdictions to adopt the model statewide code. In some cases, they permit the jurisdictions to adopt alternative codes if they meet or exceed the model statewide code. In addition, some of these states will require that the statewide code applies to any jurisdiction that does not adopt an energy code. In all cases, the energy code is mandatory statewide, with no explicit exceptions or jurisdictional flexibility. The states in this category include Idaho, Maryland, Massachusetts, Nevada, Pennsylvania, South Carolina, Tennessee, and Utah.

[1] Characterization based on October 16, 2012, e-mail correspondence with Brian Bishop, Construction/ Design Engineer for the Iowa Department of Public Safety State Fire Marshal's Office Building Code Bureau.
[2] See Database for State Incentives for Renewables & Efficiency, October 15, 2012, Internet search at: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=IL09R.
[3] See http://www.energycodes.gov/adoption/states/maine.

Figure 3.3 illustrates the comparative statistics for the three subgroups:

1. States without a statewide building energy code (referred to as "no statewide code" states, which includes Alabama, Arizona, Kansas, Mississippi, Missouri, North Dakota, and Wyoming)
2. States with a statewide building energy code and jurisdictional adoption flexibility (referred to as "flexible statewide" states, which includes Colorado, Illinois, Iowa, Maine, Montana, and Oklahoma)
3. States with a mandatory statewide building energy code (referred to as "mandatory statewide" states, which includes Idaho, Maryland, Massachusetts, Nevada, Pennsylvania, South Carolina, Tennessee, and Utah).

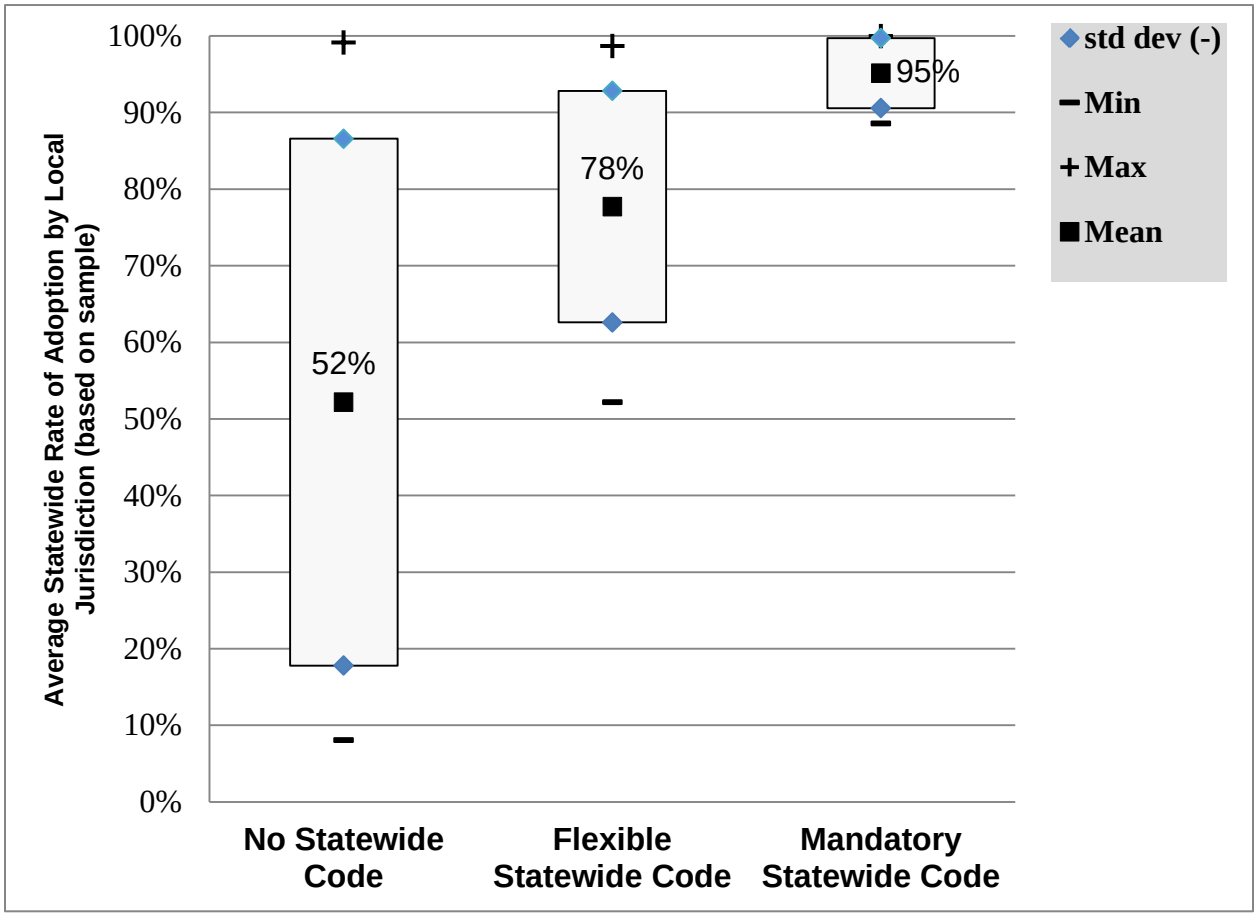

Figure 3.3. Summary Statistics by State Groupings

The average sample-wide adoption rate for states without a statewide code is the lowest of the three groups, with the largest spread (8 to 99 percent) and standard deviation from the mean. Conversely, the states with mandatory statewide energy codes have a relatively high average adoption rate (95 percent) with a very narrow spread (89 to 100 percent) and standard deviation from the mean. The states that are categorized as having some jurisdictional flexibility in the adoption process have a slightly lower sample

average adoption rate (78 percent) than the “mandatory statewide” code group, with a larger variance in state results. There are three states in the “no statewide code” category with adoption rates that are comparable to the average adoption rate for the “flexible statewide” states. These states include Arizona and Missouri, which well exceed the average with 99 percent and 88 percent sample adoption rates, respectively. It also includes North Dakota, which has an adoption rate just 11 percentage points lower than the average for the “flexible statewide” category at 67 percent.

4.0 Conclusions

A state's "home-rule" status does not necessarily imply a lower statewide energy code adoption rate, as demonstrated by Arizona and Colorado, which have two of the highest statewide adoption rates (99 percent). Both are considered strong home-rule states with a well-defined relationship between state and local governments, including separate powers outlined in the state constitutions and through established legal rulings (BCAP 2010; Schlegel and Nelson 2007). Arizona has not adopted a statewide code primarily because of its home-rule principles, while Colorado has adopted a statewide code, but maintains its home-rule status in which local municipalities decide individually which code to adopt and implement within their communities. It should be noted that many of the states in the study that have adopted statewide energy codes also are considered home-rule states, including Idaho, Illinois, Iowa, Maine, Maryland, Massachusetts, Montana, Pennsylvania, and Tennessee (Coester 2004). The jurisdictional adoption flexibility that is permitted for these states will vary. Home rule in and of itself is not all encompassing or absolute, and how these states implement their home-rule charters in terms of local government structure, autonomy, and authority varies. Thus, the impact that home-rule status has on energy code adoption and implementation will vary as well.

States that do not have a statewide energy code will, on average, have a lower statewide jurisdictional adoption rate than states that have statewide energy codes. There are, however, three states that have not adopted statewide energy codes, namely Arizona, Missouri, and North Dakota, which have adoption rates comparable with, if not better than, the average rates of states that have statewide energy codes.

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Appendix

Summary Sample and Statewide Statistics

Appendix

Summary Sample and Statewide Statistics

Because a nonprobability sampling technique was employed, sampling errors cannot be calculated, and there are limits on how much information the sample can provide about the entire state. However, because the sample size was large for each state (and approximately 80 percent of each state's new residential stock is represented by the sampling scheme), adoption ranges for each state can be extrapolated from the sample within a band of 6% (in Nevada where sample accounted for 94% of new residential construction) and 27% (in Maine where sample size accounted for 73% of new residential construction). These ranges are presented in the final three columns of the table below. To extrapolate the state ranges, one assumes an adoption rate from 0% to 100% for all residential homes not included in the sample.

								Statewide Range of Residential Stock Covered by Energy Code Based on Sample		
STATE	REEO	% of New Residential Building Stock Covered	Number of Jurisdictions in Sample	Number of Jurisdictions with Code	% of Sampled Jurisdictions with Code	Fraction of housing with energy code (based on sample)	Predominant Residential Code	Lowest Adoption Rate (based on sample)	Highest Adoption Rate (based on sample)	Range
AL	SEEA	83%	148	18	12%	17%	2009 IECC	14%	31%	17%
AZ	SWEEP	87%	34	33	97%	99%	2006 IECC	87%	99%	13%
CO	SWEEP	84%	38	36	95%	99%	2009 IECC	83%	99%	16%
IA	MEEA	81%	91	45	49%	81%	2009 IECC	66%	84%	19%
ID	NEEA	82%	28	25	89%	97%	2009 IECC	79%	97%	18%
IL	MEEA	82%	178	116	65%	83%	2009 IECC	68%	86%	18%
KS	MEEA	83%	49	11	22%	39%	2009 IECC	32%	50%	17%
MA	NEEP	85%	153	153	100%	100%	2009 IECC	85%	100%	15%
MD	NEEP	81%	151	147	97%	99%	2009 IECC	80%	99%	19%
ME	NEEP	73%	119	64	54%	78%	2009 IECC	57%	84%	27%
MO	MEEA	80%	179	165	92%	88%	2009 IECC/IRC	71%	90%	20%
MS	SEEA	80%	123	20	16%	47%	2006 IRC	38%	58%	20%
MT	NEEA	85%	103	40	39%	74%	2009 IECC	63%	78%	15%
ND	MEEA	83%	18	13	72%	67%	2009 IECC/IRC	56%	72%	17%
NV	SWEEP	94%	15	14	93%	98%	2006 IECC and 2009 IECC	93%	99%	6%
OK	MEEA	81%	64	27	42%	52%	2009 IECC/IRC	42%	61%	19%
PA	NEEP	80%	783	656	84%	91%	2009 IECC	73%	93%	20%
SC	SEEA	80%	273	201	74%	89%	2006 IECC	71%	91%	20%
TN	SEEA	80%	182	168	92%	98%	2006 IECC	78%	98%	20%
UT	SWEEP	83%	60	49	82%	90%	2006 IECC and 2009 IECC	74%	92%	17%
WY	SWEEP	91%	33	1	3%	8%	2003 IECC	7%	16%	9%

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