Ordinances to Enable Energy Efficiency in Rental Housing in the United States

by

Patrick J. Coleman

Bachelor of Arts in English
Boston College
Chestnut Hill, MA (2001)

Submitted to the Department of Urban Studies and Planning
in partial fulfillment of the requirements for the degree of

Master in City Planning

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 2011

Author _____
Department of Urban Studies and Planning
May 19, 2011

Certified by _____
Lecturer Harvey Michaels
Department of Urban Studies and Planning
Thesis Supervisor

Accepted by_____
Professor Joseph Ferreira
Chair, MCP Committee
Department of Urban Studies and Planning

Ordinances to Enable Energy Efficiency in Rental Housing in the United States

by

Patrick J. Coleman

ABSTRACT

Improved energy efficiency in rental housing is important from the perspectives of environmental, economic, and social policy, but upgrades to such buildings lag those of owner-occupied properties. With myriad reasons to improve the efficiency of this sector, this thesis seeks to better understand the barriers and strategies to achieve this goal. This research was inspired by recent partnerships among municipalities, community-based organizations, and utilities in Massachusetts, which create a new medium to serve the rental sector. Upon investigation of the policies of five jurisdictions throughout the United States, this thesis finds that well designed policies may 1) establish a minimum standard of energy efficiency in rental properties, 2) enable energy efficiency program administrators to focus attention beyond basic measures to deeper retrofits, and 3) facilitate the valuation of energy efficiency in housing markets. Additionally, this research presents a cross-cutting analysis of policy options, highlights key elements, and offers suggestions to complement existing efforts in Massachusetts, such as these partnerships, to improve the energy efficiency of rental properties.

Thesis Supervisor: Harvey Michaels, Lecturer and Director of Energy Efficiency Strategy Research, MIT Department of Urban Studies and Planning.

Thesis Readers: James Buckley, Lecturer in Housing, MIT Department of Urban Studies and Planning;

Penn Loh, Professor of the Practice, Tufts University Department of Urban and Environmental Policy and Planning.

Acknowledgements

This thesis would not have come to be without the support of many, and these words of appreciation can offer only modest recognition of the contributions of those mentioned here and others too numerous to note.

I thank my thesis advisor, Harvey Michaels, for his kind-hearted support of my meandering thesis process and his constant encouragement to think big and to craft a thesis that can change the world. Penn Loh and Jim Buckley grounded me with thoughtful, pragmatic advice and humor whenever I needed it—which was often. Additionally, Harvey and Penn deserve special acknowledgement for introducing me to the world of energy efficiency and for supporting student research to identify new ways that communities can take advantage of the potential of energy efficiency to advance environmental and social justice.

In a related manner, I thank the Green Justice Coalition, Community Labor United, and MIT's Community Innovators' Lab for supporting my summer research that provided the foundation of this thesis investigation. Additionally, Sandy Rollins of the Texas Tenants Union and Erhard Mahnke of the Vermont Affordable Housing Coalition offered their precious time and contacts to facilitate the case studies of the policies of Austin, TX and Burlington, VT.

To my classmates, thank you for being the best part of my time at DUSP. I have rarely met such remarkable people. Special thanks must go to Ann Solomon, Elijah Hutchinson, Brian Valle, Laura Manville, Kevin Feeney, Amanda Martin, and Steph Stern. I can't wait to see where you end up.

On the most fundamental level, I thank my family for their love and inspiration. My wonderful wife Catherine is simply the best. Over these last two years, she bore the brunt of frequent travels along the Northeast Corridor, lost me to libraries and group projects, and still provided me with love, food, and warmth when I got home—as long as the furnace was working. To my parents and sister, thank you for your constant encouragement and support. Ours is a family of loving and devoted members. I am forever thankful to be a part of it and to have the four of you as role models who face life with compassion, confidence, and humor.

Table of Contents

Abstract 3

Acknowledgements 4

Executive Summary 7

Chapter One: Why Seek Improvements in the Energy Efficiency of Rental Housing? 11

- **The Environmental Logic** 11
- **The Economic Logic** 12
- **The Social and Spatial Equity Logic** 13
- **A Simple Estimate of Energy Efficiency Potential** 17
- **Conclusion and Research Direction** 18
- **Definitions and Key Concepts** 19

Chapter Two: Barriers to Energy Efficiency in Rental Housing 21

- **Information** 21
- **Fragmentation** 24
- **Lack of Capital** 26
- **Additional Barriers** 27
- **Conclusion** 28

Chapter Three: Strategies to Implement Energy Efficiency in Rental Housing 29

- **Public Incentives** 30
- **Utility-Administered Programs** 31
- **Building Labeling** 34
- **Partnerships with Municipalities and Communities** 35
- **Conclusion** 37

Chapter Four: Case Studies of Energy Efficiency Ordinances Targeting Rental Housing 40

- **Innovative Approaches to Enable Energy Efficiency** 40
  - Residential Energy Conservation Ordinances 41
  - Disclosure of Building Energy Information 42
- **Case Study Synopses** 43
  - San Francisco 43
  - Wisconsin 44
  - Berkeley 45
  - Burlington 45
  - Austin 46
- **Conclusion** 47

Chapter Five: Analysis of Energy Efficiency Ordinance Options and Discussion 48

- **Context for Policy Adoption** 48
- **Applicability** 52
- **Triggers** 52
- **Requirements** 54
- **Compliance** 56
- **Administration** 59

Enforcement **60**
Costs and Connection to Energy Efficiency Programs **62**
Impacts on Tenants **64**
Outcomes and Policy Synthesis **67**
Conclusion **73**

Chapter Six: Conclusion: Ordinances as Means to Improve the Energy Efficiency of Rental Housing **76**
Ordinances Complement Existing Strategies **76**
Opportunities for Energy Efficiency Ordinances in Massachusetts **78**
Time of Sale 79
Information Disclosure 81
Performance Metric 82
Enforcement 83
Climate for Policy Adoption and Implementation 84
Conclusion **85**
Areas for Future Research **86**

Appendix A: Detailed Case Study Descriptions **88**
Research Methods **88**
San Francisco **88**
Wisconsin **97**
Berkeley **105**
Burlington, VT **113**
Austin, TX **124**

Appendix B: Interviewees **137**

References **138**

Executive Summary

Energy efficiency has many benefits. Those concerned with climate change view it as a key strategy to mitigate greenhouse gas emissions associated with energy generation, while economic and social policy advocates support energy efficiency as a cost-effective means to decrease residents' utility expenses and increase home comfort. A variety of programs support energy efficiency in owner-occupied properties, but rental and multifamily properties are typically much harder to reach. Not only might tenant households lack the benefits of energy efficiency, but also the geographic concentration of rental housing presents the possibility that some towns may disproportionately miss the benefits. In Massachusetts, the five cities with the highest population counts are all majority-tenant, in contrast with the 35 percent rate of tenant-occupied households statewide. In Boston, the largest city in New England, tenant households are 62.7 percent of the city's households. To resolve both the inequity of efficiency delivery, as well as to address the untapped opportunity, this thesis analyzes policy measures that aim to increase the efficiency of rental properties.

The barriers to energy efficiency improvements are significant, but the potential in rental housing looms large. The lack of information, fragmentation of housing and energy markets, and misaligned incentives, challenge retrofits and a detailed understanding of the energy efficiency potential in rental and multifamily properties. The diversity of property owners, from individuals to multinational corporations, presents policymakers and program administrators with varied motivations and interests and makes coordination of resources extremely difficult. Similarly, differences in home energy fuels, from natural gas, to electricity, to fuel oil, demand a nuanced approach and

preclude generalized strategies. In addition, the most oft-cited challenge to rental housing retrofits is the split incentive. If tenants pay the utility expenses and therefore stand to reap the benefits of increased comfort and lower bills, can one expect the owner to pay for upgrades that deliver improvements to another party? For these reasons, rental properties are understandably difficult to target for efficiency retrofits. Especially in cities with concentrations of renters and a relatively old housing stock, such as those in Massachusetts, historic challenges to reach the rental market has left significant potential for efficiency on the table.

The strategies to implement energy efficiency in rental housing are many and evolving. Since the energy crises of the 1970s, governments and utilities offered energy efficiency services for residential properties, though programs for rental properties developed more slowly than those for owner-occupied properties. Recently, spurred by both the economic downturn and a growing awareness of climate change, the scale of such efforts has increased and new partnerships developed among municipal governments, utilities, and community-based organizations (CBOs).

This thesis seeks to understand actions municipalities can take to complement existing voluntary retrofit efforts by reviewing ordinances that aim to enhance the energy efficiency of rental properties in San Francisco and Berkeley, California; Wisconsin; Burlington, Vermont; and Austin, Texas. Each jurisdiction's policy is unique but each seeks at least one of two objectives: the establishment of minimum energy efficiency standards or the disclosure of building energy information among current and prospective owners and tenants. A thorough analysis of these ordinances suggests that a time of sale trigger, the disclosure of building energy information, the use of energy performance

metrics, and enforcement through institutionalization and accountability are critical policy elements to facilitate greater energy efficiency in rental housing. This research finds that well-designed ordinances can 1) establish a minimum standard of energy efficiency in rental properties, 2) enable energy efficiency program administrators to focus their attention beyond basic measures to deeper retrofits, and 3) facilitate the valuation of energy efficiency in housing markets.

The adoption of an ordinance to mandate energy efficiency standards and building energy information disclosure is a logical next step for municipalities seeking to address efficiency in the rental sector—particularly those cities with existing partnerships with utilities and CBOs. These coalitions offer a unique and valuable blend of expertise and resources to implement such an ordinance. Municipalities have property records and the ability to motivate residents around common objectives. CBOs can inform, mobilize, and support their existing networks of residents impacted by an ordinance. Utilities can provide valuable information on building energy use and the resources to implement large-scale energy efficiency programs.

Passing an efficiency or disclosure ordinance is not a simple task. As these case studies demonstrate, the real estate industry is a common, vocal opponent. Nevertheless, these examples also highlight that community stakeholder processes can overcome political hurdles. Quality information and analysis and a stakeholder process that includes constituencies affected by the proposed ordinance are the building blocks of a policy development process that addresses the concerns of those involved and creates a path to adoption. With the resources of municipalities, CBOs, and utilities, ordinances

can complement existing efforts, tap the existing energy efficiency potential, and deliver the benefits to rental housing.

The following chapters follow the arc of this Executive Summary. Chapter One introduces key concepts and the environmental, economic, and social equity justifications for improvements in the efficiency of rental properties. Chapter Two summarizes the barriers to such initiatives and Chapter Three outlines the primary strategies to realize greater residential efficiency. Chapter Four reviews the five case study policies, and Chapter Five analyzes the policy elements of the ordinances. Chapter Six concludes the thesis by discussing key elements of these policies and offering suggestions for the application of similar ordinances in Massachusetts. The appendices offer more detailed information on the five policies and a list of the interviewees for this research.

Chapter One: Why Seek Improvements in the Energy Efficiency of Rental Housing?

Improvements to the energy efficiency of rental housing are logical from myriad perspectives. This chapter highlights three of the most compelling reasons: the environmental, economic, and social justifications. In addition, it provides key definitions for the thesis and charts the course of the following chapters.

The Environmental Logic

Widespread consensus exists that greenhouse gas (GHG) emissions are dramatically altering the planet. Scientists point to the seven billion tons of carbon extracted annually by the oil, gas, and coal industries globally as a major source of GHGs (Socolow and Pacala 2006). The combustion of such fossil fuels for energy generation is responsible for a large portion of carbon emissions in the United States. Recent studies find that fossil fuels provide 85 percent of the energy used in the United States (National Academy of Sciences, National Academy of Engineering, and National Research Council 2010). In recent years, buildings' electricity and natural gas consumption respectively increased to over 72 percent and 54 percent of all such consumption nationally, and these rates are projected to grow in future decades (U.S. Department of Energy 2009). In the year 2000 "the carbon associated with energy services in US buildings [constituted] 8 percent of the … global emissions … —equal to the total emissions of Japan and the United Kingdom combined" (Koomey et al. 2001, 1209). The energy consumed to supply heating, cooling, and electricity for residential buildings accounted for 18 percent of the United State's 2007 GHG emissions (Schwartz 2010).

The increases in carbon emissions have been linked to rising global temperatures, stronger storms, retreating glaciers and polar ice caps and the consequent rise in sea levels, and have spurred public and private actors globally to seek strategies to mitigate potentially dramatic shifts in environmental, social, and economic conditions. Among the many strategies, improved energy efficiency in buildings frequently ranks among the top options due to the magnitude of energy used in buildings and the relative cost-effectiveness of such efforts (National Academy of Sciences, National Academy of Engineering, and National Research Council 2010; Naucler and Enkvist 2009; Socolow and Pacala 2006). In fact, energy efficiency is often referred to as a preferred "first fuel" among those seeking a new energy paradigm.

The Economic Logic

Improvements in energy efficiency are often based on simple economic arguments of cost-effectiveness and the potential for job creation and economic development.

Energy efficiency is commonly hailed as a crucial element of efforts to curtail energy waste and GHG emissions due to its relative cost-effectiveness compared to many other options, such as the deployment of a smart grid or a transition to renewable energy sources. In buildings, the technology to facilitate greater energy efficiency continually develops, but the basic technologies are known, available, and proven. The installation of compact florescent lights (CFLs), insulation, air-sealing, and improvements to the heating, ventilation, and air conditioning (HVAC) of a building costs money, but the long-term benefits of decreased energy consumption and expenditures and the durability of the improvements causes energy efficiency to be among the most cost-effective

strategies to decrease energy use and carbon emissions. A recent study by McKinsey & Company highlights this strength. Investments in 675 energy efficiency measures were found to produce a return on investment of at least 20 percent, with savings valued against a low energy price range. Doing a net present value (NPV) analysis with a discount rate of 7 percent generates a positive NPV of $680 billion by 2020. If such measures were implemented at scale throughout the nation, McKinsey estimates that they could reduce projected energy consumption by roughly 23 percent by 2020. (Granade and McKinsey & Company 2009).

Furthermore, many hail opportunities for improvements in building energy efficiency as a means to decrease utility bills, to provide jobs, and to stimulate economic development. Public agencies and labor and community organizations highlight such benefits, especially since the recent economic downturn. Advocates hope that increases in demand for energy efficiency in buildings can result in "green jobs" and lower utility bills, which can boost local expenditures and the local economy (City of Boston 2010a; Connelly 2008; EOEEA 2010; Kaufman 2010). For example, the Commonwealth of Massachusetts recently released a "Massachusetts Clean Energy and Climate Plan for 2020" that highlights the nearly $22 billion spent on energy, almost all of which is generated outside of the fossil-fuel poor state. Should the plan's recommendations be implemented, the state projects an increase of 42,000 to 48,000 jobs (City of Boston 2010a; EOEEA 2010).

The Social and Spatial Equity Logic

This thesis focuses on efforts to enhance the energy efficiency of rental housing based on a concern for equity. In addition to the environmental and economic benefits,

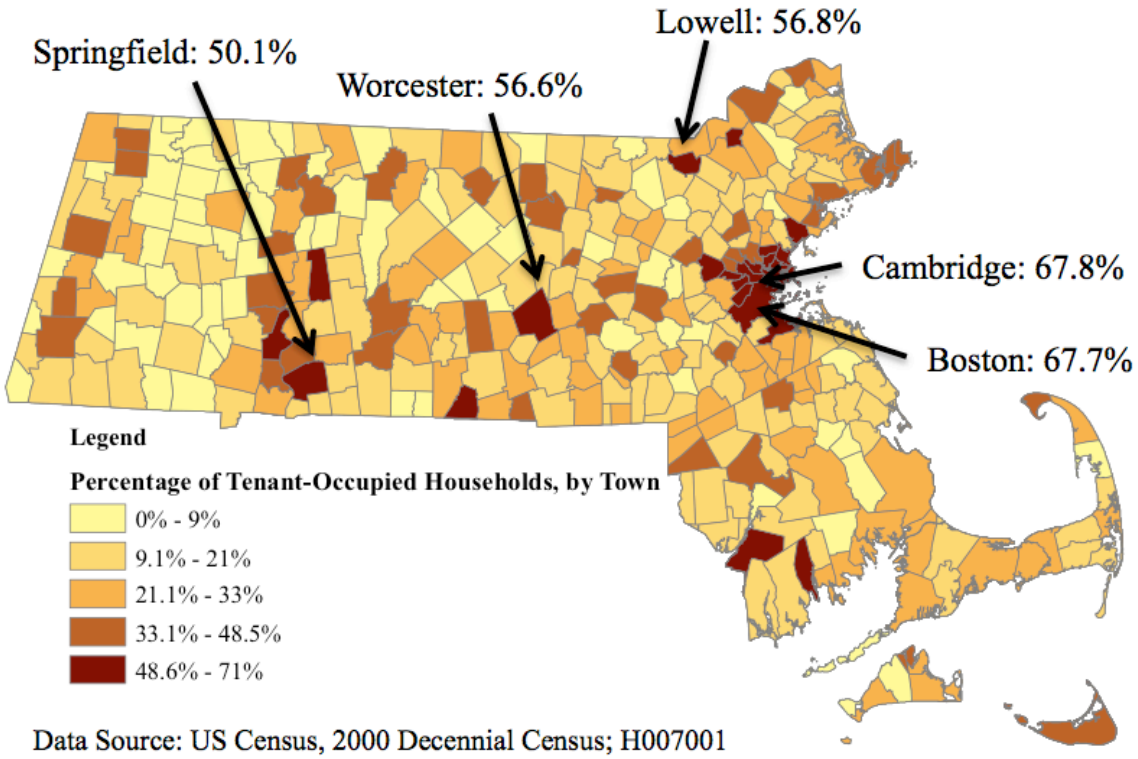
energy efficiency in residential buildings can deliver increased resident comfort through better heating systems and lower utility bills. Yet, as is described in the following chapters, energy efficiency initiatives have struggled to serve rental properties. Without improvements to current energy efficiency strategies or the creation of new efforts entirely, the benefits may disproportionately accrue to those households who own their home and exacerbate existing disparities between owners and renters. The differences in income and wealth between owners and tenants; the spatial concentration of rental properties; and the historic challenge to provide energy efficiency services to rental and multifamily buildings highlight these discrepancies.

Tenant households, who overwhelmingly live in multifamily properties, have significantly lower incomes and net wealth compared to those who own their homes. In 2008, the national median household income for homeowners was $63,700, nearly double that of renters at $32,700, and this gap widened in recent decades (Schwartz 2010). In Massachusetts, the disparity is greater than the national rate. Census data report that the 2009 median household income for tenants was $34,832 and that of owners was 141 percent greater at $83,847 (U.S. Census Bureau 2005-2009a). "The differences are starker with regard to wealth. In 2007, at $5,300, the median net wealth of renters in the United States amounted to just under 2 percent of the median for homeowners ($243,200)" (Schwartz 2010, 20-1).

In addition, owners and tenants, single- and multifamily properties are not spread uniformly through space. Rather, tenants and multifamily properties tend to be concentrated in cities. Boston's rate of *tenant*-occupied housing units (63 percent) nearly equals the statewide rate of *owner*-occupied housing units (65 percent) (U.S. Census

Bureau 2005-2009b). Figure 1-1 seeks to present the rates of tenant-occupied housing units by town in Massachusetts and highlights these figures for the five towns with the largest populations in the state, all of which are majority-tenant.

Figure 1-1



Public and private efforts to improve the energy efficiency of residential properties have functioned at large scale since the 1970s (DeCicco et al. 1995). Nevertheless, the literature of such efforts acknowledges that rental and multifamily housing is among a number of "hard-to-reach" sectors (Barbose, Goldman, and Schlegel 2009; Hirst 1989). The reasons for the lag, discussed further below, are many and include a lack of policy and programmatic focus on rental and multifamily properties. "The federal government did not treat apartment building efficiency issues as distinct from those of the single-family sector until 1979;" utilities, major actors in energy

efficiency initiatives, did not offer programs designed for such properties until the mid-1980s; and through the mid 1990s most utilities still offered no programs specific to apartment buildings (DeCicco et al. 1995, 123). A prominent public official in Massachusetts who works extensively on energy efficiency programs comments that they "seem to be designed for suburban, upper-middle class, single-family homes with sophisticated owners who … understand risk and loans and repayments."

Yet old rental properties have a tremendous need for energy efficiency improvements. A study of energy use in rental properties from 1981 found that "of existing structures built before 1939, approximately 33 percent have no ceiling insulation and 41 percent have no wall insulation. Similar deficiencies are found in only 5 percent and 6 percent, respectively, of units built after 1975" (Levine and Raab, 6). A recent national survey by the U.S. Department of Energy finds that 29 percent of renters, in contrast to 13 percent of homeowners, say that their homes are "poorly insulated" (2009). In areas of the country, such as Massachusetts, with many residential properties constructed prior to the advent of state building energy codes in the 1970s a large potential of energy efficiency may exist in rental properties—especially in older cities. Massachusetts adopted its building energy code in 1975 yet 68.6 percent of occupied rental housing units were built before 1970. In older cities, the rates are higher. In Boston and Cambridge, 75.6 percent and 72.4 percent, respectively, of tenant-occupied housing units were built prior to 1970 (U.S. Census Bureau 2005-2009c; Building Codes Assistance Project 2011).

A Simple Estimate of Energy Efficiency Potential

The following section seeks to illuminate some of the potential benefits of energy efficiency upgrades in rental buildings. Historically identified as hard-to-reach, without new or enhanced initiatives to improve the energy efficiency of rental properties, cities may be left with a disproportionate amount of housing lacking its benefits and the disparities between the incomes and wealth of owners and tenants, as well as resident comforts, may grow. Yet simply because rental properties have been difficult to serve, they may offer a large resource of untapped energy efficiency potential, and this resource may be concentrated in older, large cities.

As is discussed in the following chapter, a severe lack of information precludes detailed estimates of the magnitude of the energy efficiency potential in the rental and multifamily sector. Nevertheless, the following example provides a glimpse of such energy and financial savings should this market be accessed. In 2009 the Vermont Energy Investment Corporation (VEIC) provided the City of Cambridge, Massachusetts with an estimate of the cost and savings generated from basic energy efficiency improvements to a standard triple-decker, a quintessential building-type in the Boston area. The triple-decker that VEIC models relies on natural gas and the annual energy cost is $9,719. With insulation and air sealing improvements costing $14,847 the estimated annual energy cost drops to $6,992—a savings of $2,727 with a simple payback ($14,847 / $2,727) of 5.4 years (Vermont Energy Investment Corporation 2009).

Applying the VEIC model to the three-family dwellings of neighboring Boston demonstrates the energy efficiency potential in only one segment of the building stock. Property records from the city's Assessing Office indicate that there are 13,942 three-

family dwellings in the city. 13,807 of these, 99 percent of the entire class, were built before the state adopted an energy component to its building codes, and the median year of construction for these pre-1975 buildings is 1905. Assuming that all of the pre-1975 properties use natural gas, that 62.7 percent of the families in each of these three-unit properties is a tenant, as such a rate is the citywide average, that tenants pay the utilities, and that 50 percent of these properties lack the insulation in the VEIC model, similar upgrades require an up front cost of about $64.2 million and save tenants an estimated $11.8 million annually. If such properties were fully occupied, these savings could divert $909 from each family's annual utility expenses to savings or other investments (City of Boston Assessing Department 2010; Nexus Market Research 2007; U.S. Census Bureau 2005-2009b).

An assessment of this sort is extremely crude and nuances pervade these markets. For example, a significant proportion of such properties rely of fuel oil for heating. The example merely seeks to suggest that efforts to access the energy efficiency potential in rental housing can result in significant benefits. Additionally, this potential is likely concentrated in cities with an old housing stock.

Conclusion and Research Direction

With myriad reasons to improve the energy efficiency of rental housing, this thesis seeks to better understand the barriers and strategies to achieve this goal and investigates policies that cities and states in the United States have used to improve energy efficiency in rental housing. This research was inspired by recent partnerships among municipalities, community-based organizations (CBOs), and utilities in Massachusetts, which create a new medium to serve the rental sector. Upon review of

the policies in other jurisdictions, this research offers suggestions to complement existing efforts in Massachusetts, such as these partnerships, to improve the energy efficiency of rental properties.

Definitions and Key Concepts

Before delving deeply into the subject matter, it is important to clarify some definitions and concepts. Firstly, energy efficiency refers to the efficient use of energy resources without the loss of amenities. For example, replacing an incandescent light bulb with a CFL can deliver the same level of illumination through a much more efficient use of energy and at a lower cost. Alternatively, energy conservation refers to more judicious use of energy, which does not necessarily result in a comparable level of amenity. Using the lighting example, an energy conservation strategy might seek to simply turn off the lights upon exiting a room.

This thesis focuses on energy efficiency in existing rental properties. Individuals involved in such efforts and the literature often refer to the implementation of energy efficiency measures as a retrofit of existing properties. While some may make more nuanced distinctions, this thesis uses concepts such as an "energy efficiency improvement" and a "building retrofit" interchangeably.

As this thesis seeks to understand energy efficiency in rental housing with an intended focus on policies and programs that might be implemented in Massachusetts, where appropriate, this report conflates the distinction between "rental" and "multifamily" properties as presented in much of the literature. In Massachusetts 85.7 percent of rental units are in properties with more than one housing unit; in Boston the rate is 93.6 percent (U.S. Census Bureau 2005-2009d). It is common for the literature of

energy efficiency to only refer to multifamily properties as those that house five or more housing units (DeCicco et al. 1995), and energy efficiency programs often distinguish between such properties and those with fewer units (National Grid, NSTAR, Unitil, Berkshire Gas, et al. 2009; National Grid, NSTAR, Unitil, Western Massachusetts Electric, et al. 2009). These distinctions have merit as larger buildings have more complicated energy systems than smaller ones. However, for this thesis, which does not dwell on technical issues of building systems, it can be helpful to combine the literature's discussion of rental and multifamily properties as the observations of energy efficiency efforts in such properties in Massachusetts are mutually applicable. Therefore, discussions here relate to rental properties with more than one household.

Lastly, this research seeks to understand the challenges and policies to enable energy efficiency in rental properties broadly, and intentionally excludes detailed discussion of programs available to low-income populations, such as the federal weatherization program (WAP). WAP serves as a vital resource to deliver energy efficiency to such households, but many efforts to study and improve WAP and related programs exist. Given the opportunity to study any issue, this thesis attempts to address an area that has gained less attention: initiatives that might be applied broadly to rental housing to facilitate energy efficiency improvements regardless of the occupants' income.

Chapter Two: Barriers to Energy Efficiency in Rental Housing

With environmental, economic, and equity justifications for improved energy efficiency in buildings, why does the potential for energy savings remain so great? Why does this resource of myriad benefits remain largely untapped? Indeed, the implementation of greater energy efficiency in the residential sector, and especially in rental properties, faces a number of serious hurdles.

The literature abounds with discussion of the barriers to greater energy efficiency in residential buildings and they can be categorized in many ways. Given the focus of this thesis, barriers are classified among four broad categories: information, fragmentation of the housing and energy markets, a lack of capital, and additional barriers unique to the rental market. It should be noted that barriers in the "other" category are certainly important. They are so categorized as they do not easily fall into the first three groups, and while they do not appear to be as substantive as the others, in combination their importance warrants mention. Upon review of the literature, the most formidable of these barriers seem to be the lack of information and market fragmentation, which includes a powerful barrier unique to the rental sector—the split incentive problem.

Information

For many people energy use is not a visceral experience and it has become less so with technological advances. Scholars note the seeming invisibility of energy as a primary hurdle to more judicious energy consumption. Stern and Aronson paint a vivid

picture of the evolution of energy innovations such that "the only visible aspect of energy for most households is the bill" (1984, 35). Recent technological changes separate most households from the generation and delivery of energy. Chopping wood for heat segued to tending the coal fire and paying for the energy's delivery. The advent of oil furnaces removed the household from the primary responsibilities of heating, though deliveries of fuel oil still remind the observer of society's energy dependence. With the transition to the use of electricity and gas as primary sources, however, energy has become nearly invisible and beyond the frequent consideration of most households (Stern and Aronson 1984).

Additionally numerous reports lament the high transaction costs to achieve greater energy efficiency in buildings, which are rooted in a lack of information (Golove et al. 1996; Koomey et al. 2001). Most property owners are not building scientists and may have little understanding of energy use in buildings. Does lighting use more energy than heating? Is the refrigerator a bigger energy hog than the dishwasher? Without more granular understanding of energy use in a building it is difficult to identify areas for improvement. A better understanding of a building's energy use often relies on an inspection and expert advice of the sources of energy efficiency potential, which can be a costly first step (Golove et al. 1996). Additionally, even when an inefficient use of energy has been identified, it can be difficult to estimate the potential savings generated through a retrofit. Such ambiguity can stifle those interested to enable greater energy efficiency as estimates of the investment's financial return remain unclear (Suozzo, Wang, and Thorne 1997).

The knowledge gap grows with consideration of properties with more than one housing unit. To some extent, this knowledge gap ought not to surprise, as many multifamily properties, larger and with more complex building systems, are simply more complicated than single-family homes. Additionally, hiring an energy technician or a contractor to identify the energy efficiency potential of a larger building can be expensive (DeCicco et al. 1995). Perhaps because efforts to deliver energy efficiency to rental and multifamily housing have lagged that of single-family housing, studies also cite a lack of experienced technicians and contractors to improve the energy efficiency of multifamily properties (Laquatra 1987; DeCicco et al. 1995).

Historically, programs to retrofit residential properties have focused on single-family homes (DeCicco et al. 1995; Levine and Raab 1981), and previous studies of energy efficiency in multifamily housing lament the lack of granular property and energy information. The U.S. Department of Energy's Residential Energy Consumption Survey provides detailed data on the energy use of single-family homes, but lacks up-to-date and specific information about multifamily housing (Bamberger 2010). U.S. Census Bureau provides information at the household scale, but not at that of the property. The Census reports the number of occupied single-family properties, but for multifamily properties only reports the number of occupied housing units within properties of a given size. No central reporting of the number of multifamily properties exists. Such information is often housed within local units of government, which gather the information for property assessments, but it therefore exists in varied forms and qualities depending upon the local agency and is disaggregated above the municipal scale.

Such limited information about energy efficiency in buildings and the poor transparency of building energy performance create a low valuation of energy efficiency. From both the tenant and owner perspectives, studies find little market pressure to encourage property owners to invest in energy efficiency. Instead, owners seem reluctant to allocate scarce resources to energy efficiency rather than more visible, aesthetic improvements that they feel more directly translate to increased value on the property market (Bleviss and Gravitz 1984; DeCicco et al. 1995; Suozzo, Wang, and Thorne 1997). The story is similar with regard to tenants' valuation of the energy characteristics of a property. With little demand for energy efficiency from tenant households, market theory suggests that property owners are unlikely to improve the energy performance of their buildings (Bleviss and Gravitz 1984).

Fragmentation

Fragmentation within housing and energy markets also present formidable barriers to retrofits. In some buildings the opportunities for energy savings through more efficient building systems and appliances are many but individually remain small. The atomized savings, despite the aggregate potential, can deter one from pursuing energy efficiency measures (Koomey et al. 2001). The McKinsey report highlights this problem at a larger scale: "spread across more than 100 million locations and billions of devices used in residential, commercial, and industrial settings … this dispersion ensures that efficiency is the highest priority of virtually no one" (Granade and McKinsey & Company 2009, viii). Indeed, nuances pervade attempts to pursue energy efficiency. Different building characteristics, heating and lighting systems, fuels, climate zones, appliances, and many other factors related to energy use create a high degree of market

segmentation. With such great diversity in the market, those relying on "general energy advice, from whatever source, risk disappointment" (Stern and Aronson 1984, 42).

Within the rental market, studies note the diversity of ownership types and interests as such a barrier. Property owners include individuals, general or limited partnerships, and corporations, which could include insurance companies, pension funds, and real estate investment trusts—each with different tendencies, resources, and interests concerning ongoing building operations and demands for returns on investments in the asset (Levine and Raab 1981). Large corporations tend to own larger residential properties and are more likely to have the skills and resources of professional building management staff and trade-knowledge to exploit programs that can deliver energy efficiency (Bleviss and Gravitz 1984; DeCicco et al. 1995). Nevertheless, while smaller properties are less likely to have corporate owners, rental and multifamily properties of all sizes tend to be owned by individuals rather than corporations (Goodman Jr and Grupe 1995; Levine and Raab 1981; Bleviss and Gravitz 1984). Owner-occupants, while tending to own properties for long periods of time and who therefore could be better candidates for energy efficiency improvements with extended payback periods, often have limited access to capital and can be less sophisticated property managers (DeCicco et al. 1995).

The most oft-cited barrier to energy efficiency in rental housing, the split incentive problem, is a form of fragmentation (Bamberger 2010; Koomey et al. 2001; Suozzo, Wang, and Thorne 1997; Golove et al. 1996; Bleviss and Gravitz 1984; Stern and Aronson 1984). It is common for the tenant to be responsible for utility expenses but the property owner has the authority to implement most substantive energy efficiency

improvements. So while the cost is commonly borne by the owner, it is the tenant who reaps the direct benefits of improved housing conditions and lower utility expenses. A recent survey of owners of one to four unit rental properties housing non-low-income households in Massachusetts finds that 94 percent of tenants pay for their heat and 99 percent pay for their own electricity (Nexus Market Research 2007). To provide a concrete example of the split incentive problem, consider the triple-decker upgrade discussed in the previous chapter. If the tenants in such a building pay the utilities, would one expect the owner to invest $14,847 for the retrofit?

Lack of Capital

Despite the cost-effectiveness of many energy efficiency investments over time, implementation often depends on a source of capital. "Usually, the most effective means of saving energy … involve capital investments, while saving energy without using capital tends to involve the loss of amenities" (Stern and Aronson 1984, 51). Numerous studies have chronicled this obvious and crucial barrier and efforts to bridge the capital gap (Fuller 2010; Fuller 2009; Brown et al. 2008; Koomey et al. 2001; Stern and Aronson 1984). Nevertheless, this problem looms large. While programs specifically designed to facilitate access to capital for energy efficiency efforts seek to provide resources, many conventional sources of capital are reluctant to permit additional financing against a property to pay for energy efficiency improvements. Despite the potential for energy efficiency investments to decrease a building's operating expenses, which could hypothetically free revenue to pay the primary debt service, lenders have historically been concerned that additional leverage adds risk to an asset (Bleviss and Gravitz 1984;

DeCicco et al. 1995). This problem can be especially acute in low- and moderate-income neighborhoods (Bleviss and Gravitz 1984).

As an example of the barrier to capital, consider the recent experiences of Berkeley, California, and many other municipalities, which piloted property-assessed clean energy (PACE) programs to facilitate financing for property owners and were stymied by federal mortgage agencies Fannie Mae and Freddie Mac. Cities like Berkeley sought to aggregate the potential energy efficiency savings of individual properties to a municipal scale by offering public financing to property owners to pay for energy efficiency work, which would be repaid through assessments on local property taxes. Concerned that local PACE liens would be senior to Fannie- and Freddie-assisted mortgages, the federal agencies decided to stop underwriting mortgages for properties with a PACE assessment, effectively killing the program nationally until the risks and roles can be clarified (Woody 2010).

Additional Barriers

The literature of energy efficiency in rental and multifamily properties discusses many other barriers. This review limits this discussion to the most pressing barriers, including a few not easily classified according to the groups above. Low rental vacancy rates in strong rental markets, such as the Boston area, can give property owners little interest in energy efficiency improvements as owners expect a vacant unit to find an occupant soon (Bleviss and Gravitz 1984). In addition, studies suggest that the high rate of tenant turnover in rental properties discourages owners' investment in energy efficiency measures, especially those inside individual housing units such as lighting, appliances, and thermostats, as owners are concerned about potential misuse and abuse

by tenants (DeCicco et al. 1995). Furthermore, DeCicco et al. suggest that owners of properties with existing code violations or poor housing conditions, which are more likely in multifamily housing than in single-family (Schwartz 2010), are often reluctant to open their properties for inspection or review by third parties, such as energy efficiency auditors or public agencies seeking to improve the energy efficiency of the building. Unfortunately, such housing is likely to be that which could most benefit from a retrofit (DeCicco et al. 1995).

Conclusion

This chapter summarized some of the key barriers to energy efficiency improvements generally and in rental and multifamily properties. Such barriers are certainly formidable, and therefore suggest that the potential for greater energy efficiency in the rental sector remains large. The following chapter describes the primary efforts to enable energy efficiency in rental housing and suggests how such strategies address the barriers presented here.

Chapter Three: Strategies to Implement Energy Efficiency in Rental Housing

Many policies and programs have tried to improve the energy efficiency of rental and multifamily properties (DeCicco et al. 1995). Nevertheless, perhaps because such efforts are newer and less well developed than those that address single-family housing, rental and multifamily housing is considered one of the "hard to reach" sectors for energy efficiency initiatives (Barbose, Goldman, and Schlegel 2009; Hirst 1989). The primary strategies to enable energy efficiency in rental housing historically include public incentives and utility-administered programs. In recent years, the conflation of an economic downturn, ongoing geopolitical instability in regions of the world rich in fossil fuels, and a growing understanding of the problems associated with climate change increased the public attention on energy efficiency, resulted in an expansion of these programs, and supported the development of two additional strategies: building labeling initiatives and new partnerships. Indeed, politicians at all levels of government, labor unions, and advocacy organizations hail energy efficiency in residential properties as a means to decrease residents' energy bills, to provide jobs through increased demand for energy efficiency-related work, and to mitigate the negative environmental impacts of carbon emissions (EOEEA 2010; City of Boston 2010a; Kaufman 2010; Middle Class Task Force and Council on Environmental Quality 2009; Connelly 2008). This chapter seeks to describe the general efforts to enable energy efficiency in rental housing, including public incentives, utility-administered programs, building labeling, and newly emerging partnerships, and discusses the ability of these programs to overcome the

barriers presented in the previous chapter. Where appropriate, examples highlight efforts in Massachusetts.

Public Incentives

Financial incentives can address multiple barriers to energy efficiency in existing rental properties, and the public sector has long sought to provide such resources. Early in national efforts to implement energy efficiency in residential properties the federal government sought to facilitate financing through the creation of the Solar Energy and Energy Conservation Bank, which provided subsidized loans for the installation of energy conservation measures (Levine and Raab 1981). Tax credits also supported investments in energy efficiency, and the federal government's weatherization assistance program (WAP) offers deep subsidies for efficiency improvements in the homes of low-income households (U.S. Department of Energy 2011a). In Massachusetts, the federal WAP program offers incentives averaging $5,500 per eligible household, defined as those below 60 percent of the state median income (EOHED 2011).

In recent years, the federal government's stimulus package, the American Recovery and Reinvestment Act (ARRA), provided significant funding to expand such efforts and to pilot new programs with additional incentives. ARRA provided $5 billion in additional funding for the WAP program and allocated $3.2 billion in Energy Efficiency and Conservation Block Grants (EECBG) to city and state efforts, including a number of innovative pilots in Massachusetts, described further below (U.S. Department of Energy 2010, 2011b). Additionally, ARRA funds created the Better Buildings program, a $508 million initiative to support 41 state and local government experiments

across the country to develop self-sustaining energy efficiency programs (U.S. Department of Energy 2011c).

Utility-Administered Programs

Programs offered by utilities complement those of public agencies and often incorporate such incentives to provide bundled services to customers. There is a long history of utilities offering programs to customers to enable greater energy efficiency, and while a detailed history is beyond the scope of this study, a brief summary is important to provide context in Massachusetts where the utilities administer the bulk of the energy efficiency programs for residential properties.

Electric and gas utilities began to offer energy efficiency services for customers in the 1980s for a variety of reasons. The 1978 National Energy and Conservation Policy Act established the Residential Conservation Service (RCS), which required large electric and gas utilities to offer energy audits of the properties of their customers (DeCicco et al. 1995). Audits are performed by a building energy technician who inspects the property to identify opportunities to improve its energy efficiency through measures such as additional insulation or duct sealing, and have become a mainstay of energy efficiency programs to help building owners understand the value of a building and its energy systems. While the RCS program did not offer a comprehensive energy efficiency program that included financial support for the recommended measures, it forced utilities to become familiar with building energy audits, energy efficiency potential, retrofits, and served as the foundation for many utility-administered energy efficiency programs still in operation (DeCicco et al. 1995).

In Massachusetts, utilities also expanded such efforts after recognizing that improvements in energy management can help administer system-wide energy loads and advance research efforts (Raab 1994). Utilities in the state began to offer financial incentives to customers funded in large part by a surcharge on ratepayers' monthly energy bills. Such efforts offered a variety of incentives to utility customers and have grown rapidly in recent years.

Since 2008 increased funding, the establishment of aggressive policy goals, and a number of new initiatives have helped Massachusetts become a leader of energy efficiency policies and programs (Molina et al. 2010). That year the state passed a number of bills addressing energy and environmental issues, including the Green Communities Act (GCA) and the Global Warming Solutions Act (GWSA), which, among other things, significantly altered the structure of the ratepayer-funded energy efficiency programs administered by the utilities and mandated the state to develop a plan to decrease its carbon emissions by 25 percent below 1990 levels by 2020 (Commonwealth of Massachusetts 2008a, 2008b). Given the energy efficiency potential in buildings, the state's recently proposed climate action plan to achieve this GHG reduction relies heavily on retrofitting existing properties (EOEEA 2010).

The GCA renewed the state's mandate for utilities to offer energy efficiency programs to customers and vastly expanded the public resources to support them. Indeed, the GCA requires the utilities to acquire all energy efficiency potential that costs less than adding additional units of energy to the supply side to the market (Environment Northeast 2008). Before the GCA, the annual utility-administered energy efficiency program budgets averaged $150 million (Kaufman 2010). In the post-GCA paradigm,

the 2009-2012 annual budgets for the programs average $700 million (Guidice and Gorke 2010). These publicly funded programs are supported by a surcharge on ratepayers' utility bills, and a minimum of 80 percent of the state's revenues from its participation in the Regional Greenhouse Gas Initiative, a northeast regional carbon cap and trade program, and other sources (Environment Northeast 2008). While utilities remain the program administrators, they are required to work collaboratively, a major change from the utility-specific energy efficiency programming before the GCA, to develop three-year program plans in consultation with an Energy Efficiency Advisory Council (EEAC) composed of energy efficiency experts and advocates (National Grid, NSTAR, Unitil, Western Massachusetts Electric, et al. 2009; National Grid, NSTAR, Unitil, Berkshire Gas, et al. 2009; Environment Northeast 2008).

The three-year plans developed collectively by Massachusetts' utilities and approved by the EEAC explain the primary energy efficiency programs offered. The MassSAVE program targets owners of one to four unit properties and is administered by a contractor hired by the utilities. The program seeks to bundle energy efficiency services by offering free property audits, recommendations of energy efficiency actions, and suggestions of available financial incentives to support the suggested measures. It prioritizes improvements in a building's thermal envelope, HVAC and mechanical systems, water heating, lighting, and appliances, and offers incentives such as a $1600 rebate on an integrated water heater and condensing boiler to encourage action (Mass Save 2011a). Utilities also partner with private lenders to administer the Massachusetts HEAT Loan program, which provides financing to owners of such properties. HEAT Loans offer up to $25,000 at 0 percent interest with a 7-year term for common energy

efficiency improvements. Public funding channeled through the utilities pays down the interest rates on the loans, which are issued by private banks (Mass Save 2011b; National Grid, NSTAR, Unitil, Berkshire Gas, et al. 2009; National Grid, NSTAR, Unitil, Western Massachusetts Electric, et al. 2009).

The utilities' three-year plan also outlines a Multifamily Retrofit Program that provides analogous services to properties that house five or more units. Again, the program offers a property assessment to identify areas of energy efficiency potential, and seeks to connect property owners and managers with resources to improve the building, such as rebates of $150 to $500 on air conditioners and heat pumps (Mass Save 2011c). Notably, the utilities' multifamily program seeks to develop offerings designed to appeal to each property owner depending on the type of ownership and interests (National Grid, NSTAR, Unitil, Western Massachusetts Electric, et al. 2009).

Building Labeling

Aggressive state interest in building energy issues and support from ARRA enabled Massachusetts to develop innovative and expanded programs to support energy efficiency in residential housing. In July 2008 the state's Executive Office of Energy and Environmental Affairs (EOEEA) convened a task force of building, energy, and environmental leaders to craft a plan to dramatically decrease energy use in residential and commercial buildings by 2030. Among many recommendations, the task force report suggests the establishment of energy performance standards and a requirement of "home energy ratings in conjunction with specific transactions, inspections, or renovations" by 2012 (EOEEA 2009, 3). The report suggests that the occasions that might trigger such a rating could be "the time of sale, so that prospective buyers have access to essential,

validated information regarding the anticipated energy performance of the home" and that the label could be available to tenants, which "would influence building upgrade decisions" (EOEEA 2009, 23).

Massachusetts then leveraged federal and other funding to implement pilot rating and labeling programs similar to those suggested by the task force. In western Massachusetts the state's Department of Energy Resources is collaborating with the U.S. Department of Energy and area utilities to develop a labeling program for small residential buildings in coordination with utility-administered programs to encourage residents to retrofit their buildings (EOEEA 2011). In eastern Massachusetts, the state is planning a different labeling pilot for commercial and large multifamily properties. This pilot effort seeks to develop an "asset" rating system that labels a building's energy performance along a scale of technical building energy performance founded upon zero net energy use. Such a rating system differs from those based on building performance as determined by energy consumption data, such as that provided by utilities. The state's asset rating effort, which focuses on the inherent energy characteristics of the building itself, seeks to neutralize the potential for the occupants' behavior to skew the rating through differences in energy consumption habits (DOER 2010).

Partnerships with Municipalities and Communities

Units of local government have become increasingly interested in issues of environmental sustainability in recent years (Portney 2002). In Massachusetts, this interest is manifest in a number of city-scale efforts to improve building energy efficiency including the establishment of municipally-supported organizations to encourage resident efforts in energy efficiency (Jay 2010). Additionally, a new network

initiative of cities and philanthropies seeks to support municipalities to identify energy efficiency potential in local communities and to develop programs to capture the benefits (Worcester Telegram & Gazette 2010). Consideration of local energy efficiency efforts in this thesis focuses predominantly on Boston to provide a manageable scale for discussion, because the city has demonstrated clear initiative in this arena, and because the concentration of rental and multifamily housing forces the city to pay greater attention to this sector.

The City of Boston's leadership on energy efficiency issues is motivated at least in part by the threat posed by rising sea levels around the coastal city. Indeed, the city's climate action plan highlights a rather dramatic image, Figure 3-1, of the famous Back Bay neighborhood flooded as a result of a storm modeled on assumptions of high carbon emissions (City of Boston 2010a).

Figure 3-1: 2100 Flooding Projection for Boston's Back Bay

Source: City of Boston 2011b

The city's climate action plan sets targets for GHG emissions reduction and seeks to achieve these goals in part through improved energy efficiency in buildings. To seed that effort, Boston allotted $1.6 million of federal EECBG funding to create Renew Boston, a new, collaborative effort that combines utilities' energy efficiency programs with the resources of the city and neighborhood organizations. The effort combines the existing resources of MassSAVE with additional public incentives and community-based outreach through non-profit community organizations to provide targeted services to Boston's unique housing characteristics. The program targets smaller residential properties, such as the city's ubiquitous triple-deckers, and specifically rental properties (City of Boston 2010b; Renew Boston Facilitation Team et al. 2010).

The integration of municipal and community-based resources offers a new and potentially promising strategy to enable energy efficiency in rental housing. These efforts can build on existing strategies, as programs like Renew Boston provide additional funding to MassSAVE, and the activation of CBOs and neighborhood networks has recently been noted in the literature as a unique and valuable strategy to facilitate greater participation in energy efficiency programs (Pitt 2010; Wood 2010).

Conclusion

The strategies reviewed here combat a number of the barriers described in Chapter Two. Table 3-1 lists these barriers and aligns the strategies of this chapter with the barriers they are likely to mitigate. All of these efforts seek to tackle the information barrier by providing actors with data and support to retrofit residential properties. Public incentives and utility-administered programs may offer a bridge across the capital gap, and utility programs and municipal and community partnerships target the split incentive

with nuanced resources for owners and residents of rental properties. In addition, the utility-administered programs cater to different types of property owners thereby addressing an element of market segmentation.

Table 3-1: Summary of Barriers and Strategies to Enable Energy Efficiency in Rental Housing	
Barriers to energy efficiency in rental housing	**Strategies that address the barrier**
Information	
Poor building and energy data / transaction costs	Public incentives* Utility-administered programs* Partnerships with municipalities and communities*
Poor valuation of energy efficiency	Building labeling*
Fragmentation	
Split incentive	Utility-administered programs* Partnerships with municipalities and communities*
Diversity of ownership	Utility-administered programs*
Lack of capital	Public incentives* Utility-administered programs*
Additional	
Low vacancy rate	?
High tenant turnover	?
Owner reluctance to third party inspection	?

* New or recent increase in activity

While these strategies offer valuable resources, questions linger whether they can sufficiently serve the "hard-to-reach" rental market. As Table 3-1 suggests, no energy efficiency strategy seems to address low vacancy rates, high tenant turnover, and the reluctance of owners to open their property to a third party. The recently expanded public and utility programs, albeit with more resources, improved collaboration, and bundled services, are simply expanded versions of programs that have been offered for decades. Perhaps program revisions can permit them to better serve hard-to-reach sectors, but in substance these programs differ little from historic efforts. Additionally, such programs remain entirely voluntary, relying on the initiative of the property owner to use the programs' resources. The increased involvement of municipalities, community

groups, and building labeling suggest new strategies that could increase retrofit rates, but it is too early to tell whether such experiments will be effective. Therefore, an investigation of other strategies to enable improved energy efficiency in rental housing could offer ideas of alternative or complementary efforts.

Chapter Four: Case Studies of Energy Efficiency Ordinances Targeting Rental Housing

With the exception of some new efforts in Massachusetts, such as the state's building labeling pilots and the utility-municipal-CBO partnerships, recent activities to deliver improved energy efficiency to rental properties differ from historic offerings primarily in scale. Inspired by the increased local activity and collaboration, this thesis seeks to understand additional policy actions that may be available to municipalities should the current portfolio of strategies in Massachusetts be insufficient. Where conventional energy efficiency strategies have struggled to fully serve the rental sector, policies in San Francisco and Berkeley, California; Burlington, Vermont; Austin, Texas; and Wisconsin proactively target such properties with enhanced initiatives. This research investigates and analyzes ordinances in these jurisdictions that explicitly seek to improve the efficiency of rental properties.

This chapter summarizes these types of ordinances and provides a synopsis of each of the cases. The following chapter provides an analysis of distinctions among these policies, which is crucial to understand their ability to enable greater energy efficiency in rental housing. Interested readers can find detailed descriptions of each of the case study policies in Appendix A.

Innovative Approaches to Enable Energy Efficiency

Each of the policies studied here mandates an action intended to improve the energy efficiency of rental properties, though some of them apply to more than rental buildings. The policies of San Francisco, Wisconsin, Berkeley, and Burlington are

considered Residential Energy Conservation Ordinances (RECOs), which mandate physical building standards under certain circumstances. Austin's policy seeks to facilitate the disclosure of building energy information as well as building upgrades given certain conditions. A number of these policies incorporate characteristics of both RECOs and disclosure ordinances. The following paragraphs provide a broad overview of such policies.

Residential Energy Conservation Ordinances

In the wake of the energy crises of the 1970s, many state and local governments adopted an energy component to existing building codes to protect residents from rising energy costs and to curtail energy waste. Yet policymakers recognized that as building codes commonly apply only to new construction or major renovations and that as the offerings of public agencies and utilities were voluntary, a large portion of existing housing could be left without energy efficiency upgrades. Therefore, a number of cities and states adopted RECOs, which mandate energy efficiency standards in existing properties at a certain point in time—commonly when properties change ownership (Suozzo, Wang, and Thorne 1997).

Previous studies note that RECOs can deliver energy efficiency to existing housing, provide a baseline level of comfort to tenants by establishing a floor of energy efficiency, operate at little cost to owners and program administrators, and support the creation and sustainability of local jobs by ensuring ongoing work for energy efficiency contractors and related services (Suozzo, Wang, and Thorne 1997; Butterfield and Eisen 1987). Fit to local circumstances, RECOs can provide location-specific guidance to property owners, thereby addressing the lack of information about the means to improve

the energy efficiency of buildings. Established at the state or local level, RECOs can cater to local property and climate characteristics. Additionally, the age of local residential properties often affects the selection of RECO standards. In Berkeley, for example, attic insulation was among the top energy efficiency priorities as a majority of the homes were built before insulation became a common building characteristic (Suozzo, Wang, and Thorne 1997). Furthermore, RECOs are noted to be uniquely suited to deliver energy efficiency improvements in jurisdictions with a high proportion of tenant-occupied housing and tight housing markets (Laquatra 1987), and that their structure addresses many barriers, including the split incentive (Suozzo, Wang, and Thorne 1997).

Therefore, researchers note that RECOs address a number of barriers summarized in Table 3-1. Designed according to local circumstances, RECOs can address the lack of information about energy efficiency by providing guidance to owners of appropriate measures. Furthermore, as they can apply regardless of the attribution of utility expenses, housing ownership characteristics, and through variations in the rental market, RECOs can address the split incentive, the diversity of ownership, low vacancy rates, and high tenant turnover—a number of which are untouched by current energy efficiency efforts.

Disclosure of Building Energy Information

The disclosure of information about a building's energy characteristics and performance is another target of state and local policies and programs. A recent study notes many benefits of such disclosure. The report suggests that with more information about a building's energy characteristics, the invisibility of energy begins to fade and energy efficiency's valuation may improve. Additionally, such disclosure policies can

encourage property stakeholders to participate in existing energy efficiency programs, such as those offered by utilities. Recognizing the energy performance of their building in comparison to others may not only encourage owners to seek such resources, but tenants in such properties might push owners to do so. Additionally, energy disclosure policies can enable tenants to make more informed choices about their next housing choice through improved understanding of the potential energy expenditures associated with a property or a housing unit (Dunsky et al. 2009).

Therefore, information disclosure policies address a number of barriers to the provision of energy efficiency in rental properties. Obviously, such policies can address the lack of information and transaction cost barriers as well as that of poor valuation. Furthermore, such policies present an opportunity for the high-tenant-turnover barrier to become additional leverage to improve the energy efficiency of rental properties. Armed with an estimation of the energy costs of a new home, the frequent movement of tenants can dramatically increase the pressure on owners to improve the facilities' energy efficiency.

Case Study Synopses

San Francisco

In 1982, the City of San Francisco amended its building codes to include a RECO that mandates energy efficiency standards in residential properties at the time of sale, major property renovations, a conversion from master- to sub-metering, or a conversion to condominiums. The policy applies to privately owned rental- and owner-occupied housing, and requires that subject properties are outfitted with certain measures listed in the ordinance. An inspector verifies property compliance, and expenditures pursuant to

the RECO are limited (City of San Francisco 1991). Previous studies of the San Francisco RECO suggest that the policy has been effective (Shelley 1989; Suozzo, Wang, and Thorne 1997), but no formal evaluation has been conducted. The current Energy and Climate Programs Manager of the City of San Francisco acknowledges its historic efficacy but ascribes little incremental value to the policy at this point due to its prescriptive nature and the magnitude of the climate and energy problems the city faces (Broomhead 2011a).

Wisconsin

Wisconsin appears to be the only state in the nation with an operational RECO policy. The state's Rental Weatherization Program was adopted in 1985 and seeks to "establish minimum energy efficiency requirements for rental units" (State of Wisconsin 2008) in order to save energy costs (Hertel 2011a). For rental properties constructed before adoption of the state's building energy codes, the policy requires an inspection and certification that the property meets certain energy efficiency requirements before it can be sold. Compliance with the policy can be satisfied either by adherence to a list of prescriptive energy efficiency measures or through satisfaction of an energy performance metric (Wisconsin Department of Commerce 2011). The ordinance sets no firm cost limitations, though specific measures may be exempt if the payback period is greater than five years (Panoska 2008). While little quantitative data exists to demonstrate the energy and cost savings generated by Wisconsin's RECO, it has established a baseline of energy efficiency in more than 100,000 properties (Hertel 2011a).

Berkeley

Berkeley's RECO was adopted in 1987 and requires that residential properties, subject to some exceptions, are outfitted with a list of prescriptive energy efficiency measures when a property undergoes major renovation or changes ownership. Caps on the cost of compliance mitigate the impact of the policy on owners (City of Berkeley 1991). Berkeley's Energy Office, the Buildings and Safety Division, and a non-profit organization contracted by the city to perform the property inspections collaboratively manage RECO compliance. The city has not performed a formal evaluation of its ordinance, but the RECO program administrator feels that the policy has helped the city curtail its energy use (LaPierre 2011a).

Burlington

Burlington's RECO, called the Minimum Energy Efficiency Standards Ordinance of 1997, mandates improvements of rental properties where tenants pay the utility expenses when such properties are sold. The ordinance provides a list of prescriptive energy efficiency measures that properties must furnish at the point of a transfer in ownership (City of Burlington 1997). However, the language of the ordinance was drafted with sufficient flexibility such that program administrators do not seek the prescriptive compliance of every property; instead they target buildings that consume more energy than comparable properties (Buckley 2011). Burlington's municipally-owned electric utility, the Burlington Electric Department (BED), administers the program and manages its compliance in concert with the area gas utility and certified private contractors who inspect subject properties. Expenditures to implement energy efficiency are limited to mitigate the impact on owners (City of Burlington 1997).

Burlington has not conducted a formal evaluation of its RECO policy, but staff are confident that the program is cost-effective and that it has delivered substantial benefits to residents by improving the worst-performing rental properties (Buckley 2011). BED reports that its RECO has facilitated energy efficiency improvements in 225 buildings housing 630 units, 6.9 percent of all currently occupied rental units, from 1997 to spring 2011 (U.S. Census Bureau 2011a; Thiels 2011).

Austin

In 2009 Austin adopted its Energy Conservation Audit and Disclosure (ECAD) ordinance, which requires owners of residential property to perform an energy audit to facilitate the valuation of energy efficiency in property sales, to encourage owners to enroll in utility-administered energy efficiency programs, to provide the city with information of high-energy-use properties, and to subsequently mandate the decrease in energy consumption of such buildings. The ordinance is managed by the city's municipally owned electric utility, Austin Energy (AE), and applies to all residential properties, though requirements differ depending upon the type of property. For example, owners of properties with one to four housing units must perform an audit before the property is transferred to a new owner and share the audit results with the prospective purchaser. Owners of properties with five or more housing units must conduct an energy audit by June 1, 2011 and share the results with current and prospective tenants. Mandated building improvements only apply to high-energy users among the larger property class (City of Austin 2008). Given the recent adoption of the policy, no quantitative measure of impact is available, but program administrators have noticed an increase in properties enrolling in AE's energy efficiency programs (Kisner

2011a), and other observers note that the disclosure enables the valuation of energy efficiency in real estate transactions (Biedrzycki 2011).

Conclusion

This chapter provided a summary of the types of policies this thesis investigates and thumbnail descriptions of each case study. A more detailed investigation of these policies is necessary to glean the key distinctions and lessons of these policy experiments. The following chapter seeks to provide such explication.

Chapter Five: Analysis of Energy Efficiency Ordinance Options and Discussion

To understand the variations among these five case studies, this chapter provides a cross-cutting analysis of the elements of each jurisdiction's ordinance. Where relevant, a synthesis and reflection of policy provisions among the cases is highlighted. The conventional policy issues investigated include: the context for the policy's adoption, applicability, triggers, requirements, compliance, administration, enforcement, costs, connection to other energy efficiency programs in the jurisdiction, and outcomes. Additionally, the review seeks to understand whether policies that mandate energy efficiency-related standards and actions result in increases in tenants' rents of a magnitude greater than any decrease in utility expenditures resulting from the energy efficiency measures. The concern for the net economic affect of such policies on tenants' expenses is a major concern to Massachusetts housing and energy efficiency advocates, such as Community Labor United (Boyd 2011).

Context for Policy Adoption

Twenty-seven years and thousands of miles separate the adoption of these policies and the different eras and the political environments undoubtedly colored their adoption. Nevertheless, certain trends are apparent.

Firstly, likely influenced by the political climate of the times and places, the logic for adoption of the policies shifted greatly over the three decades. The policies of San Francisco, Wisconsin, and Berkeley, respectively enacted in 1982, 1985, and 1987, were all adopted in reaction to the energy crises of the 1970s (Broomhead 2011a; Hertel

2011a; LaPierre 2011a). Such policies are explicit attempts to expand the scope of public efforts beyond the reach of building energy codes to capture energy efficiency potential in existing housing. Burlington's policy, in contrast, was not implemented until 1997, after more than a decade of policy debate motivated not only by efforts to protect residents from energy expenses, but also the advocacy of housing and tenant activists seeking to address the split incentive problem (Buckley 2011; Pine 2011). Austin's ECAD ordinance evolved from a municipal climate change plan (Biedrzycki 2011; Kisner 2011a), similar to others adopted across the country in recent years, as units of local government expanded their interest in environmental and climate issues.

Secondly, a review of the policies of San Francisco, Wisconsin, and Burlington indicates that local policymakers recognized the potential of such measures to deliver economic development and equity to tenants. Each of these policies sought energy efficiency improvements in residential properties to decrease resident expenditures on energy and to encourage local employment through increased demand for energy efficiency-related services (City of Burlington 1997; City of San Francisco 1991; Suozzo, Wang, and Thorne 1997). With respect to improved and more equitable access to efficient housing for tenants, the preamble to San Francisco's RECO justifies legislative action as "little progress has been made to [improve] the energy efficiency in rental housing," regardless of whether the tenant or the property owner pays the utilities (City of San Francisco 1991). The policies of Wisconsin and Burlington apply only to rental properties, an acknowledgement that existing energy efficiency efforts left such buildings with inadequate opportunity to improve the quality of tenants' homes (City of Burlington 1997; State of Wisconsin 2008).

Additionally, the real estate industry in Wisconsin, Burlington, and Austin resisted the energy efficiency ordinances of these jurisdictions. In the case of Austin, the opposition was quite aggressive. The city's Board of Realtors published what one member of the city's policy development Task Force describes as "doomsday articles" of the negative economic impact the policy would have on the city and low-income households in particular, as those seeking to sell their homes would be prevented by the ordinance (Biedrzycki 2011). In Burlington, landlords augmented such calls of economic harm and government intrusion in the marketplace with the specter of increased rents as the likely result of mandated upgrades (Pine 2011; Wimpey 2011). The real estate industry in Wisconsin also resisted the policy's creation (Shelley 1989) and maintained its opposition winning amendments to weaken the policy in 1998 (Hertel 2011a). Of these cases, Wisconsin's policy appears to be the only one so amended due to the resistance of the real estate industry, suggesting, perhaps, that the strain of these ordinances on real estate operations is not burdensome.

Furthermore, the adoption process of each policy included a strong signal of support from a governing body, and a number of them grew from years of discussions among community stakeholders. San Francisco's RECO developed through an initiative of the city's Board of Supervisors which established a stakeholder committee to develop policy proposals to protect residents from rising energy costs (Broomhead 2011a). In the early 1980s, Wisconsin's state legislature passed an act requiring the establishment of a program to improve energy efficiency in rental housing, which evolved into the state's RECO (Suozzo, Wang, and Thorne 1997). The City of Berkeley, like its counterpart across the bay, established an energy commission to work with community stakeholders

to develop energy efficiency policies, from which the RECO developed (LaPierre 2011a). Burlington's RECO, though long in development, was a clear policy objective of Progressive members of the City Council in the 1980s who directed a community stakeholder group to determine the details of such a mandatory upgrade policy (Buckley 2011). In Austin, those interviewed credit the city's ECAD to the climate change efforts of former Mayor William Wynn who pushed the city to establish a Task Force to identify opportunities for improved energy efficiency in the city's buildings (Biedrzycki 2011; Kisner 2011a). Undoubtedly, various political constituencies pushed these policymakers to take action. While a more thorough understanding of these political circumstances requires further research, it is notable that each policy was adopted upon decisive action of a governing entity, often relying on a community discussion process to determine the details.

Lastly, the unique circumstances of Burlington and Austin, both with municipally owned utilities, warrants mention. As is explained in the following sections, both utilities serve a vital function in the program administration of these policies and this local, public expertise provided valuable research and technical assistance during the deliberations of the policies' development (Buckley 2011; Kisner 2011a).

In sum, the logic for adoption of these policies has shifted over time, but certain trends emerge. Early policies sought a government mandate to control energy use for public benefit, and the most recent policy emerged from a local response to climate change. The need to expand the potential economic benefits associated with energy efficiency and equity for tenants was a key factor in a number of policies, and the real estate industry is a common opponent of such efforts. Additionally, these policies were

often developed after a clear demonstration of support from a major governing actor, and the existence of a municipally owned utility can support ordinance development and administrative functions.

Applicability

The policies reviewed here seek to extend the implementation of energy efficiency among buildings that may not be captured by the conventional strategies discussed in Chapter Three. The RECOs of San Francisco, Wisconsin, Berkeley, and Burlington apply to those properties not subject to the prevailing building energy codes and Austin's ECAD applies to properties greater than 10 years old and which have not recently participated in an energy efficiency program. In Burlington and Wisconsin, the RECO applies only to rental housing although each policy has nuances in its application, which are explained more in Appendix A. The policies of San Francisco, Berkeley, and Austin apply to nearly all residential properties, although the requirements of Austin's policy differ based on the type of property as is described below. Each policy permits exemptions under certain circumstances, such as when property ownership is transferred to another family member or where such transfers result from instances of financial hardship, as in the event of a foreclosure (City of Austin 2008; City of Berkeley 1991; City of Burlington 1997; City of San Francisco 1991; State of Wisconsin 2008).

Triggers

Each policy case has one common policy element: the energy efficiency requirements are triggered by changes in property ownership. Some policies, such as that of San Francisco and Berkeley, also apply when subject properties undergo certain renovations whereas Austin's ordinance has two triggers: a change in ownership for

properties with less than four housing units and a deadline of June 1, 2011 for larger properties. Nevertheless, it is notable that despite distinct policy development processes across the country spanning multiple decades, each ordinance targets changes in ownership to implement energy efficiency improvements in buildings (City of Austin 2008; City of Berkeley 1991; City of Burlington 1997; City of San Francisco 1991; State of Wisconsin 2008).

Triggers - Synthesis

The logic of energy efficiency improvements at the time of sale is compelling. As energy efficiency efforts generally require a capital expenditure, transfers in property ownership can be crucial moments to realize the public goal, as Brian Pine, the City of Burlington's Assistant Director for Housing and Neighborhood Revitalization and a former tenant organizer who advocated for the city's RECO in the 1980s, relates:

> If at time of sale you find that $5,000 worth of work needs to happen, that gets factored into the sales price. And that gets accepted now because its standard operating procedure and everybody knows about it and so it's just part of every transaction. And that's what's so elegant about the idea. Time of sale anything. Time of sale code enforcement, time of sale energy upgrades, dealing with lead at time of sale…. Dealing with the issue at time of sale makes so much sense because a willing buyer and a willing seller are negotiating the transaction, and that's when the checkbook opens up, and that's when you can have a very honest discussion about, "Your value is actually reduced by the fact that, within the next 6 months I must spend this extra 5 grand just to get up to compliance with this very basic code."

A RECO's mandate of physical standards and the disclosure of building energy information at the time of sale enable energy efficiency measures to become the subject of discussions much larger than atomized questions of building energy systems and end-uses. These cases suggest that with such ordinances, improvements in the energy

efficiency of buildings can become an institutionalized element of real estate transactions and larger financing packages, often requiring little incremental cost, and can facilitate improved valuation of energy efficiency.

Requirements

The requirements of these policies vary from prescriptive requirements to adherence to building energy performance standards, and most recently, the provision of information about a building's energy characteristics.

San Francisco and Berkeley – The Prescriptive Policies

The RECOs of San Francisco and Berkeley mandate that subject properties comply with a prescriptive list of physical building elements outlined in the ordinances, which include common energy efficiency measures, such as the installation of insulation and duct sealing (City of Berkeley 1991; City of San Francisco 1991).

Wisconsin and Burlington – The Transition from Prescription to Performance

The policies of Wisconsin and Burlington mark a transition from prescriptive- to performance-based requirements. Initially, Wisconsin's policy relied on a prescriptive list, but amendments to the policy in 1998 permits compliance based on a performance metric, of BTUs consumed, per square feet, per heating degree day or other methods approved by the administrative agency. Properties that do not meet the threshold must implement energy efficiency measures (Hertel 2011b; State of Wisconsin 2008).

Similarly, Burlington's RECO technically requires that subject properties adhere to a prescriptive list of measures. However, after initial attempts to verify compliance required significant resources to inspect each property sold, the program administrator shifted its administrative processes to rely on a performance metric of building energy

use, defined by the BTUs consumed, per square foot, per heating degree day (Buckley 2011). Now, BED focuses its attention on those properties that consume high levels of energy. With the performance metric, the energy consumption of roughly 60 percent of properties sold is below the threshold and requires no further action from the owner or BED; the remaining 40 percent are subject to BED's efforts to enroll property owners in energy efficiency programs (Buckley 2011). This approach, targeting properties that consume the most energy in the city, enables Burlington to establish a floor of energy efficiency in rental properties, which continuously improves over time.

Austin – The Provision of Information for Efficiency

Austin's ordinance seeks to disclose a property's energy information to encourage more granular valuation of energy efficiency in the housing market and to enable utility-administered energy efficiency programs to offer nuanced services to each property (Kisner 2011a). For properties that house one to four units, an owner is required to conduct an energy audit and to share the results with the prospective purchaser before any such property is sold. For larger properties, owners are required to conduct an energy audit of the facility by June 1, 2011, to share the results with all current and prospective tenants, and to post a copy of the audit in a common area of the property. Among the bigger buildings, the ECAD requires energy efficiency improvements when a property's energy use is 150 percent of comparable properties. The ordinance relies on a metric of average energy use per square foot, and requires that owners of such high energy-use properties bring the usage down to 110 percent of comparable properties within 18 months (City of Austin 2008).

Requirements - Synthesis

Scholars note that in recent decades environmental policies have changed from the regulatory efforts of a centralized unit of government dictating certain outcomes to strategies to achieve the results (John 1994). The transition in requirements of these energy efficiency ordinances seems to track a similar path and changes in technology and the abilities of program administrators support this trajectory. The early RECOs of San Francisco, Wisconsin, and Berkeley all initially relied on inspectors verifying individual property compliance with a prescriptive code and compliance was tracked with paper records—many of which still have yet to be entered into the current computer tracking systems. Without access to building energy use data, which is often a challenge in areas with privately owned utilities, such a process seems appropriate. While the basic performance metric used by BED and AE, BTUs per square foot, is a simple calculation given computer files with building energy use data and property records, the generation of this metric is likely based on information housed in two filing cabinets in different agencies. Without the use of a computer, compiling this data would be a cumbersome process. Yet with the widespread use of computers the transition to a performance based system seems logical and more feasible. Furthermore, given that the electric utilities in Burlington and Austin are municipally owned, compiling the necessary data is perhaps easier as the basic elements of the performance metric are likely housed in the municipality's energy and assessment offices rather than one data element housed in a privately owned utility.

Compliance

Compliance with the energy efficiency policies of these jurisdictions often relies on verification by an inspector. A related discussion of this process is included in the

following section on Administration, and a full explanation of these processes can be found in Appendix A. This section seeks to highlight some of the challenges to compliance resulting from the existence of firm energy efficiency cost limitations, exemptions of measures in building areas difficult to access, and poor compliance record keeping that prevent a detailed understanding of the impact of the energy efficiency policy.

The policies of San Francisco, Berkeley, and Burlington all include limitations to the capital expenditures required of owners (City of Berkeley 1991; City of Burlington 1997; City of San Francisco 1991), and in Wisconsin, owners' costs are limited by a cost-effectiveness provision that exempts energy efficiency measures with costs that exceed the estimated energy savings over a five year period (Panoska 2008). These limitations are summarized in Table 5-1. Additionally, policies commonly exempt measures where its installation is deemed infeasible, as may be the case of insulation in "inaccessible" attics (City of Berkeley 1991; City of San Francisco 1991; LaPierre 2011c).

Table 5-1: Cost Limitations for Policy Compliance

Jurisdiction	Cost Cap or Cost-Effectiveness Provision
San Francisco	1% of property sales price or assessed value, whichever is greater, with a maximum limit of $1,300 for buildings with two or fewer units
Wisconsin	Exemptions permitted if cost of energy efficiency measure exceeds estimated energy savings over five years
Berkeley	0.75% of sales price for properties with two or fewer units; $0.50 per square foot for properties with three or more units
Burlington	3% of sales price or $1,300 per unit, whichever is less; Measures must not exceed a seven year payback
Austin	N/A

Note: The cost limitations listed here apply to transfers in ownership; different limitations may apply when policies are triggered by renovations.

Spending limitations were often adopted in compromises with the real estate industry (Broomhead 2011a; Wimpey 2011), but as the costs of energy efficiency

improvements increased, properties may technically comply with the ordinance without implementing key energy efficiency measures (Broomhead 2011a; LaPierre 2011c). Furthermore, the poor quality of administrative records, such as in San Francisco, can result in little understanding of what upgrades have been performed in subject properties despite their technical compliance with the RECO.

> The administrative method is a tiny piece of paper, smaller than a postcard, that somebody signs-off on and staples to the escrow package and it ends up as a checkmark at the Recorder's Office. So there is no information there about what was done, just that it has been done, met RECO. What the hell does that mean? Did they have to install attic insulation or was it exempt? What about the ducts? Were they sealed or were they exempted because they had asbestos? … What was done? There is no information about that at all. Just done or not done (Broomhead 2011a).

Compliance - Synthesis

With consideration of the discussion of prescriptive and performance requirements above, these compliance experiences suggest two lessons. Firstly, while cost limitations to mandatory energy efficiency policies may be a political necessity to placate the real estate industry, they need to be sufficient to cover key energy efficiency costs and pegged to a cost index that changes over time. Secondly, while a performance metric can theoretically be satisfied without the installation of a key measure, such as attic insulation, it is preferable to a prescriptive code, with which building characteristics, such as inaccessible attics, may preclude the installation of some of the most important measures in the ordinance. Of course, a performance metric needs to be set with sufficient stringency, and subject to quality verification, but it presents property owners with greater flexibility to realize the goals of the ordinance, and may enable the

jurisdiction to generate greater public benefit than if critical elements on a prescriptive list are exempted due to nuances of the ordinance or property characteristics.

Administration

The agencies responsible for the administration of these policies are listed in Table 5-2.

Table 5-2: Program Administration of Ordinances

Jurisdiction	Primary Administrator	Entities that Support Program Administration
San Francisco	City Department of Buildings Inspection	City's Assessors Office; Building inspectors; County register of deeds; Real estate industry.
Wisconsin	State Department of Commerce	Building inspectors; County register of deeds.
Berkeley	City Planning and Development Office	Non-profit building inspection contractor; Real estate industry.
Burlington	Burlington Electric Department	Vermont Gas; Building inspectors; Real estate industry.
Austin	Austin Energy	Texas Gas Services; Building inspectors.

A more detailed discussion of the roles and relationships of these administrative agencies is included in Appendix A. Of note, however, is that in jurisdictions which rely predominately on building energy performance, Burlington and Austin, the municipally owned utility is the primary administrator and their efforts rely on a collaborative relationship with other area utilities to share property energy usage data. BED's program administration relies on a partnership with the area gas utility, which provides the heating fuel to 98 percent of the city's properties, to determine which properties require further attention pursuant to the ordinance (Panoska 2008). "When a building comes up for sale, we work collaboratively with the gas company to evaluate the … billing data" to determine if the property needs to be inspected or if it satisfies the performance standard

(Buckley 2011). A similarly collaborative relationship exists in Austin. Though the ordinance relies on building inspectors who have been trained and certified to perform the ECAD-specific property audits, AE and Texas Gas collaborate to share information and the incentives each utility offers to improve a building's energy efficiency.

Enforcement

Enforcement mechanisms vary across the cases, but similarities exist and some keys to efficacy can be suggested. A summary of the primary enforcement mechanisms is provided in Table 5-3. The de jure actions are those specified in the ordinances; the de facto actions are those upon which administrators actually rely for the programs' operations.

Table 5-3: Ordinance Enforcement Mechanisms

Jurisdiction	De Jure Enforcement	De Facto Enforcement
San Francisco	City may pursue civil legal action.	Institutionalization in real estate processes.
Wisconsin	County register of deed will not file property transfer without certificate of RECO compliance; State may pursue legal action and issue fines.	Reliance on county registers of deeds.
Berkeley	City can place lien on property and issue fines.	Institutionalization in real estate processes.
Burlington	City may pursue legal action and issue fines.	Institutionalization in real estate processes; BED files "Violation Notices" with property records.
Austin	City may pursue legal action and issue fines.	Continued follow-up with owner of subject property; Disclosure of building energy efficiency characteristics leverages public monitoring.

While each ordinance includes the means for aggressive enforcement action from the respective unit of government in the form of fines or legal action, interviews with program administrators indicate that such powers have only been used in Wisconsin. Yet while the state had previously pursued legal action against errant owners, such efforts are

not seen as an effective use of precious resources (Hertel 2011a). In all other cases, program administrators are unaware of anytime that legal action or fines had been used to force a noncompliant owner to act (Broomhead 2011a; Buckley 2011; Kisner 2011a; LaPierre 2011a).

Instead of aggressive enforcement mechanisms, program administrators rely on the integration of the ordinances' requirements into real estate processes. For example, Wisconsin's policy requires that all county registers of deeds verify that a RECO certificate of compliance accompanies any deed transfers of subject properties (State of Wisconsin 2008). State program administrators feel that this mechanism is extremely effective, as sellers and buyers do not want their transaction suspended at the final step (Hertel 2011a). Similarly, program administrators in San Francisco, Berkeley, and Burlington rely on the institutionalization of RECO compliance within the normal processes of real estate transactions. To encourage this result, many of the program administrators devote significant efforts to educate sellers, buyers, and real estate agents about the ordinance to encourage adherence (Buckley 2011; Kisner 2011a; LaPierre 2011a). In Burlington, program administrators estimate that such efforts translate to a 97 percent compliance rate (Buckley 2011), and the city's Assistant Director of Housing and Neighborhood Revitalization comments that compliance is a "standard operating procedure" (Pine 2011).

Unique among these cases, Austin's policy may gain more watchdogs than just the program administrator, though it is too early to know. As Austin's policy seeks to provide information about the energy characteristics of a property to multiple stakeholders, the indirect pressures of prospective purchasers and tenants may provide

additional leverage to encourage improvements in the energy efficiency of subject properties.

Enforcement - Synthesis

This review suggests three lessons of program enforcement practices. Firstly, echoing a previous study on this subject, enforcement practices such as Wisconsin's that threaten the disruption of real estate transactions may effectively ensure compliance with energy efficiency ordinances at the time of sale (Suozzo, Wang, and Thorne 1997). Secondly, enforcement practices that integrate compliance into the rote processes of real estate transactions can help program administrators ensure compliance if real estate actors accept the policy. Thirdly, increases in the transparency of building energy characteristics may leverage more democratic and expansive monitoring of energy efficiency ordinances.

Costs and Connection to Energy Efficiency Programs

There are various costs associated with energy efficiency policies and the building improvements they seek to implement, including those to owners, program administration, and the price of incentives from efforts such as utility-administered energy efficiency programs to support retrofits. A more thorough analysis of these cases is required to develop a detailed understanding of all of these costs, but this review suggests that the costs tend to be manageable and are unlikely to add significant incremental cost to property sales when energy efficiency improvements are required at the time of sale.

The administrative costs of these policies, which can be reviewed more fully in Appendix A, are slight and governing jurisdictions often set the fees of document filing

and certification of ordinance-related building inspectors to cover administrative costs (Buckley 2011; Hertel 2011a; LaPierre 2011a; Panoska 2008; Suozzo, Wang, and Thorne 1997). Filing fees are borne by property owners, who also pay for the up-front costs of required energy efficiency improvements, although in many cases program administrators seek to mitigate the impacts on owners by integrating the ordinance with public incentives and utility-administered energy efficiency programs.

Within the cost caps and cost-effectiveness constraints described above, the actual cost of compliance to owners is difficult to track. Program administrators in San Francisco, Wisconsin, Berkeley, and Burlington do not have quantitative data of the actual costs of compliance to owners and it is simply too early in the operations of Austin to estimate owner costs (Broomhead 2011a; Hertel 2011a; Kisner 2011a; LaPierre 2011a; Thiels 2011). Wisconsin estimates that the cost of compliance is a "couple hundred dollars" (Hertel 2011a). Berkeley estimates that the cost is typically less than $3000, but does not track such data (LaPierre 2011c). Similarly, Burlington estimates the cost of compliance to be $650 - $750 per apartment (Burlington Electric Department 2011), though the program administrator states that BED has found tracking such costs to be nearly impossible as they are typically subsumed in financing that accompanies the property sale (Thiels 2011).

Another crucial element related to program efficacy is the policy's integration with resources available to help owners pay for energy efficiency upgrades. Interviews with the program administrators of the RECOs in San Francisco and Wisconsin suggest that they offer little support to owners of properties subject to the ordinance. Rather, administrators in both jurisdictions note that home contractors and other energy

efficiency technicians integrate the availability of resources for energy efficiency improvements into their marketing activities (Broomhead 2011a; Hertel 2011a). Berkeley's program administrator states that the city seeks to connect property owners with available energy efficiency-services through public relations activities and the city's ordinance compliance materials (LaPierre 2011a). BED and AE, on the other hand, integrate their role as program administrator into their efforts to provide conventional utility-administered energy efficiency services. Indeed, both of them use the building energy reports generated through the ordinance requirements to develop specific energy efficiency offerings from both the electric and the collaborating gas utility, to improve the property's energy efficiency (Buckley 2011; Kisner 2011a).

Impacts on Tenants

This research finds no evidence that the policies of San Francisco, Wisconsin, Berkeley, Burlington, and Austin add additional pressure to tenants' limited budgets. More detailed discussion of this theme in the context of each jurisdiction is included in Appendix A; the discussion is presented here in summarized form as the comments of the interviewees are quite similar.

Tenants in buildings improved pursuant to Berkeley's policy "simply reap the benefits," notes the city's program administrator—a comment echoed by interviewees in San Francisco, Burlington, and Austin (Biedrzycki 2011; Broomhead 2011a; Buckley 2011; Kisner 2011a; LaPierre 2011a; Pine 2011). Wisconsin's program administrator says that he has heard no complaints from tenants about the policy's impact, which one may expect as a result of tenants having little knowledge of the state's policy and the role of the administrative agency. Yet the administrator also states that his agency has "had

people complain [and say] 'I want you to come out here and go after my landlord because the windows are terrible, [and] there is no insulation,'" suggesting that at least some of the state's tenants recognize the role of the RECO policy and the administrative agency (Hertel 2011a). Burlington's program administrator similarly remarks that he has heard no one say, "'they made my building more efficient and now my rent's gone up'" (Buckley 2011). Repeated efforts to identify a local housing or tenant advocate to speak about the impacts of the energy efficiency ordinances of San Francisco, Wisconsin, and Berkeley were all unsuccessful.

Interviewees in a number of jurisdictions feel that the requirements of the respective energy efficiency policies are likely to have a limited negative impact on tenants as a result of the cost limitations and the general cost-effectiveness of basic energy efficiency measures, which lead to savings on tenants' utility expenditures. In Berkeley and Burlington, both jurisdictions where there is a cost limitation in the RECO, interviewees note that such caps limit both the energy efficiency that can be delivered to a property and, therefore, additional financial pressures on owners who might subsequently pass the cost along to tenants (LaPierre 2011a; Wimpey 2011). Additionally, a number of interviewees feel that the poor valuation of energy efficiency among tenants and the housing market in general prevents owners from charging more for efficient units. Broomhead of San Francisco feels that when viewing a potential new apartment a tenant is likely to say, "'I can't tell whether or not this place has been insulated and the water heaters wrapped, I don't even know about that stuff. [For this] apartment, the guy wants $800 a month and the guy next door wants $700 a month and I see that they're pretty much equal and in the same neighborhood, we'll go for the one

that is $700 a month'" (Broomhead 2011a). Of course, policies like Austin's that seek to provide more information about building energy efficiency to enable its valuation may alter this sentiment, but at present this research finds little evidence to counter the assertions of these program administrators.

Among the constituencies involved in Burlington's early policy discussions, housing and tenant activists sought a policy to improve rental housing and to mitigate tenants' energy expenditures without the potential of additional rent burdens. Ultimately, the city's energy advocates convinced the housing and tenant advocates that the RECO's requirements were modest and cost-effective, such that the incremental cost of the energy efficiency measures would add little to the other costs associated with a property sale. "It's tough to pinpoint, but I don't think there is anyone who, with a straight face, is going to claim that [Burlington's RECO] has caused them to make significant … rent increases" (Pine 2011). The former Director of Vermont Tenants, a tenant organizing group, and the current Director of Coordinated Statewide Housing Services for the Champlain Valley Office of Economic Opportunity notes that in the context of a property sale, where owners are already assuming the weight of a new mortgage, the incremental cost of energy efficiency measures add very little additional burden (Wimpey 2011). Comments from interviewees in Burlington and Austin support the claim that among the myriad pressures of the rental housing market, energy efficiency is simply not a major force (Biedrzycki 2011; Kisner 2011a; Pine 2011).

Interestingly, in response to questions on this theme, an energy consumer advocate in Austin wonders whether concerns about the potential of an increase in rent burden on tenants resulting from owner expenditures on energy efficiency is a

modification of the alarmist statements of the real estate industry during that city's early policy discussions. "That sounds like another way that people suddenly become very ardent low-income advocates in order to not have to do something that they should be doing." She follows with, "I'm not buying that argument … energy efficiency does not equal extravagance" (Biedrzycki 2011).

Outcomes and Policy Synthesis

This survey and related studies suggest that such ordinances have contributed to improvements in the energy efficiency of the rental sector, but poor record keeping and limited quantitative data prevent a detailed understanding of the policies' contributions. No jurisdiction has performed a formal evaluation of its ordinance, although Austin plans to do so in the future. Nevertheless, the limited data available and intimate knowledge of the individuals interviewed for this research suggest that ordinances to mandate energy efficiency standards and the disclosure of building energy information can establish a baseline of energy efficiency, enable service providers to focus on more nuanced energy efficiency services for subject properties and on deeper retrofits, and facilitate the valuation of energy efficiency in the housing market. A summary of the outcomes of the ordinances follows; a more detailed discussion of these issues can be found in Appendix A.

San Francisco

Previous studies of San Francisco's RECO provide estimates of the energy and cost savings attributable to the policy and estimate the number of properties in compliance. In a 1989 study, a former RECO program administrator referenced a 1985 study conducted by an area utility suggesting that the RECO delivered a 19 percent

decline in energy consumption for both single family homes and apartment buildings (Shelley 1989). A study by the American Council for an Energy Efficient Economy (ACEEE) in 1997 suggests that the RECO facilitated the weatherization of 160,000 housing units, 49.3 percent of all currently occupied housing units, generating an average energy savings of 15 percent per household and saving the city $6 million (Suozzo, Wang, and Thorne 1997; U.S. Census Bureau 2011b). A 2008 study reports that from 1989 to 2008, 71,103 residential properties had been inspected and comply with the RECO (Panoska 2008). However, with such claims of property compliance, one wonders how many properties technically comply with the RECO yet were exempt from performing specific energy efficiency measures, such as the insulation of attics, due to cost limitations or accessibility issues.

The city's Energy and Climate Programs Manager, Cal Broomhead, feels that the ordinance effectively facilitated the implementation of energy efficiency throughout the city in its early years, but attributes little present value to the RECO. In the 1980s, Broomhead states, building contractors effectively used the city's RECO to market their services and the policy delivered "attic insulation and [the] other measures" the ordinance requires (Broomhead 2011a). Currently, Broomhead states, "most of the accessible attics have been insulated" and as the costs of energy efficiency upgrades increased, the insulation of "attics [is frequently] exempted just because [the cost of insulation exceeds] the cap" (Broomhead 2011a, 2011b). "Therefore, insulation contractors are finding too little work [for the RECO] to warrant their attention" (Broomhead 2011b).

Coupled with previous studies of the policy, Broomhead's comments suggest that the city's ordinance effectively facilitated improvements in subject properties, but that the

marriage of the spending caps and the prescriptive nature of the policy, exempting insulation from inaccessible attics, precludes energy efficiency contractor innovation to improve the energy efficiency of a property, and thereby limits the policy's ability to deliver a benefit now. Says Broomhead, "I see it as a moribund ordinance. I think it did quite a bit of work in the 80s and the 90s, but I don't think it's doing any more work for us" now (Broomhead 2011a).

Wisconsin

Similar to the review of San Francisco's RECO, previous studies of Wisconsin's policy and the observations of program administrators suggest that it has successfully aided improvements in the energy efficiency of rental properties, but limited quantitative data prevent a strong demonstration of the ordinance's efficacy. A 1989 study cites an early RECO administrator's estimate that 95 percent of Wisconsin's rental housing was not weatherized in 1984 (Shelley 1989). The 1997 study by ACEEE attributes the weatherization of 60,000 rental properties, one-third of such properties in the state, to the RECO (Suozzo, Wang, and Thorne 1997). However, from 1985 to 1997, RECO program administration relied on paper records, only some of which have since been entered into the computer system currently used (Hertel 2011a), so these claims are difficult to verify. The current program administrator notes that as of February 2011 128,890 rental properties are certified as in compliance, which suggests that a significant proportion of the state's rental properties now enjoy the benefit of a minimum level of energy efficiency. More granular understanding of what proportion of rental housing those in compliance comprise is difficult to determine as no central database of the number of

rental properties exists and the state's computer tracking system precludes the tabulation of the number of units in the 128,890 properties (Hertel 2011a).

Berkeley

Berkeley's program administrator estimates that roughly 400 of the city's 40,000 properties change ownership annually, which gives the city the opportunity to ensure that 1 percent of its residential properties comply with the RECO each year. Records indicate that from September 2003 to December 2010 3,508 housing units, 8.7 percent of all currently occupied housing units in the city, roughly 1.2 percent of such units annually, were inspected and comply with the policy, yet the city's tracking system prevents easy distinction of whether the properties are renter- or owner-occupied (U.S. Census Bureau 2005-2009e; LaPierre 2011a). Similar to other policies, early program records were kept on paper and have not yet been entered into the current computer tracking system, so estimates of the overall RECO impacts are difficult to quantify (LaPierre 2011c).

Despite the lack of detailed RECO records, the program administrator believes, with the supporting evidence of longitudinal utility analysis, that the RECO has meaningfully contributed to the city's varied efforts to improve the energy efficiency of buildings.

> We have very non-granular energy reports from our utility showing a community-wide trend of energy reduction citywide. There are a lot of things in play. Some of it is certainly from our RECO, and certainly some of the early savings are from that. Some of it is from utility programs for energy efficiency. Some of it is due to the energy crisis that hit … California in 2000 – 2001…. We can't put actual numbers on RECO (LaPierre 2011a).

Given the nascent nature of building energy efficiency programs during the 1980s, if utility data does demonstrate a downward trend in city energy consumption around the

time of the policy's adoption, at least a correlation may exist, though further investigation is required to better understand the magnitude of the impact of the city's RECO.

Burlington

BED has tracked the number of properties and units that have been sold in the city annually, and those that have actually improved as a result of the city's efforts. BED does not, however, have estimates of the energy and financial savings resulting from these improvements, nor does it, as mentioned above, have data on the costs of the energy efficiency upgrades. So while BED's program administrator believes in the program's efficacy, he acknowledges the limitations of the claim. "We know the results are positive. We don't have cost-effectiveness, but given the short paybacks on the things we require, for the most part, we're fairly confident that overall the program has been cost-effective" (Buckley 2011).

As of early 2011, Burlington's RECO has facilitated energy efficiency improvements in 225 properties housing 630 tenant households since 1997. 630 rental units represent 6.9 percent of all currently renter-occupied housing units (U.S. Census Bureau 2011a). Assuming that some rental housing units have been constructed since 1997, the percentage of rental housing units in the City of Burlington that have had energy efficiency improvements since 1997 is greater than this percentage. The properties improved as a result of the RECO represent 26.2 percent of all rental properties sold during that period, and 24 percent of the housing units in those properties (Thiels 2011). Table 5-4 summarizes these figures.

Table 5-4: Outcomes of Burlington's RECO Policy, 1997 - 2011

	Buildings	Units
Rental Property Sales	860	2624

Number Improved	225	630
Number Improved as Percentage of Rental Property Sales	*26.2%*	*24.0%*
Source: Thiels, 2011.		

In addition to such accounting of the properties and units improved via the city's RECO, a program administrator who has worked with the policy since its initial discussions in the 1980s feels that the RECO has enabled BED to improve the energy efficiency of some of the most inefficient rental buildings in the city. "Over these 15 years we've fixed some of the worst issues out there and I think that was our real goal to begin with. You know, there were some real sieves in this town and a lot of those are a lot less leaky today than they were and they would not have gotten there without the force of law" (Buckley 2011). As the city has been able to plug some of the biggest gaps in terms of energy efficiency, BED has set its sights higher: "Most of the buildings are insulated these days. … We're just not where we were 15 or 20 years ago … as a result of this ordinance. We're really becoming generically more interested in … deeper retrofits" (Buckley 2011).

Austin

It is too early to ascribe quantitative outcomes of Austin's ECAD, but the city plans to conduct a formal evaluation of its efforts in the future (Kisner 2011a). Without a formal evaluation, anecdotal evidence available from the program administrator and an energy consumer advocate involved in the policy's development suggests that the ordinance encourages property owners to enroll in energy efficiency programs and that purchasers are using the audit results to leverage building energy performance during sales negotiations.

As of January 2011, AE's program administrator reports that 11 percent of the homes in the utility's energy efficiency programs enrolled pursuant to the ECAD. "We're seeing homes that are having audits done and getting the upgrades completed" (Kisner 2011a). Suggesting that the ECAD is affecting property negotiations, the program administrator notes that market actors are working together to amend the ordinance to determine how the audit can be available earlier in the real estate transaction process (Kisner 2011a). The consumer advocate cites similar anecdotes, noting property purchasers who appreciated the building energy information as they sought to acquire a property. "I know people who have used [the energy audit] to negotiate … the price because they found out as a result of having the audit that the air conditioner was really old and on its last legs …" (Biedrzycki 2011). Similarly, as properties with more than five units approach the June 1, 2011 deadline to complete an energy audit, AE's program administrator notes an increase in the number of properties seeking energy efficiency upgrades (Kisner 2011a).

Conclusion

This chapter provided an integrated discussion of the policy elements of these case studies. The key points of this chapter's discussion are highlighted in Table 5-5. The following and concluding chapter summarizes key findings and suggests how elements of these cases could complement existing initiatives in Massachusetts and Boston.

Table 5-5: Key Points of Case Study Policy Elements

Policy Element	Key Points
Context of Policy Adoption	• The justification of energy efficiency ordinances has grown from an effort to protect residents from rising energy costs to a concern for tenant protections and an equitable distribution of the benefits of energy efficiency to a need to confront climate change.

	• Economic development opportunities offer compelling support for energy efficiency ordinances. • The real estate industry is a common opponent of energy efficiency ordinances. • Adoption of energy efficiency ordinances often relies on clear expressions of support from a major governing actor and the deliberations of a stakeholder group. • Municipally owned utilities can provide strong support for the development and administration of energy efficiency ordinances.
Applicability	• Energy efficiency ordinances often seek to capture the potential energy efficiency in buildings not covered by prevailing energy codes and which have not recently participated in energy efficiency programs, such as those commonly offered by utilities.
Triggers	• Setting the point of implementation to transfers in ownership can mitigate the impact of costs to improve the energy efficiency of rental buildings, as they can be integrated into the financing packages of the acquisition.
Requirements	• Energy efficiency ordinances can mandate physical standards according to a prescriptive list of measures, seek adherence to a threshold of building performance, and facilitate the disclosure of building energy information among current and prospective tenants and owners. • Adherence to the requirements of an energy efficiency ordinance may depend greatly on technological capacity and access to building information.
Compliance	• Cost and access limitations may challenge implementation of energy efficiency measures. • Such limitations ought to appropriately balance the additional cost burden on tenants and owners and the energy efficiency benefits of the ordinance's requirements. • Cost containment measures should track the costs of housing and building improvements over time, rather than provide a static limit. • Performance metrics, though more complicated and in need of verification, may be preferable to prescriptive requirements.
Administration	• Reliance on a performance metric requires ready access to building information, such as may be provided by municipally owned utilities.
Enforcement	• The de jure and de facto enforcement mechanisms of energy efficiency ordinances may vary. • Effective enforcement mechanisms may be those that 1) seek to institutionalize adherence to the energy efficiency ordinance into real estate transactions, 2) present the possibility that real estate transactions may be stopped for noncompliance, and 3) increase access to building energy information such that additional parties can help monitor compliance.
Costs and Connection to Energy Efficiency Programs	• Little data exists, but the costs of energy efficiency ordinances to owners and administrative agencies seem slight, especially when integrated into larger property financing packages at time of sale. • The integration of energy efficiency ordinances and utility-administered energy efficiency programs may effectively enhance the energy efficiency of rental buildings.
Impacts on Tenants	• Tenants in jurisdictions with energy efficiency ordinances have not complained of additional rent burdens resulting from the policy. • Cost caps and cost-effectiveness limitations of energy efficiency ordinances may protect tenants from undue additional rent burdens

	incommensurate with decreases in utility expenses generated by energy efficiency measures. • The limited valuation of energy efficiency in the rental housing market may mitigate owners' ability to charge more rent for efficient buildings, but efforts to enhance the disclosure of building energy information may challenge this status quo.
Outcomes	• Limited quantitative data of the outcomes of energy efficiency ordinances exist, but the intimate knowledge of program administrators and other observers suggest that ordinances such as those analyzed can 1) establish a floor of energy efficiency in rental buildings; 2) enable energy efficiency program administrators to focus beyond basic retrofits; and 3) facilitate the valuation of energy efficiency in housing markets.

Chapter Six: Conclusion: Ordinances as Means to Improve the Energy Efficiency of Rental Housing

This chapter concludes the thesis by providing a summary of the core findings and placing energy efficiency ordinances in the context of the earlier discussion of barriers and strategies to deliver energy efficiency in rental housing. In addition, this chapter suggests the key elements of such ordinances and avenues for policy application in Massachusetts, and specifically Boston.

Ordinances Complement Existing Strategies

The review of the ordinances of San Francisco, Wisconsin, Berkeley, Burlington, and Austin suggests that such policies can effectively improve the energy efficiency of rental properties. While limited quantitative data prevents a clear understanding of the financial and energy savings, the experiential knowledge of program administrators and observers indicate that such municipal ordinances can establish a minimum standard of energy efficiency in rental housing at limited cost to owners and with little cost burden on tenants. Additionally, comments of those monitoring the policies of San Francisco, Burlington, and Austin suggest that with such a floor, program administrators and others seeking to improve the energy efficiency of rental properties can focus beyond basic retrofits—to effectively raise the ceiling. Lastly, the experiences of program administrators and related parties in Wisconsin, Burlington, and Austin suggest that their policies facilitate the valuation of energy efficiency in the housing market. However, future efforts to enact ordinances such as these, or elements thereof, need to employ better data collection to determine the magnitude of the contributions.

Energy efficiency ordinances present strategies to further combat the barriers to improved energy efficiency in rental housing and open new fronts on challenges heretofore unmet. Table 6-1, a modified representation of the barriers and strategies discussed in Chapters Two and Three, identifies where these ordinances can further facilitate retrofits.

Table 6-1: Summary of Barriers and Strategies to Enable Energy Efficiency in Rental Housing

Barriers to energy efficiency in rental housing	Strategies that address the barrier
Information	
Poor building and energy data / transaction costs	Energy efficiency standards and disclosure ordinances Utility-administered programs* Partnerships with municipalities and communities* Public incentives*
Poor valuation of energy efficiency	Energy efficiency standards and disclosure ordinances Building labeling*
Fragmentation	
Split incentive	Energy efficiency standards and disclosure ordinances Partnerships with municipalities and communities* Utility-administered programs*
Diversity of ownership	Energy efficiency standards and disclosure ordinances Utility-administered programs*
Lack of capital	Public incentives* Utility-administered programs*
Additional	
Low vacancy rate	Energy efficiency standards and disclosure ordinances
High tenant turnover	Energy efficiency standards and disclosure ordinances
Owner reluctance to third party inspection	Energy efficiency standards and disclosure ordinances

* New or recent increase in activity

The primary benefits of energy efficiency ordinances that mandate standards and the disclosure of building energy information are their applicability across fragmented markets and the greater availability of information to provide tenants and owners with estimates of the value of building energy performance. The provision of information and

standards can challenge multiple barriers, including the lack of information, the split incentive, the diversity of ownership characteristics, the poor valuation of energy efficiency, low vacancy rates, high tenant turnover, and owners' reluctance to third party inspectors. For some of these barriers, such strategies work because of the nature of a mandate: given certain conditions, an action is required regardless of the party responsible for the utility payments, the ownership type, market conditions, or an owner's discomfort with outside parties. Public mandates are often controversial, but like the adoption of the first housing codes at the turn of the 20th century and building energy codes in the 1970s, the public good the mandate generates justifies the action and adoption depends on political will. For other barriers, such as the lack of information and the poor valuation of energy efficiency, mandated standards and energy information can provide the motivation and means to achieve the public objective. Furthermore, with the disclosure of building energy information, tenants are able to make more informed decisions of the potential utility expenses in their next apartment, which converts the high turnover barrier into a continuous, indirect pressure on owners to retrofit their buildings.

Opportunities for Energy Efficiency Ordinances in Massachusetts

Adoption of energy efficiency ordinances in Massachusetts is a logical extension of the current strategies, discussed in Chapter Three, to improve the energy efficiency of rental buildings. With a cold climate, an old building stock, and high rates of tenant-occupied housing in cities, Massachusetts' municipalities are prime locations. Such policies complement the initiatives of state and local governments seeking to meet GHG reduction targets and enhance opportunities for economic development while supporting a more equitable distribution of the benefits of improved energy efficiency in residential

properties. When adopting such an ordinance, municipalities should include the following elements: 1) a time of sale trigger; 2) the disclosure of building energy information; 3) a performance metric; and 4) enforcement through institutionalization and accountability. Furthermore, partnerships among municipalities, CBOs, and utilities provide a climate that is ripe for policy adoption and effective implementation.

Time of Sale

To consider the potential contribution of a time of sale policy, recall the discussion of Boston's triple-deckers in Chapter One and suppose a time of sale ordinance applies to such properties that are rentals and were built before adoption of the state's building energy codes in 1975. Furthermore, the ordinance mandates an energy efficiency standard at the time of sale satisfied through the upgrades modeled in the VEIC study. Assuming that 50 percent of the subject properties need the insulation and air sealing improvements to comply and that tenants occupy 62.7 percent of these 13,807 three-family dwellings, as is the rate of tenant-occupied housing units citywide, the ordinance triggers retrofits of 4,328 properties. Applying the average 4.9 percent sales rate of the city's three-family dwellings in the last decade, approximately 212 properties would trigger the ordinance and require upgrades costing $14,847 per property as the VEIC estimates (City of Boston 2011). In year one, the total cost of the retrofits is $3.2 million, which generates a savings of $579,000 for the residents. Expanding this scenario from 2011 through 2020 the total cost of the upgrades is $31.5 million. The lifetime savings of a durable improvement like insulation in the 2,122 tenant-occupied housing units the policy retrofits, estimated to accrue over the 10 years subsequent to these phased-in upgrades, is $57.8 million. Such upgrades would save over 400 billion BTUs

of energy, the carbon dioxide equivalent of over 20,000 metric tons in GHG emissions, or the annual GHG emissions of nearly 4,000 automobiles (City of Boston Assessing Department 2010; U.S. Census Bureau 2005-2009b; Vermont Energy Investment Corporation 2009; U.S. Department of Energy 2011).

Though these costs look large, they are not burdensome. Per building, the cost is 3.7 percent of the average assessed value of the three-family properties in the City of Boston built before 1975 (City of Boston Assessing Department 2010). Such a rate is slightly higher than the cost limitations of the ordinances reviewed in this thesis. For example, Burlington's policy caps the owner's contribution at 3 percent of the sales price and includes a per unit limit of $1,300. Of course, public incentives and utility-administered programs can bring down the cost of this retrofit, but even when simply factored into acquisition financing, such upgrades are manageable. Assuming a 20 percent down-payment on a pre-1975 triple-decker selling for the average assessed value of such properties with a mortgage at 7 percent interest and a 30 year term, the monthly mortgage payment is $2,118. Spread evenly among three rental units, the debt service accounts for about $706 of the monthly rent. Adding the full cost of the upgrades in the VEIC model to the property acquisition and assuming that no public or utility-administered incentives are available, the monthly debt service increases to $2,197, or $732 per unit. The VEIC model projects an annual savings of $909 in energy costs per apartment, about $75 per month, which compensates for the $26 incremental cost of the retrofit in the debt service likely to be passed along to tenants in the form of a rent increase. Tenants get better housing at a lower cost, the owner's asset improves, and society and the environment get the benefits of lower GHGs.

While the idiosyncrasies of buildings and energy and housing markets requires that such estimates rely on more granular data and calculations than these, this simple analysis suggests that the energy efficiency potential in rental housing is significant, particularly in cities with an old housing stock and a large proportion of tenant-occupied housing units, and that a time of sale ordinance could facilitate environmental, economic, and social benefits.

Information Disclosure

In addition to a time of sale policy, one that facilitates the disclosure of building energy performance is a logical action to value energy efficiency in the housing market, to furnish tenants with information related to the living expenses of a new apartment, to increase the indirect pressure on owners to improve the efficiency of their properties, and to provide program administrators, such as utilities, with more information to offer nuanced services. Furthermore, such disclosure can help municipal-CBO-utility partnerships, like Renew Boston, to target limited resources on those buildings with the greatest energy use. Currently, notes Larry Chretien of Mass Energy Consumers Alliance, one of two organizations administering the Renew Boston program, efforts to enroll a rental property in energy efficiency programs are extremely time-intensive. Such work takes twice as long as efforts to enroll an owner-occupied home simply because program administrators must coordinate with both the owner and the tenant (Chretien 2011). While more complex coordination of energy efficiency efforts in rental housing may be expected due to the number of the parties involved, opportunities to focus such partnerships' outreach on those properties with high energy use would return greater energy efficiency per dollar than outreach efforts that blanket entire neighborhoods,

effectively treating all buildings as if they are identical. As Chretien remarks, "I think the whole program really ought to be targeting people on the right side of the bell curve in terms of energy consumption" (Chretien 2011). The disclosure of building energy information can facilitate precisely such targeting.

Performance Metric

When adopting an energy efficiency ordinance, the use of a performance metric based on data, such as the energy use and square footage of a property, is one useful medium to disclose information and against which to measure building characteristics and require energy efficiency standards. The metric is preferable to a prescriptive requirement as cost caps, policy elements frequently adopted to placate real estate interests, and building accessibility limitations can prevent fulfillment of a prescriptive list. Additionally, when married to mandatory standards at certain points, such as time of sale or by a certain date, a performance metric can permit program administrators to target limited resources to the worst performing buildings, thereby establishing a floor of energy efficiency which continually improves over time.

However, ordinances founded upon a performance metric have limitations as the requisite data inputs may be difficult to compile and the energy use characteristics of building occupants, rather than the building itself, may skew the metric. A metric based on energy use per square foot can be easily calculated if the agencies likely to have such information, utilities and municipal assessors' offices, collaborate to produce the metric. As the cases of Burlington and Austin demonstrate, such data sharing is possible between public agencies and private utilities, yet these jurisdictions also have municipally owned electric utilities, which may provide the gas utilities with greater comfort when sharing

the data. In areas where both utilities and municipalities seek opportunities to engender improved energy efficiency in residential building, such data sharing can be mutually beneficial.

Even if data sharing protocols are established, the nature of such a performance metric is challenged by the poor granularity of the metric itself, which conflates the energy characteristics of both the building and its occupants. Nevertheless, the current availability of the data elements of such a performance metric merits its implementation until a viable alternative is feasible at scale. An asset label, as the Massachusetts Department of Energy Resources seeks to develop, may better represent building characteristics without the potential for residents' behavior to skew the metric. While such an initiative has clear merit, it is still in a pilot stage and is likely years away from widespread implementation. In its absence, a performance metric of BTUs per square foot rests on data currently available. Averaging across the units of a property and several years of energy data may result in a metric less skewed by isolated behaviors. Where a poor ranking results from occupants' behavior, such information can target energy efficiency resources to encourage a behavior change.

Enforcement

All well-designed ordinances have an enforcement provision. The case studies of this thesis suggest that successful enforcement practices of energy efficiency ordinances are those that institutionalize the requirements into the on-going processes of real estate transactions and those with the ability to halt real estate transactions for noncompliance. Through institutionalization, policy adherence becomes a standard operating procedure and the real estate community can facilitate compliance. While these two enforcement

avenues may seem in contradiction, an effective energy efficiency ordinance should incorporate both: seek to institutionalize the ordinance in common real estate practices and reserve the opportunity to strenuously enforce the policy where responsible parties are negligent.

Climate for Policy Adoption and Implementation

Partnerships among the city, CBOs, and utilities provide a welcome environment for such policies. These coalitions offer a unique and valuable blend of expertise and resources to adopt and effectively implement an energy efficiency ordinance. Municipalities have detailed property records and the ability to motivate residents around common objectives. CBOs can offer organized networks to inform, mobilize, and support residents affected by the policy. Utilities can provide valuable information on building energy use and the resources to implement large-scale energy efficiency programs.

The adoption of such policies simply requires a spark, which can come from any member of such a partnership while the others can provide mutual support. The initiative of cities can capture the support of utilities seeking to satisfy their state mandated energy efficiency goals and constituents in rental housing. CBOs can deliver the real benefits of energy efficiency to their members and utilities can use such policies to channel residents into their programs. The greatest benefit and support for adoption of such an ordinance may be available to municipalities that act first, as the state encourages utilities to offer generous assistance and subsidies to jurisdictions testing innovative strategies.

Of course, adoption of an energy efficiency ordinance may not be a simple matter. For example, policymakers ought to expect resistance from the real estate industry, as the

cases in this thesis suggest. Yet these cases highlight that community stakeholder processes can overcome political hurdles. Quality information, analysis by a respected party, and the establishment of a community stakeholder process representing the constituencies affected by the proposed ordinance can be the building blocks of a policy development process that addresses the concerns of those involved and illuminates a path for adoption. Analysis such as that of the triple-decker above enables parties to consider the potential impacts of such a policy and to design programs to mitigate concerns. For example, if such a municipal policy were integrated into pre-existing municipal-CBO-utility partnership efforts, offerings of deeply subsidized retrofits could assuage early hesitation and subsequently yield to financing programs.

Conclusion

There is great potential for improvements in the energy efficiency of rental properties, particularly in cities, which have a high concentration of such buildings and where the housing tends to be older than in other jurisdictions. Municipal ordinances can effectively tap this potential and deliver the environmental, economic, and social benefits of energy efficiency to tenants and cities.

This thesis investigates the ordinances of five jurisdictions that mandate efficiency standards or building energy information disclosure and finds that these strategies can 1) deliver a minimum standard of energy efficiency in rental housing; 2) enable program administrators to focus attention beyond basic weatherization to deeper retrofits; and 3) facilitate the valuation of energy efficiency in housing markets. Energy efficiency ordinances can complement existing efforts to retrofit rental housing through their applicability across fragmented housing and energy markets and their ability to

provide information, which facilitates the valuation of a property's energy efficiency. Policies that rely on a time of sale trigger, disclose energy information, are based upon a performance metric, and include proper enforcement provisions can deliver improved energy efficiency in rental housing, reduce GHG emissions, and stimulate local economic development. Adoption of such a policy is a logical step for a municipality seeking aggressive action to address global environmental and energy challenges, and newly emerging partnerships among municipalities, CBOs, and utilities offer a blend of mutually reinforcing resources to adopt and effectively implement an ordinance that delivers the twin goals of efficiency and equity.

Areas for Future Research

A number of policy areas related to this research deserve greater scrutiny. While this study finds little evidence of additional expense burden on tenants as a result of mandatory energy efficiency standards, further research of the issue is warranted. The presentation and discussion of the issue here relies on qualitative, experiential data of program administrators and others involved in the ordinances. In addition, those involved in energy efficiency efforts in Massachusetts note that the pre-existing conditions of rental properties often present a challenge to building improvements. As Penelope Conner, Vice President of Customer Care for NSTAR, a major utility in the state notes, "I cannot put insulation in an [attic] if they've got holes in the roof" (Conner 2011). The magnitude of these problems is not well understood (Chretien 2011), but significant efforts may be necessary to overcome such "pre-weatherization" issues. Those seeking more information on this subject and avenues to address the problem may consider further investigation of the efforts of Berkeley and Burlington, where

interviewees note that pre-weatherization is not a major barrier due to effective municipal housing inspection services (Buckley 2011; LaPierre 2011a).

Appendix A: Detailed Case Study Descriptions

Research Methods

The research methods for this thesis included archival research of each case study policy and interviews with key individuals. In all cases except San Francisco, interviews were conducted with an individual involved in the policy's program administration. Unable to access this individual in San Francisco, an interview was conducted with the city's Energy and Climate Programs Manager. Interviews were also conducted with consumer, housing, and tenant advocates to understand the policies' adoption, implementation, and impact on tenants, but in some cases such efforts were unsuccessful. To develop a better understanding of how the lessons of such policy experiments could be applied to the Massachusetts and Boston context, a number of interviews were conducted with individuals involved in local energy efficiency efforts. A complete list of those interviewed for this thesis can be found in Appendix B.

San Francisco

Population:	797,271
Number of occupied housing units:	324,185
Rate of tenant-occupied housing units:	62.0 %

Source: U.S. Census Bureau 2011b

Policy Summary

In 1982, the City of San Francisco amended its building codes to include a Residential Energy Conservation Ordinance (RECO) that mandates energy efficiency improvements in residential properties at the time of sale, major property renovations, a conversion from master- to sub-metering, or a conversion to condominiums. The policy applies to privately owned rental- and owner-occupied housing, and requires that subject

properties are outfitted with a list of prescriptive measures intended to improve energy efficiency. An inspector verifies property compliance, and expenditures pursuant to the RECO are limited (City of San Francisco 1991). Previous studies of the San Francisco RECO suggest that the policy has been effective (Shelley 1989; Suozzo, Wang, and Thorne 1997), but no formal evaluation has been conducted. The current Energy and Climate Programs Manager of the City of San Francisco acknowledges its historic efficacy but ascribes little incremental value to the policy at this point due to its prescriptive nature and the magnitude of the climate and energy problems the city faces (Broomhead 2011a).

Context for Policy Adoption

San Francisco's RECO emerged from an extended public process involving a committee created by the city's Board of Supervisors to develop proposals to protect residents from the energy crises after the 1970s (Broomhead 2011a). The preamble to the RECO legislation explicitly cites the Board of Supervisor's findings that the "citizens of San Francisco will continue to experience rapid increases in the cost of home energy and uncertainty as to the availability of future home energy supplies," and highlights the economic and community benefits of improved energy management, including "the lowering of housing costs, stimulation of the local economy and creation of local jobs" (City of San Francisco 1991). The ordinance notes that two-thirds of the city's housing is rental and while recognizing successful energy efficiency efforts in owner-occupied housing the legislation states that "little progress has been made in improving the energy efficiency in rental housing" regardless of whether the tenant or the owner pays the utilities (City of San Francisco 1991). Despite the public process to develop the

legislation, the bill faced significant opposition and passed on a 6-5 vote of the Board of Supervisors (Shelley 1989).

Applicability

San Francisco's RECO applies to privately owned single, multi-unit, and condominium properties built before July 1, 1978 whether the tenant or owner is responsible for the utility bill (City of San Francisco 1991). Properties built after that date must comply with the state's building energy code (Suozzo, Wang, and Thorne 1997), so the policy seeks to capture the energy efficiency potential in existing properties not subject to the new construction codes. The policy also applies to residential portion of mixed-use properties. RECO exemptions are permitted under certain circumstances, such as title transfers within families, those pursuant to foreclosures, and in other instances of hardship and estate settlement (City of San Francisco 1991).

Triggers, Requirements, Compliance, and Public Access to Building Information

Subject properties must comply with the city's RECO when ownership is transferred to a new entity or in the case of major renovations. When such events occur the seller must obtain an energy inspection by a certified party to ensure compliance with the RECO standards, though the responsibility may be transferred to the purchaser under certain conditions. To transfer responsibility of RECO compliance, the seller and purchaser must agree, an energy inspection must be completed prior to the property transfer, and an escrow fund sufficient to pay for the estimated costs of compliance must be established. The new owner must perform the work identified in the RECO inspection within 180 days after purchasing the property. RECO compliance is also required at the

time of major property renovations, determined by a cost threshold specified in the policy for different property sizes, as well as at the time of metering and condominium conversions (City of San Francisco 1991).

Compliance with San Francisco's RECO is satisfied through a property's adherence to the prescriptive list of elements identified in the policy. Subject properties are required to install ceiling insulation in accessible spaces, apply weather-stripping, caulk and seal major cracks and to use a water heater insulation blanket. Additionally, buildings with three or more units are required to insulate hot water and steam pipes, and to perform re-commissioning, or a tune-up, of the property's boiler if it has not been serviced in the last five years. However, the total costs of compliance are limited and if the installation of any required measure is deemed not cost effective, that measure is not required. If the amortized cost of the measure's installation over its useful life is greater than the estimated savings, the measure is considered not cost effective. The cost limitations are set by the legislation, and were pegged at the average price to perform the RECO requirements at the time of the RECO's adoption (Broomhead 2011a). For all properties, spending is limited to one percent of the property's purchase price or one percent of its assessed value whichever is greater. For buildings of two units or less, RECO expenditures are capped at $1,300 (City of San Francisco 1991).

San Francisco's Energy and Climate Programs Manager, Cal Broomhead, notes that the policy's cost caps may result in limited energy savings. Spending limitations were adopted as "palliative to the real estate industry and to the home mortgage folks who didn't want to see a big hit," but over time, as the costs of energy efficiency improvements increases the spending caps have resulted in property compliance with

RECO without implementing important energy efficiency measures (Broomhead 2011a). Additionally, Broomhead suggests that the prescriptive nature of the policy limits its efficacy. Exemptions for energy efficiency measures, such as insulation in inaccessible attics, are common as the cost exceeds the RECO's spending cap. Yet in such circumstances the property can still be considered in compliance with the policy. Once such compliance is registered with the city it is not reviewed again upon future property transfers (Broomhead 2011a).

Compliance with the RECO is satisfied when a certified inspector has reviewed the property for adherence and filed a certificate of compliance with the San Francisco Department of Building Inspection (DBI). The owner of the property is to file a copy of the certificate with the San Francisco County Recorder's Office (City of San Francisco 1991).

Properties' certificates of compliance are accessible to the public at the offices of the Department of Buildings (City of San Francisco 1991).

Administration and Enforcement

San Francisco's RECO is administered by the city's DBI, which collaborates with the city's Assessors Office to check compliance of properties transferred against the DBI's RECO records (Suozzo, Wang, and Thorne 1997). Current city staff lament the administrative and enforcement challenges of the city's RECO. While the current administration system may result in an understanding of whether a property complies, it provides little information about the type of improvements that were performed and the incremental value of the policy. Referencing an attempt in the 1990s to study the RECO policy, Broomhead recalls that an earlier researcher struggled to find accessible,

informative data beyond interviews with city employees and contractors. Explaining the problem, the city's Energy and Climate Programs Manager notes that the city's RECO management system is only able to determine whether the property complies or does not comply:

> The administrative method is a tiny piece of paper, smaller than a postcard, that somebody signs-off on and staples to the escrow package and it ends up as a checkmark at the Recorder's Office. So there is no information there about what was done, just that it has been done, met RECO. What the hell does that mean? Did they have to install attic insulation or was it exempt? What about the ducts? Were they sealed or were they exempted because they had asbestos? … What was done? There is no information about that at all. Just done or not done (Broomhead 2011a).

Program administrators have also cited poor quality control as a problem. A previous review of the policy highlights the challenge of consistent, standardized RECO inspections due to a reliance on private inspectors (Panoska 2008).

Responsible parties who do not comply with the RECO are subject to civil actions initiated by the city, but according to Broomhead the city has never pursued such action. Instead, the city relies on real estate agents to ensure compliance through sales transactions, believing that they seek to avoid any potential liability should clients be targeted for noncompliance (Broomhead 2011c).

Costs and Connection to Energy Efficiency Programs

The fees charged for filing, the certification of inspectors, and property inspections cover the city's program administration expenses (Panoska 2008; Suozzo, Wang, and Thorne 1997). Such fees, itemized in Table A-1, cover the costs of a city clerk and information systems technician to manage the filing and the database that tracks

properties. Property owners pay for the inspection, generally conducted by private inspectors who set their own rates (Panoska 2008).

Table A-1: Filing and inspection fees for San Francisco's RECO		
	One and two unit properties	Properties with three or more units
Filing fees		
Compliance energy reports and certificates	$10.00	
Appeals	$43.05	
Certification for inspectors	$20.50	
Inspection fees		
Initial inspection	$52.00	$58.30 – $116.55
Compliance inspection	$26.00	$28.60 - $58.30
Table adapted from Panoska 2008.		

The city does not seem to actively encourage property owners who must comply to take advantage of utility-administered energy efficiency or other financial incentives. Instead, the city notes that contractors seeking to perform RECO-related work for property owners frequently tout available financial incentives as they market their services (Broomhead 2011c).

Impacts on Tenants

Evidence of the impact of San Francisco's RECO on tenants is difficult to find, but city staff believe that tenants benefit from the improved energy efficiency of residential properties subject to the ordinance and suffer little negative impact. The city's staff feels that "tenants that live in homes that have had improvements clearly benefit" and notes that because tenants ascribe little value to energy efficiency, as compared to more aesthetic qualities of housing units, owners have little ability to charge more for an energy efficient unit. Broomhead cites the invisibility of energy efficiency measures and scant public understanding of energy efficiency as barriers to landlord efforts to charge more for energy efficiency. If a tenant visits a potential new apartment, "looks at it and

[says] 'I can't tell whether or not this place has been insulated and the water heaters wrapped, I don't even know about that stuff. [For this] apartment, the guy wants $800 a month and the guy next door wants $700 a month and I see that they're pretty much equal and in the same neighborhood, we'll go for the one that is $700 a month'" (Broomhead 2011a).

Several attempts to interview tenant and housing advocates about the effects of San Francisco's RECO on tenants in the city were unsuccessful.

Outcomes

Previous attempts to measure the outcomes of San Francisco's RECO policy suggest that the program has provided a benefit to the city and tenants, but current city staff question its value and seek improvements and other policy initiatives to deliver energy efficiency to rental properties. In a 1989 study of San Francisco's RECO, which consisted of an interview with the DBI's Chief of Apartment and Hotel Inspections, the DBI Chief references a 1985 study by Pacific Gas and Electric that found a 19 percent decline in energy consumption for properties, both single-family homes and apartments, that were improved pursuant to the RECO (Shelley 1989). A 1997 study by ACEEE reported that since the RECO's adoption, the policy had facilitated the weatherization of 160,000 housing units generating an average household energy savings of 15 percent, saving $6 million citywide (Suozzo, Wang, and Thorne 1997). From 1989 to 2008, the city reported that "71,103 residential properties [had] been inspected and [comply] with the ordinance" (Panoska 2008). However, amid mention of the thousands of units in compliance, one wonders how many such properties were exempt from specific measures due to cost limitations and accessibility.

Broomhead feels that the RECO effectively delivered energy efficiency to rental properties in the 1980s and 1990s, but that recently the policy has delivered little energy efficiency. In the 1980s contractors actively leveraged the RECO for marketing purposes and the policy was "able to deliver attic insulation and [the] other measures" (Broomhead 2011a). Yet as time passed and as costs increased, Broomhead questions the incremental value of the RECO. The policy "is adding very little to the overall efficiency of the sector. Most of the accessible attics have been insulated; therefore, insulation contractors are finding too little work to warrant their attention" (Broomhead 2011b) and many "attics were getting exempted just because [the cost of insulation exceeds] the cap" (Broomhead 2011a). In 2002, Broomhead surveyed San Francisco contractors to understand whether they were getting work as a result of the RECO. "They said they were getting very little business. They were wrapping a water heater. They were insulating some pipes, maybe…. It wasn't worth it for them to go out and market anymore" (Broomhead 2011a).

Broomhead reports that San Francisco is exploring new methods to encourage energy efficiency including the establishment of a building rating system. He hopes that such a system is powerful enough to overcome the split incentive for the majority of the market, but acknowledges that a mandatory ordinance may be required to pick up laggard properties when owners do not install energy efficiency measures by voluntary means (Broomhead 2011a).

Broomhead's comments paint an intriguing picture of San Francisco's RECO. His comments, coupled with previous studies of the policy, suggest that the city's RECO effectively facilitated improvements in subject properties, but that its program structure,

especially the firm cap on expenses and the exemptions pursuant to the limited crawl space in many of San Francisco's attics, limits the policy's ability to deliver additional benefit. The marriage of the spending caps with the prescriptive nature of the policy preclude, perhaps, contractors proficient in improving the energy efficiency of a property from performing additional, innovative methods. Says Broomhead, "I see it as a moribund ordinance. I think it did quite a bit of work in the 80s and the 90s, but I don't think it's doing any more work for us" (Broomhead 2011a).

Wisconsin

Population:	5,599,420
Number of occupied housing units:	2,246,512
Rate of tenant-occupied housing units:	30.1 %

Source: U.S. Census Bureau 2011c

Policy Summary

Wisconsin seems to be the only state in the nation with an operational RECO policy. The state's Rental Weatherization Program was adopted in 1985 and seeks to "establish minimum energy efficiency requirements for rental units" (State of Wisconsin 2008) in order to save energy costs (Hertel 2011a). For rental properties constructed before adoption of the state's building energy codes, the policy requires an inspection and certification that the property meets certain energy efficiency requirements before it can be sold to another owner. Compliance with the policy can be satisfied either by adherence to a list of prescriptive energy efficiency measures or through satisfaction of an energy performance metric (State of Wisconsin 2008). There are no firm cost limitations to the policy, though specific measures may be exempted if the payback period is greater than five years (Panoska 2008). While little quantitative data exists to

demonstrate the energy and cost savings generated by Wisconsin's RECO, it has established a baseline of energy efficiency measures in more than 100,000 properties (Hertel 2011a).

Context for Policy Adoption

The oil embargo of the mid-1970s was a major impetus behind Wisconsin's RECO which seeks to improve the energy performance of existing buildings, to create protections for tenants, to decrease energy consumption, and to create jobs within the state (Shelley 1989; Suozzo, Wang, and Thorne 1997). At the time of policy adoption, advocates argued that improvements in the energy efficiency of rental housing in Wisconsin could deliver an economic benefit, a theory similar to that of the climate action plans adopted in recent years, including those of Boston and Massachusetts (City of Boston 2010a; EOEEA 2010). Analysts and advocates highlighted the state's reliance on energy imports, which caused local dollars to flow out of state rather than stimulate local economic activity (Kirschling, Pnazek, and Moore 1982).

Wisconsin's real estate industry fought against the adoption of the state's RECO, winning some exclusions, including all owner-occupied properties up to four units (Shelley 1989). The real estate industry continued to challenge elements of the policy and successfully eliminated some of the requirements through amendments in 1998 (Hertel 2011a).

Applicability

Wisconsin's RECO applies to all rental units constructed before the adoption of the state's building energy codes in 1976 and 1978. However, owner-occupied properties with four units or less and seasonal habitations not occupied during the winter are

exempt. The RECO applies to mixed-used facilities; its application to the whole facility or only to the building's residential space depends on the proportion of the property comprised by residential use. Wisconsin's policy applies regardless of whether the landlord or the tenant pays the utility bill (State of Wisconsin 2008).

Triggers, Requirements, Compliance, and Public Access to Building Information

Adherence to the RECO is required when ownership of subject properties are transferred between owners. Some transfers, such as those between household members, pursuant to corporate mergers, foreclosure, and some financial hardships, are exempt.

Wisconsin's RECO requires owners of properties subject to the policy to hire an inspector to verify compliance with the policy. Compliance can be satisfied either by verification of installation of the prescriptive measures listed in the policy or by meeting a performance metric. The prescriptive measures include common energy efficiency measures, such as the insulation of accessible attics, ducts, and pipes. Windows are to be double paned or fitted with storm windows, unless the property can pass a blower door test that demonstrates a well-sealed thermal envelope. Annual space heating energy usage data determines RECO compliance through the performance metric, which was permitted after amendments in 1998 (Hertel 2011b). To comply, properties must satisfy the thresholds specified in Table A-2 (State of Wisconsin 2008).

Table A-2: Maximum Annual Space Heating Energy Use for Units Pursuant to Wisconsin's RECO (BTUs per square foot, per heating degree day)

Number of Dwelling Units	Certificate of Compliance Issued Prior to Sale[1]	Certificate of Compliance Issued after Sale[1]
1- 8 Dwelling Units	9.0	7.0
9+ Dwelling Units	7.0	5.0

[1] refers to property transfers after March 1, 1999

Source: State of Wisconsin 2008.

Certificates of compliance accompany property records when a deed is transferred and filed with a county-level register of deeds. An additional copy is sent to the state administrative agency, which tracks property compliance. Compliance can be delayed by one year if the property owner gains approval of the state and files a stipulation with the deed. Property owners can get a waiver of RECO responsibilities if the building is to be demolished within two years of a title transfer) (State of Wisconsin 2008).

The state's administrative agency provides access to property compliance records via the internet (Wisconsin Department of Commerce 2011). Program administrative staff note that purchasers and home contractors use such public access to target properties for purchase and to market their services (Hertel 2011a).

Administration and Enforcement

Wisconsin's Department of Commerce administers the state's RECO, though implementation requires the cooperation of departmental-approved inspectors who review subject properties, and county-level registers of deeds throughout the state to enforce the program. One full-time staff-person manages the daily operations of the program. The state charges a $50.00 fee for each property's certification, which generally covers the state's administrative costs for the program (Hertel 2011a).

Enforcement of Wisconsin's RECO relies on the cooperation of the county registers of deeds throughout the state, which the state considers an effective enforcement mechanism (Hertel 2011a). A certificate of compliance, a stipulation, or a waiver pursuant to the RECO policy must accompany any deed transfer at the time of filing with the county register of deeds (State of Wisconsin 2008). For those properties transferred with a stipulation, indicating that RECO compliance will be satisfied within one year, the

Department of Commerce issues reminder notices at six and nine months following the date of property transfer to facilitate RECO compliance. Non-compliance can result in legal action and fines, and while the state has previously pursued legal action it is not generally performed as such efforts consume scarce resources (Hertel 2011a).

State program administrators feel that current enforcement mechanisms are effective. When county registers encounter property sellers and buyers seeking to file a deed with an open stipulation, meaning the ownership of the subject property was previously transferred with a stipulation that it should have complied with the RECO within one year of the initial transfer, the register will not file the deed because of the cloud on the property's title (Hertel 2011a). Compliance is then left to the property seller and buyer to resolve before the register will file the deed for the second transfer.

Costs and Connection to Energy Efficiency Programs

The state establishes a cap on the fees inspectors may charge property owners to determine compliance, though the program administrator estimates that the average property inspection costs $125, which he believes is often in excess of the costs of the necessary energy efficiency upgrades to ensure compliance (Hertel 2011a; Panoska 2008). However, the state's record-keeping system does not track the actual costs of compliance for property owners (Hertel 2011a).

Wisconsin's RECO program administration does not appear to be well integrated with available public incentives or utility-administered energy efficiency programs. An interview with a program manager suggests that while owners may access low-interest loans and other programs to facilitate implementation of greater building energy efficiency, such programs are generally beyond the scope of the efforts of the state's

program administration staff. The state program administrator believes that most building owners pay for RECO compliance with their own funds, rather than leveraging other energy efficiency resources, and that modest nature of the RECO requirements ensures that "the cost [of compliance] is not prohibitive," typically costing a "couple hundred dollars" (Hertel 2011a).

Impact on Tenants

Information about the impact of Wisconsin's RECO policy on tenants is slight, though the current program administrator feels that it largely results in benefits through improved energy efficiency without significant additional pressure in the form of rent increases. Early program administrators recognized that owners could potentially get higher rents for more efficient homes, but estimated that the impact of the policy on the housing market had been minimal (Shelley 1989). Current program administrators have not heard complaints that the program results in additional rent burdens on tenants. "I don't know that we've had anybody complain to that effect, that the landlord raised their [sic] rent because they insulated or put in new storm windows…. We have had people complain [and say] 'I want you to come out here and go after my landlord because the windows are terrible, [and] there is no insulation.' But we have no way of pulling that property into our program until it's sold" under the current RECO policy (Hertel 2011a).

If the RECO requirements are as modest as the current program staff suggest, costing little more than "a couple hundred dollars on insulation in order to bring [a property] into compliance," (Hertel 2011a) the annualized cost of the RECO per dwelling unit could be so slight that the requirements simply may not add a significant cost to be passed on to tenants. While a study of energy and cost savings resulting from the RECO

has not been performed, energy efficiency measures such as insulation of ceilings and ducts, are typically considered to be so cost-effective that savings from utility expenses may compensate for any rent increases resulting from landlords passing through the cost of RECO compliance.

Outcomes

Wisconsin has never conducted a formal study to determine the outcomes of its RECO policy. Previous studies of the program, data available through the state's online property compliance tracking system, and the knowledge of the program staff suggest that the policy does support minimum energy efficiency standards in rental properties though it is difficult to attribute an energy savings to the policy.

Early program staff estimated that in 1984 95 percent of Wisconsin's rental properties were not weatherized (Shelley 1989). In 1997 ACEEE conducted a study of the program and notes that the staff estimates the policy had resulted in the weatherization of approximately 60,000 rental properties, one-third of such properties statewide, in the previous decade (Suozzo, Wang, and Thorne 1997). However, verification of the figures is difficult to determine given the poor state of available data. From 1985 to 1997, the state used paper records to manage the program; while administration is now conducted through a computer system, the state has not yet entered all of the paper records into the current system (Hertel 2011a).

As of February 2011, 128,890 rental properties have been certified in compliance with the state's RECO, yet 24,425 of these are listed with a stipulation or a waiver, meaning that 104,465 actually adhere to the RECO's energy efficiency requirements. While the state's computer system tracks the number of dwelling units in each property,

it cannot easily tabulate the number of dwelling units in properties that comply (Hertel 2011a). No central database lists the number of rental properties in Wisconsin, but the following crude analysis, based on extremely conservative assumptions, suggests that the policy has improved the weatherization rate from 5 percent in 1984. Assuming that all of the properties in compliance as of February 2011 house only one rental unit and that all of the state's current 677,283 rental units were built before adoption of the state's building energy codes in 1976 and 1978, such that there had been no construction of rental properties in the intervening years, at least 15 percent (104,465 / 677,283) of Wisconsin's rental housing now complies with the state's minimum energy efficiency standards (U.S. Census Bureau 2005-2009f). Yet without a formal study of the program, administrative staff can only estimate that the energy savings resulting from the program are "probably significant" (Hertel 2011a).

Among those 24,425 properties in the state's tracking system with either a stipulation to complete the RECO requirements within one year or a waiver to raze the property within two years of a title transfer, staff estimate that less than one percent of these have been filed with waivers, suggesting that a significant number of properties require follow-up to ensure adherence to the policy (Hertel 2011a).

Program staff cite another indicator of the RECO's efficacy. As noted above, prospective property purchasers and building contractors take note of a property's RECO compliance when considering purchases or marketing services. The program manager specifically notes that contractors use the state's public listings of property compliance, available online, to identify and market services to owners of properties that are not in RECO compliance, such as those with outstanding stipulations (Hertel 2011a).

Berkeley

Population:	100,877
Number of occupied housing units:	40,079
Rate of tenant-occupied housing units:	54.9 %

Source: U.S. Census Bureau 2011d

Policy Summary

Berkeley's RECO was adopted in 1987 and requires residential properties, subject to some exceptions, to be outfitted with a list of prescriptive energy efficiency measures when a property undergoes major renovation or changes ownership. Caps on the cost of compliance mitigate the impact of the policy on owners (City of Berkeley 1991). Berkeley's Energy Office, the Buildings and Safety Division, and a non-profit organization contracted by the city to perform the property inspections collaboratively manage RECO compliance. The city has not performed a formal evaluation of its ordinance, but the RECO program administrator feels that the policy has helped the city curtail its energy use (LaPierre 2011a).

Context for Policy Adoption

The City of Berkeley adopted its RECO policy as a response to the energy crisis of the 1970s; the policy sought to "protect people from rising energy costs" (LaPierre 2011a). The legislation's preamble explicitly notes the finite nature of energy resources and the potential environmental harm related to the use of energy. Increasing energy prices and their unpredictability also provided justification for the policy. The bill seeks to "promote the wise and efficient use of energy and water by prescribing standards for physical components of residential structures" as such use "is essential to the health, safety and welfare of the people of the City of Berkeley" (City of Berkeley 1991).

Berkeley's RECO was a product of an Energy Commission, created by the city, which worked with community stakeholders for an extended period of time to develop the policy and consensus for its support. "By the time it was adopted, there was very little resistance" to the RECO (LaPierre 2011a).

Applicability

Berkeley's RECO applies to all residential property in the city, including studios, lofts, and live-work spaces that are 1,500 square feet or smaller. When transfers of ownership result from instances of financial hardship, as in the event of a foreclosure, responsibility for compliance with the RECO may be postponed but the owner still must allocate funds for RECO compliance in escrow, which must be satisfied within one year of the date of a property transfer (City of Berkeley 2008).

Triggers, Requirements, Compliance, and Public Access to Building Information

Any transfer in ownership of residential property and renovations of such properties that cost more than $50,000 triggers compliance with Berkeley's RECO (City of Berkeley 1991). In the case of a sale, either the seller or the buyer may assume responsibility for RECO compliance. If the buyer assumes responsibility, a notice must be filed with the city indicating such a transfer of responsibility and compliance must be met within one year. Full compliance with all requirements of the RECO must be satisfied before a property is sold two times, meaning a seller "cannot transfer compliance with RECO to [a] new buyer if the responsibility has already been transferred once to the seller from the previous sale" (City of Berkeley 2008). When the RECO is triggered by a renovation, the requirements must be satisfied by the party that requests a

city building permit, commonly the owner, and compliance is verified by city inspectors through a conventional building inspection of the renovation (City of Berkeley 2008).

The requirements of Berkeley's RECO include a list of prescriptive, common energy efficiency measures to improve a building's heating system, ducts, and hot water systems. Ceiling insulation must be installed in accessible spaces; accessible heating ducts must be sealed, weather-stripping must be applied to doors, and hot water pipes must be insulated. A water heater blanket must be installed as well as low-flow water devices throughout the building. Additionally, incandescent light bulbs in the common areas of multi-unit properties must be replaced with more efficient devices. Inaccessibility to building systems can preclude the RECO requirements and there are spending caps, as explained below, to mitigate costs to property owners (City of Berkeley 1991). Berkeley is considering the integration of a performance based metric to determine RECO compliance, but as of February 2011, the city was waiting for the State of California to approve a software package to aid building performance measurement (LaPierre 2011a; Panoska 2008). Similarly, due to the structure of the spending caps for larger properties, which limit the RECO's current ability to require energy efficiency upgrades, the city is considering modifications to the policy to improve its efficacy for such properties (LaPierre 2011a, 2011c).

RECO compliance is satisfied when, in the case of property sales, the seller provides the buyer with a copy of the certificate of compliance, which is issued by the non-profit organization contracted by the city to perform all RECO inspections. Should the buyer assume responsibility for RECO compliance, notice of such a transfer of responsibility is filed with the City of Berkeley. A normal building inspection by the

City of Berkeley ensures compliance in the case of renovations (City of Berkeley 2008). The non-profit contractor that performs the audits provides reports of property compliance to the city's Energy Office (City of Berkeley 2008; LaPierre 2011a).

Any member of the public can call the city's Buildings and Safety Division to learn about a property's RECO compliance (LaPierre 2011c).

Administration and Enforcement

Administration for the RECO program is housed within Berkeley's Planning and Development Department. One staff person in the department's Office of Energy and Sustainable Development provides technical assistance for owners and manages the city's non-profit contractor who conducts the property inspections. Two additional staff in the department's Building and Safety Division manage the administrative paperwork. Where RECO responsibility is transferred to the purchaser, city staff is in frequent communication with the buyer to ensure prompt compliance. Filing fees cover the expenses of the administrative staff, but not that of the technical advisor, who spends about 10 hours per week on RECO-related work (Panoska 2008). The Berkeley City Council sets the inspection fees, listed in Table A-3 below, charged by the non-profit contractor such that they cover the organization's costs (LaPierre 2011a).

The city tracks listings of properties available for purchase, but relies extensively on the real estate community, which now makes RECO compliance a routine element of property transfers, to ensure compliance. "Real estate professionals, title companies, and homeowners accept the ordinance, and ensuring compliance has become a routine part of doing business" (Suozzo, Wang, and Thorne 1997). The city does not view a lack of

compliance as a large problem: "We pretty much have 100 percent compliance at this point" due to the real estate community's acceptance of the ordinance (LaPierre 2011a).

While the city has the ability to issue fines and place liens on properties, as of February 2011 it has never used either enforcement mechanism (LaPierre 2011a).

Costs and Connection to Energy Efficiency Programs

Filing fees charged by the city, found in Table A-3, cover the costs of the administrative staff (Panoska 2008).

Table A-3: Filing and Inspection Fees for Berkeley's RECO	
Filing fees	
Certificate of compliance	$15
Inspection fees	
Renovations	Included in the cost of construction permit
Sale or ownership transfer	$100, plus $50 for each additional unit
Re-inspections	$50, plus $25 for each additional unit

Source: Adapted from Panoska 2008

Owner expenditures to satisfy the RECO are limited. For properties with two housing units or less, RECO-related expenditures are capped at 0.75 percent of the final sales price. For larger properties, RECO expenditures are limited to $0.50 per square foot. One percent of the cost of any renovation constitutes the RECO cap under such circumstances. If the expenditure cap is reached during a property sale and some RECO elements remain incomplete, they must be performed before any subsequent transfer (City of Berkeley 2008). Alice LaPierre, the Energy Efficiency Coordinator for the city's Office of Energy and Sustainable Development and a RECO program administrator, reports that despite the existence of the expenditure cap, increased sales prices and the exclusions of measures in building areas deemed inaccessible functions such that

properties with two units or less do not meet the spending cap on the second sale (LaPierre 2011c).

However, the city feels that the $0.50 per square foot spending cap for larger properties is insufficient ensure to full compliance with all of the measures listed in the RECO. As the ordinance caps the spending at a fixed amount per square foot for such properties, "it's a much lower rate as property prices have increased" such that owners of such properties "rarely … do attic insulation" (LaPierre 2011a). The city has not tracked the actual costs of owners to ensure RECO compliance, though it estimates that the costs of complete compliance are less than $3,000 (LaPierre 2011c).

The city's program administrators seek to ensure that property owners and the real estate industry are aware of available financial incentives for energy efficiency upgrades. The city offers a compliance guide with suggestions of such resources, which can also be found on the city's website. Additionally, program administrators are frequent presenters at events of homeowner and real estate organizations and the city hosts several outreach events annually during the spring and fall where an estimated 400-800 consumers attend (LaPierre 2011c).

Impacts on Tenants

It is difficult to know whether Berkeley's RECO impacts tenants in any manner beyond mandating that the owners of their homes comply with the policy's energy efficiency requirements. Program administration staff feel that tenants in buildings improved via RECO "simply reap the benefits" (LaPierre 2011a). However, staff also acknowledge that without more granular data on the costs to owners to comply it is

difficult to understand the pressures owners may feel to pass the costs of energy efficiency upgrades on to tenants (LaPierre 2011a).

Similar to the discussion of the San Francisco RECO's impact on tenants, if the cost of compliance with Berkeley's RECO is relatively modest, as may be the case for properties with three or more units due to the price cap per square foot, the policy's requirements may not be a major financial burden on owners such that tenants would feel an additional rental pressure that is not balanced by a decrease in utility expenses resulting from the energy efficiency improvements. Of course, a low cost limitation for energy efficiency measures also means that tenants may go without the benefits of building improvements.

Outcomes

The City of Berkeley has not performed an evaluation of its RECO policy, but the city has a limited understanding of the number of housing units that comply with the ordinance and estimates the energy and cost savings generated should the average Berkeley home install the measures listed in the RECO policy (LaPierre 2011a). Early program administration relied on index cards, which the city has yet to convert to its new computer tracking system, but the program administrator's records indicate that between September 2003 and December 2010, properties housing 3,508 dwelling units, or 8.7 percent of all 40,079 currently occupied housing units, were inspected and certified as in compliance with RECO (U.S. Census Bureau 2005-2009e; LaPierre 2011a). The city is not easily able to distinguish between single-family compliance and that of multi-unit apartments. Nevertheless, some of these properties deemed compliant might be without

all of the requisite RECO elements due to the spending cap. The program administrator estimates that roughly 400 properties transfer ownership annually (LaPierre 2011a).

Overall estimates of energy and cost savings resulting from RECO have not been determined and program staff cite many complications for such an evaluation, as it is difficult to understand whether a property owner installs a RECO-required measure due to the existence of the policy or as a result of other efforts.

> We have very non-granular energy reports from our utility showing a community-wide trend of energy reduction, citywide. There are a lot of things in play. Some of it is certainly from our RECO, and certainly some of the early savings are from that. Some of it is from utility programs for energy efficiency. Some of it is due to the energy crisis that hit … California in 2000 – 2001…. We can't put actual numbers on RECO (LaPierre 2011a).

The city also acknowledges that changes in occupant behavior that coincide with property sales and RECO compliance can dramatically shift energy usage at the dwelling, causing additional difficulty to quantify the policy's results (Panoska 2008).

The city does estimate the average energy and financial savings possible should a home without the required RECO elements install all of them. The city estimates that a single-family home that installs the RECO measures can save about $698 annually. Assuming that space and water heating rely on natural gas, the city estimates that the RECO measures save 246 therms and 400 kWh annually. The cost of the measures are estimated at $2,600, not including labor (LaPierre 2011b). Berkeley has not sought to develop such estimates of housing units in properties with more than one unit, though program staff note that as many of the city's properties housing more than one family are converted homes or duplexes, they are physically similar to single-family homes and therefore the energy savings are likely to be similar (LaPierre 2011a).

Burlington, VT

Population:	38,630
Number of occupied housing units:	15,156
Rate of tenant-occupied housing units:	59.8 %

Source: U.S. Census Bureau 2011e

Policy Summary

Burlington's RECO, called the Minimum Energy Efficiency Standards Ordinance of 1997, mandates improvements of rental properties where tenants pay the utility expenses when such properties are sold. The ordinance provides a list of prescriptive energy efficiency measures that properties must furnish at the point of a transfer in ownership (City of Burlington 1997). However, the language of the ordinance was drafted with sufficient flexibility such that program administrators do not seek the prescriptive compliance of every property; instead they target buildings that consume more energy than comparable properties (Buckley 2011). Burlington's municipally-owned electric utility, the Burlington Electric Department (BED), administers the program and manages its compliance in concert with the area gas utility and certified private contractors who inspect subject properties. Expenditures to implement energy efficiency are limited to mitigate the impact on owners (City of Burlington 1997). Burlington has not conducted a formal evaluation of its RECO policy, but staff are confident that the program is cost-effective and that it has delivered substantial benefits to residents by improving the worst-performing rental properties (Buckley 2011). BED reports that its RECO has facilitated energy efficiency improvements in 225 buildings housing 630 units, 6.9 percent of all currently occupied rental units, from 1997 to spring 2011 (U.S. Census Bureau 2011a; Thiels 2011).

Context for Policy Adoption

The adoption of Burlington's RECO differs from the others reviewed here in a variety of ways. Firstly, implemented in 1997, it was adopted at least a decade after those discussed above. Efforts seeking such an ordinance began at least as early as 1986 when an affordable housing task force, supported by the city's Community and Economic Development Office, unanimously supported the idea of such a policy (Pine 2011). Secondly, Burlington's RECO was initially an element of the city's Enterprise Community initiative supported by the federal government's Department of Housing and Urban Development. The RECO was piloted in one neighborhood and subsequently extended throughout the city. Lastly, the City of Burlington is unique as it owns the electric utility, BED, and the BED was integral to the policy development and adoption efforts (Buckley 2011; Pine 2011).

The idea of a RECO won the early support of Progressive members of the Burlington City Council in the mid-1980s (Buckley 2011; Pine 2011) as housing and tenant advocates recognized the importance of energy costs to tenants but were stymied by the split incentive problem. "The issue of energy was always on the list, but we always came to the roadblock, or the dead-end of, 'Well, wait … we've got a problem that affects the tenant, but yet the owner of the building doesn't really care … because [the problem] doesn't affect them'" (Pine 2011). Advocates were attracted to the policy by the logic of insulating current owners from a government mandate by linking the requirement to a sale of the property (Pine 2011).

Despite discussions in the 1980s, the political opportunity to adopt a RECO did not appear until 1994 when the city initiated a planning process to secure the federal designation of an Enterprise Community, a program of the U.S. Department of Housing

and Urban Development. To become an Enterprise Community, the city engaged in "a massive grassroots visioning and planning process that developed [a] ten-year strategic plan" and considered a number of energy policies through which the RECO gained prominence (Pine 2011). The policy idea "became the focus of [Burlington's Community and Economic Development Office], Burlington Electric, Vermont Energy Investment Corporation and Vermont Tenants, Inc." (Pine 2011). Pushed by Progressives on the city council and housing advocates, the Burlington City Council tasked a committee of stakeholders to research and consider policy ideas to address energy use in rental properties.

The ordinance committee worked for three years to develop a recommendation to the city council. As in other jurisdictions, the real estate industry, especially property owners, resisted the idea of the ordinance. Landlords raised the specter of the need to increase tenants' rents to pay for the policy's requirements, protested government intervention in the marketplace, and spoke of the potential for economic harm (Buckley 2011; Pine 2011). Through the ordinance committee process, BED organized workshops, often in collaboration with architects and engineers, for the public, and landlords in particular, to review and discuss matters under consideration by the committee. Ultimately, the ordinance committee "achieved an uneasy consensus" on recommendations to the city council, which desired to implement such a policy and simply wanted the committee to decide the details (Buckley 2011).

Burlington's RECO justifies action to improve the energy efficiency of rental housing on social and economic grounds. The ordinance refers to "substandard dwellings [that] compromise public health, safety and welfare" and notes that improving the city's

energy use can lower housing expenses, stimulate the economy, and create employment opportunities (City of Burlington 1997). Unique among the RECOs reviewed in this study, the preamble of the ordinance acknowledges the potential tension between capital expenditures to improve energy efficiency and rent increases; the legislation notes that its requirements are intended to balance the needs of energy expenditures and housing affordability as "any increase in rent that may result from [an energy efficiency] investment is expected to be offset over time by reductions in energy bills" (City of Burlington 1997).

Applicability

Burlington's RECO applies to all rental properties where tenants are responsible for the heating costs and which are not in compliance with the city's building energy code established in 1991 (City of Burlington 1997; Panoska 2008). Typically, only properties constructed after 1991 or those that have been substantially renovated already comply with the energy code of 1991; other rental properties are subject to the city's RECO. For mixed-use properties and those that are owner-occupied, the ordinance applies only to that portion of the property occupied by tenants. Properties not rented between November 1 and March 31 are exempt and properties that are to be demolished or converted to non-residential use within one year of a sale may have the requirements waived. Where property ownership is transferred within a family, pursuant to a divorce, or as a result of foreclosure, bankruptcy or other instances of financial hardship, properties are not required to satisfy the RECO requirements (City of Burlington 1997).

Triggers, Requirements, Compliance, and Public Access to Building Information

A transfer of property ownership triggers compliance with Burlington's RECO (City of Burlington 1997). The ordinance lists standard energy efficiency measures to be installed at the time of sale including the insulation of the ceiling, exterior walls, heating pipes, ducts, and electric hot water heaters. Windows must be double-glazed or have storm windows, and doors must have weather-stripping. A building's air leakage rate must be no more than a rate specified in the ordinance, as calculated by an inspector, and heating, combustion devices, and other components of a heating system must have been tested to ensure proper performance (City of Burlington 1997).

Early attempts to administer the ordinance through verification of the required building elements proved difficult as individual property inspections required substantial resources. Therefore, BED developed a performance metric based on a property's energy consumption calculated through utility data, and permitted by some flexibility in the language of the ordinance, to serve as a "first cut" property review to determine whether the subject property should trigger a complete inspection pursuant to the RECO policy (Buckley 2011). Over time, a performance standard, based on a calculated rate of BTUs per square feet per heating degree days, became the default standard against which properties, in comparison with others in a BED database, are judged by program administrators to require a comprehensive building inspection to verify RECO compliance. Based on this simple calculation, BED estimates that about 60 percent of properties sold pass this performance threshold; those that do not pass the metric require further investigation and a potential audit to verify RECO compliance or to identify necessary improvements to satisfy the requirements of the city's policy (Buckley 2011).

For those properties that do not satisfy the performance metric set by BED, an inspector certified by BED or a Vermont licensed mechanical engineer audits the building. While property owners can choose the inspector, BED encourages owners of those properties that rely on Vermont Gas for heating fuel, 98 percent of buildings subject to the policy (Panoska 2008), to enroll in the utility's energy efficiency programs, which can provide a free property audit to determine RECO compliance and can offer subsidized energy efficiency services and financial incentives (Buckley 2011). Inspectors review the property and provide their report to the owner and the BED program administrator. This report must be included with the deed at the time of recording with the city clerk. The inspection either certifies compliance, if the property meets the RECO's specifications, or identifies the property's deficiencies and the required improvements, which must be satisfied within one year of a property sale (City of Burlington 1997).

Burlington's RECO does not require any public disclosure of a property's compliance.

Administration and Enforcement

BED serves as the program administrator. One BED staff person spends roughly 2 to 3 hours per week on RECO-responsibilities serving two primary functions: 1) working with owners, realtors, and banks to ensure that all parties understand the RECO requirements at the time of sale, and 2) monitoring compliance with any work necessary after completion of a property inspection. Filing fees cover BED's administrative costs (Buckley 2011; Panoska 2008). Over the years, BED and Vermont Gas have developed a collaborative partnership to share utility information and to facilitate program

administration and the provision of resources to owners that need to improve their properties pursuant to the RECO. "When a building comes up for sale, we work collaboratively with the gas company to evaluate the … billing data" to determine if the property needs to be inspected or if it satisfies the performance standard (Buckley 2011). Property owners who are Vermont Gas customers can get free RECO audits through the gas utility and BED provides any necessary audits for properties that rely on fuel oil or electricity as the primary heating fuel. BED credits a close, cooperative relationship with Vermont Gas to ensure that program administration costs are low (Buckley 2011).

BED's enforcement of the city's RECO primarily consists of follow-up with owners to ensure compliance. After one year, BED staff estimate that 97 percent of properties sold in Burlington comply with RECO, and credits the persistence of program administration staff for the high compliance rate. BED acknowledges that a small percentage of owners simply ignore the policy's requirements and while BED has the ability to fine non-compliant owners and to seek legal action, such tactics are rarely pursued. BED's ability to use the city's legal capabilities for RECO compliance is overwhelmed by the city's need to use those scarce resources to pursue legal actions related to health and safety issues in residential properties. Instead, BED developed a practice of issuing Violation Notices, which are attached to the property records. For those few properties that fail to comply with the RECO at the time of an initial transfer of ownership, compliance typically occurs when the property is sold a second time (Buckley 2011).

Costs and Connection to Energy Efficiency Programs

The costs to BED for program administration are minimal as only 2 to 3 hours per week of staff time is required to track property transactions and compliance with the ordinance. Such administrative expenses are covered by filing fees of $30 per building, charged to property owners (Burlington Electric Department 2011; Buckley 2011).

The fees for a property inspection are not set by the ordinance, yet for a private inspector fees are estimated to cost $75 - $100 per unit (Burlington Electric Department 2011). Owner expenditures to satisfy RECO are capped at 3 percent of the property sales price or $1,300 per rental unit whichever is less. Additionally, expenditures must not exceed the ordinance's cost-effectiveness standard, set at a seven year payback term for any measure (City of Burlington 1997). If, at the time of sale, a property needs to install energy efficiency measures, the owner typically enrolls in the utility energy efficiency programs offered by Vermont Gas and BED to take advantage of the incentives offered by the utilities. The average cost of building improvements to property owners is $650 - $750 per apartment but BED has found efforts to track owner costs extremely difficult as such costs are frequently rolled into the property acquisition and other property improvement costs (Burlington Electric Department 2011; Thiels 2011).

Impacts on Tenants

While many housing advocates had been early supporters of the idea of the legislation, some were concerned of the potentially negative effects on tenants should the costs of energy efficiency improvements be passed along to tenants in the form of rent increases. Ultimately, such concerns were assuaged by energy advocates and experts who argued that the prescriptions of the ordinance were extremely modest, cost-effective, and easily performed such that the costs to property owners would be so low that the

potential for a net increase in tenant living expenses, after balancing any rent increase with decreased utility expenditures resulting from the improved energy efficiency, was unlikely (Pine 2011).

Nearly 15 years after the policy's adoption, there is little available quantitative data to understand the overall impact of Burlington's RECO on tenants' rents. Nevertheless, some individuals who were involved in the policy's development and adoption and who have been engaged in tenant, housing, and energy issues in Burlington for decades agree that the policy has effectively delivered a floor of energy efficiency in rental properties without adding a noticeable burden on tenants. Those interviewed for this thesis all suggested that the low-cost and general cost-effectiveness of the RECO's requirements limits the financial justification for landlords to pass costs related to the ordinance on to tenants (Buckley 2011; Pine 2011; Wimpey 2011).

Interviewees point to the lack of complaints and the fact that the real estate industry has not pushed to significantly amend or appeal the ordinance as evidence that the RECO's modest requirements present little financial pressure on owners and tenants.

> I have not heard … a lot of complaining about this. I heard a lot about it at the beginning, about what a problem it was going to be. [I recently asked the program staff about tenant complaints and she said] she's not aware of a single complaint about rent impact that's really documented—that somebody said "They made my building more efficient and now my rent's gone up." … I think if there had been [a tenant complaining about a rent increase resulting from the RECO] it would have found its way to me. That would have caught my attention, believe me (Buckley 2011).

Those interviewed contend that by coupling the RECO requirements to the time of property sale, any up front costs of the necessary energy efficiency improvements not covered by the incentives of utility energy efficiency programs can simply be wrapped

into the property's mortgage. While a property's new debt-burden may translate to rent increases, the low cost of the required energy efficiency improvements add little incremental cost (Pine 2011). "I don't think it adds a huge amount to the cost, in the long run, to the rents" (Wimpey 2011).

However, those interviewed also acknowledge that it is extremely difficult to make causal connections between landlord costs for RECO compliance and rent increases, and that often rents do increase at the time of sale. "It's tough to pinpoint, but I don't think there is anyone who, with a straight face, is going to claim that [Burlington's RECO] has caused them to make significant … rent increases" (Pine 2011).

Outcomes

BED has not performed a formal program evaluation of the RECO policy but program staff feel the policy has effectively addressed some of the worst performing properties in the city. "We know the results are positive. We don't have cost-effectiveness, but given the short paybacks on the things we require, for the most part, we're fairly confident that overall the program has been cost-effective" (Buckley 2011). As of early 2011, Burlington's RECO has facilitated energy efficiency improvements in 225 properties housing 630 tenant households since 1997. 630 rental units represent 6.9 percent of all currently renter-occupied housing units (U.S. Census Bureau 2011a). Assuming that some rental housing units have been constructed since 1997, the percentage of rental housing units in the City of Burlington that have had energy efficiency improvements since 1997 is greater than this percentage. The properties improved as a result of the RECO represent 26.2 percent of all rental properties sold

during that period, and 24 percent of the housing units in those properties (Thiels 2011). Table A-4 summarizes these figures.

Table A-4: Outcomes of Burlington's RECO Policy, 1997 - 2011		
	Buildings	Units
Rental Property Sales	860	2624
Number Improved	225	630
Number Improved as Percentage of Rental Property Sales	*26.2%*	*24.0%*
Source: Thiels, 2011.		

BED staff involved with the RECO since the initial policy discussions in the 1980s credit the ordinance with improving some of the city's worst properties. "Over these 15 years we've fixed some of the worst issues out there and I think that was our real goal to begin with. You know, there were some real sieves in this town and a lot of those are a lot less leaky today than they were and they would not have gotten there without the force of law behind it" (Buckley 2011). As the city has been able to plug some of the biggest gaps in terms of energy efficiency, BED has set its sights higher: "Most of the buildings are insulated these days. … We're just not where we were 15 or 20 years ago … as a result of this ordinance. We're really becoming generically more interested in … deeper retrofits" (Buckley 2011).

BED staff credit the program's success to the collaborative efforts during the policy's development and adoption phase and clear "marching orders" from the Burlington City Council to develop a plan that would deliver energy efficiency to rental properties (Buckley 2011). Additionally, BED notes its partnership with Vermont Gas and the ability to integrate the energy efficiency services of both utilities to limit program overhead cost, especially since the BED transitioned to the performance metric standard thereby limiting the cost of property inspections. Acknowledging that its performance

standard only captures broad strokes of a building's energy use, BED values the metric to ease program administration. "Obviously [the performance standard] does not give the level of accuracy that … a field audit will do, but from a program administration standpoint and from a political support standpoint it has made life much easier" (Buckley 2011).

While not an outcome in terms of energy or financial savings, Burlington's RECO has become an engrained element in real estate transitions and property sales have begun to reflect the valuation of a property's energy efficiency:

> If at time of sale you find that $5,000 worth of work needs to happen, that gets factored into the sales price. And that gets accepted now because its standard operating procedure and everybody knows about it and so it's just part of every transaction. And that's what's so elegant about the idea. Time of sale anything. Time of sale code enforcement, time of sale energy upgrades, dealing with lead at time of sale…. Dealing with the issue at time of sale makes so much sense because a willing buyer and a willing seller are negotiating the transaction, and that's when the checkbook opens up, and that's when you can have a very honest discussion about, "Your value is actually reduced by the fact that, within the next 6 months I must spend this extra 5 grand just to get up to compliance with this very basic code (Pine 2011).

Austin, TX

Population:	747,984
Number of occupied housing units:	304,477
Rate of tenant-occupied housing units:	53.5 %

Source: U.S. Census Bureau 2011f

Policy Summary

In 2009 Austin adopted its Energy Conservation Audit and Disclosure (ECAD) ordinance, which requires owners of residential property to perform an energy audit to facilitate the valuation of energy efficiency in property sales, to encourage owners to enroll in utility-administered energy efficiency programs, and to provide the city with

information to mandate the decrease in energy consumption of high-energy-use properties. The ordinance is managed by the city's municipally owned electric utility, Austin Energy (AE), and applies to all residential properties, though requirements differ depending upon the type of property. For example, owners of properties with one to four housing units must perform an audit before the property is transferred to a new owner and share the audit results with the prospective purchaser. Owners of properties with five or more housing units must conduct an energy audit by June 1, 2011 and share the results with current and prospective tenants. Mandated building improvements only apply to high-energy users among the larger property class (City of Austin 2008). Given the recent adoption of the policy, no quantitative measure of impact is available, but program administrators have noticed an increase in properties enrolling in AE's energy efficiency programs (Kisner 2011a).

Context for Policy Adoption

Those interviewed for this thesis credit the adoption of Austin's ECAD policy to former Mayor William Wynn (Biedrzycki 2011; Kisner 2011a). After several years of study by a city-supported stakeholder group focused on opportunities to enable Austin to mitigate greenhouse gas emissions, the city passed a resolution in 2007 that identified improvements in the city's buildings as one of five primary components of the city's Climate Protection Plan (City of Austin 2007). The resolution explicitly directs city resources to "reverse the negative impacts of global warming" by, among other things, "[pursuing] energy efficiency upgrades to [the] existing building stock through measures including … implementing policies identifying opportunities for energy efficiency retrofits and upgrades, and requiring all cost-effective retrofits and upgrades for all

properties at the point of sale" (City of Austin 2007). To develop specific recommendations on energy efficiency issues, the city created a task force composed of representatives of relevant industries including real estate, banking, energy, environmental, advocacy, and building services. This team met from February to September 2008 to develop policy recommendations for the Mayor and City Council (Austin Energy Efficiency Upgrades Task Force 2008).

The Task Force's objectives were far-reaching. They included seeking improvements in the energy efficiency of all buildings in the city to implement all cost effective measures to reduce the city's carbon footprint; the promotion of housing affordability; the reduction of energy demand from buildings to mitigate the need for new energy supply; procedures to encourage private market investment in energy upgrades; and efforts that "minimize disruption to existing real estate industry process" (Austin Energy Efficiency Upgrades Task Force 2008, 6). The Task Force also reviewed similar policy initiatives in other jurisdictions, including those outlined above in San Francisco, Berkeley, and Burlington. Unique for many cities, the Task Force was able to rely on the data and expertise of the city's municipal electric utility, AE, to aide its analysis.

A consumer advocate involved in the Task Force, Carol Biedrzycki of the Texas Ratepayers' Organization to Save Energy (Texas ROSE), notes that the original notion for a policy to address building energy efficiency was similar to those policies outlined above, which mandated energy efficiency improvements at the time of sale. However, representatives of the real estate industry organized an effective campaign against such mandates, by publishing reports citing threats to Austin's real estate market, the possibility that property owners would not be able to sell their properties because of the

hurdle of costs associated with energy efficiency improvements, and specifically noted barriers for low-income owners who have less available capital to invest in energy efficiency. Biedrzycki reports that the real estate industry issued reports arguing that the value of homes sold on the Austin real estate market would drop; "they basically said that nobody would be able to sell their house and that it would cost a whole lot of money. Those were their two basic arguments" (Biedrzycki 2011). The Austin Board of Realtors published "doomsday articles about how a point of sale ordinance would be the end of modern life here in Austin. They somehow became an advocate for low-income people, and talked about what a terrible impact this would have on people who were poor, and it just went on and on and it was very effective" (Biedrzycki 2011).

Short of mandating energy efficiency in buildings, the Task Force established targets for energy upgrades to be implemented through adoption of its recommendations. For example, among properties housing one to four units, "the percentage of owner occupied homes sold each year that would perform the specified upgrades would grow from 25 percent in the first year following the passage of the ordinance to 85 percent in the fourth year following passage of the ordinance"
(Austin Energy Efficiency Upgrades Task Force 2008). With the support of AE, the Task Force also developed aggregated estimates of the potential energy savings, costs and payback periods for different building sectors for 2009-2020. These estimates are reprinted here in Table A-5.

Table A-5: Impact by Building Sector

	Single Family (1-4 units)	Multifamily (5+ units)
Percentage improvement in sector energy efficiency	12-15%	10-16%
Total cost of upgrades	$70,746,075	$40,636,700

Cost of rebates	$21,638,000	$23,836,700
Cost to property owners[1]	$49,108,075	$16,800,000
Annual energy savings[2]	$11,149,530	$5,843,909
Simple payback in years	4.4	2.9
10 year net cumulative energy savings[2]	$62,387,225 ($111,495,300 - 49,108,075)	$41,639,090 ($58,439,090 -19,800,000)
[1] Cost to property owners is after rebate cost; [2] Energy savings are based on current utility rates and are thus conservative.		
Note: This table is a reproduction of Table 1 in the Energy Efficiency Upgrades Task Force report to Austin's Mayor and City Council. Some labels have been modified to ease interpretation.		

Source: Austin Energy Efficiency Task Force 2008.

After developing procedures to mitigate the potentially negative effects highlighted by the real estate industry, such as exemptions for low-income and long-time owners who had previously participated in utility-administered energy efficiency programs, Biedrzycki felt the Task Force was poised to recommend that the city adopt an ordinance that encourages voluntary actions to improve building energy efficiency with a possible mandate should the voluntary efforts prove to be ineffective. The mandate was to be accompanied by a cost cap for the improvements (Austin Energy Efficiency Upgrades Task Force 2008; Biedrzycki 2011). However, as the task force concluded its efforts, the stakeholders voted on various policy recommendations, and as a body was unwilling to support a wholesale mandatory policy. Biedrzycki feels that the Task Force was "made up primarily of business people" and that only she and a representative of a tenants' rights organization represented "ordinary people" (Biedrzycki 2011). Therefore, the Task Force's policy recommendations to the Mayor and City Council supported the disclosure of building energy characteristics with some mandated improvements for properties that use a disproportionate level of energy (Austin Energy Efficiency Upgrades Task Force 2008; Biedrzycki 2011).

Applicability

Austin's ECAD ordinance applies to all residential properties in the City of Austin if the building receives electricity from AE. The ECAD and AE refer to residential properties with one to four housing units as "single family" or "residential" properties and those with five or more housing units are considered "multifamily" facilities (City of Austin 2008). Due to the potential for confusion from such definitions, where such a distinction is crucial this report notes the specific property size. AE reports that about 173,000 electricity meters, approximately 31 percent of AE's customers, are in properties that house one to four families; about 130,000 meters are found in properties with more than 5 housing units. As few properties in the city are master-metered, AE estimates that these 130,000 meters represent approximately the number of housing units in properties with five or more units (Kisner 2011a).

Properties housing one to four families may be exempt from the ECAD pursuant to property transfers within families, foreclosure, and hardship, or if the property is to be demolished within six months after an ownership transfer. Additionally, such properties are exempt if the property is less than 10 years old or if the property has participated in AE's utility-administered energy efficiency or free weatherization program within the last 10 years. Properties with more than five housing units are exempted from the ECAD's requirements if the property has participated in some of AE's energy efficiency programs designed for this property class, such as programs that address building HVAC and duct systems, since June 1, 1999 or due to unique circumstances and pending the approval of AE (Austin Energy 2009; City of Austin 2008).

Triggers, Requirements, Compliance, and Public Access to Building Information

The ECAD is triggered under different circumstances depending on the type of property. Properties that house one to four units trigger the ECAD when they are transferred from one owner to another. Larger properties must comply with the ECAD on a more aggressive timeline; the owners of all such properties must perform an energy audit of the facility, as is described more fully below, by June 1, 2011 (City of Austin 2008).

The ECAD seeks to facilitate improved valuation of a building's energy performance and to encourage property owners to enroll in AE's energy efficiency programs by enabling owners and purchasers to develop a better understanding of the energy characteristics of subject property and initiating a conversation between owners and AE's energy efficiency program staff. For properties that are one to four units, the owner of the facility must conduct an energy audit of a property offered for sale and provide a copy of the audit to the prospective purchaser and to AE. The prospective purchaser must receive a copy of the audit before the property is sold and AE must receive a copy no later than 30 days after the audit has been conducted. The ECAD provides no requirement that tenants in these smaller properties receive a copy of the energy audit or any other information pursuant to the facility's energy use (City of Austin 2008; Kisner 2011a).

Since the policy's adoption in 2009, AE and other stakeholders have noted that sellers were providing the audit late in the course of property transactions, but that various parties, including realtors, lenders, energy efficiency contractors, and "consumer activist groups … all wanted [the audit] earlier" in the sales process (Kisner 2011a). Therefore, AE and others worked to propose amendments to the ECAD that require

disclosure of the energy audit at the time a property owner and purchaser sign a contract of sale, such that the energy disclosure runs parallel to a conventional property inspection pursuant to a sale (Kisner 2011a). As of April 2011, these proposed rule changes have not been adopted by the City of Austin.

Properties with five or more housing units and which are at least 10 years old are required to perform an energy audit prior to June 1, 2011. A copy of this energy audit must be provided to AE no later than 30 days after its completion and the results of the energy audit are to be provided to current and prospective tenants of the property (City of Austin 2008). The audit results provided to tenants are designed to be in a simplified format rather than the lengthy, detailed property audit form. Such results are to be posted in property common areas and must remain in place. Prospective tenants are to be provided with a copy of the audit results when they receive a lease application (Austin Energy 2009; City of Austin 2008).

The politics of a mandated property audit required AE to develop an audit protocol that is cheaper and therefore less extensive than other common home audit systems. To mitigate the cost to the owners, program administrators wanted to keep the cost of the single-family audit under $300, much less than an industry standard audit by the Residential Energy Services Network (RESNET) that could cost $1000 and provide the owners with more detailed data. AE feels that the less detailed audit helps to achieve the ECAD's goals, which seek to guide property owners to energy efficiency programs and to drive investment in energy efficiency measures rather than simply provide a detailed audit (Kisner 2011a).

In addition to the audit and disclosure requirements, properties with more than five units and "an average per-square-foot energy usage exceeding 150 percent of the average" for such properties must implement energy efficiency "improvements to the facility sufficient to bring the facility to within 110 percent of the average per-square-foot energy usage" within 18 months (City of Austin 2008).

The initial rules issued to implement the ECAD are silent on the high-energy user provisions of the ordinance, but AE intends to enable such comparisons of the average energy use of buildings through market segmentation based on properties' age and the type of heating fuel. AE expects that revisions to the ECAD rules will guide comparison of electric and gas properties against one another and buildings will be classified according to the date they were constructed to compare performance against others built under the same building energy code. For example, properties built before the City of Austin adopted its initial energy code in 1985 are compared against other such properties; those built between 1986 and 2003, when the city updated its energy code, are compared against one another, and those built subsequently are compared (Kisner 2011a).

Administration and Enforcement

The ECAD is administered by the city's municipal utility, AE, which significantly eases program administration as property data, such as square footage, and utility data are simply shared among different city agencies rather than the sharing of data between municipalities and private utilities (Kisner 2011a). While AE is responsible for monitoring property transactions, tracking audits, and supporting the provision of energy efficiency services, the audits may be performed by any energy efficiency auditor the property owner chooses provided that the auditor has been certified or otherwise

approved by AE. Presently, any person certified by the Building Performance Institute or RESNET is permitted to conduct property audits (Austin Energy 2009). AE provides a list of approved auditors on their website (Austin Energy 2011) and offers training to those seeking to become ECAD auditors. Recognizing that owners of larger multifamily properties often rely on professional property management staff and may be reluctant to have outside building technicians instruct owners and staff how to operate a facility, AE has encouraged such property owners to send their building staff to AE trainings to become ECAD auditors and to perform the inspections in-house (Kisner 2011a).

After the audits are complete, AE reaches out to the property owner to market their energy efficiency incentives and services based on the needs identified in the inspection. AE collaborates with Texas Gas Services to administer incentives related to gas usage where one property can use incentives from both utilities (Kisner 2011a).

The ordinance empowers the city to issue fines and pursue legal action to enforce the policy, but the program administrator reports that as of March 2011, no fines have been issued and the city is not aware of any complaints that would spur legal action. Rather, AE's enforcement seeks a friendlier route to encourage greater education and action by owners, purchasers, and tenants of the value of energy efficiency in buildings. Even among properties designated as high-energy users, AE issues notices to owners of such properties seeking to develop property-level energy efficiency action plans to make property owners aware of AE's incentives and educational programs designed to encourage behavior change among tenants. Ultimately, AE seeks to institute all cost-effective energy efficiency measures as possible. For the high-energy users, if energy efficiency measures are implemented and the property still has not achieved the targeted

reduction, AE remains satisfied that no more can be done. "That's the best bar they can get; that's where they land; that's the reality of it" (Kisner 2011a).

Costs and Connection to Energy Efficiency Programs

ECAD program cost estimates are difficult to determine at this point. Certified private auditors may set their own rates. For owners of properties with one to four housing units, AE estimates the cost of the audit to be $200-$300 for a typical home (Austin Energy 2010). Interestingly, the per building estimate of the audit costs for larger properties is about $200 (Kisner 2011b).

The Task Force that worked to develop the ECAD policy estimated aggregated costs to property owners and to AE in the form of rebates to owners, but it is difficult to determine a per building or per unit cost estimate. These costs, included in Table A-5 above, highlight the quick payback of the upgrade measures at 4.4 years for one to four unit properties and 2.9 years for larger properties (Austin Energy Efficiency Upgrades Task Force 2008).

As one of the primary goals of the ECAD is to educate property owners and tenants of building energy issues and to connect energy users with utility-administered energy efficiency services, the program is well connected to the energy efficiency programs offered by AE and Texas Gas Services. ECAD promotional materials clearly identify available rebates and resources available from the two utilities for actions such as the installation of attic insulation, duct replacement or sealing, and improved HVAC systems (Austin Energy 2010). AE highlights that incentives available from AE and Texas Gas Services can "pay up to 33 percent of the cost of the insulation and up to 56

percent of the cost of duct repair—the two most frequent energy efficiency improvements for older homes" (Austin Energy 2010).

Impacts on Tenants

Given the nascent status of the ECAD any impacts on tenants in Austin are unknown. The program administrator and Biedrzycki, the Executive Director of Texas ROSE, feel that tenants are unlikely to experience negative impacts as a result of the ordinance. Both interviewees note an expectation that property owners are more likely to be able to charge higher rents due to a property's visual characteristics than its energy efficiency (Biedrzycki 2011; Kisner 2011a). Biedrzycki's comments suggest that market forces and expensive renewable energy systems may be more powerful than the valuation of energy efficiency. Further challenging the assertion that improvements in energy efficiency may result in rent increases, Biedrzycki questions whether such a concern for tenants is actually a modified version of the alarmist statements from the real estate industry during the early ECAD discussions. "That sounds like another way that people suddenly become very ardent low-income advocates in order to not have to do something that they should be doing," says Biedrzycki. She follows with, "I'm not buying that argument … energy efficiency does not equal extravagance" (Biedrzycki 2011).

Outcomes

It is too early to identify quantitative outcomes of Austin's ECAD, but the city does plan to conduct a formal evaluation of its efforts (Kisner 2011a). In the absence of a formal evaluation, anecdotal evidence available through the program administrator and consumer advocate suggests that the ECAD encourages property owners to enroll in

energy efficiency programs and that purchasers are using the results of energy audits during sales negotiations.

As of January 2011, AE's ECAD program administrator reports that 11 percent of the homes enrolled in the utility's energy efficiency programs have done so pursuant to the ECAD. "We're seeing homes that are having audits done and getting the upgrades completed" (Kisner 2011a). Suggesting that the ECAD is affecting property negotiations, AE's program administrator notes that market actors are working together to amend the ordinance to determine how the audit can be available earlier in the real estate transaction process (Kisner 2011a). Biedrzycki cites similar anecdotes, noting property purchasers that have expressed appreciation for the building energy information as they sought to acquire a property. "I know people who have used [the energy audit] to negotiate … the price because they found out as a result of having the audit that the air conditioner was really old and on its last legs …" (Biedrzycki 2011). Similarly for the larger residential properties, as properties with more than five units approach the June 1, 2011 deadline to complete an energy audit, AE's program administrator notes an increase in the number of properties seeking energy efficiency upgrades (Kisner 2011a).

Appendix B: Interviewees

Bierdrzycki, Carol. Executive Director, Texas Ratepayers' Organization to Save Energy, Austin, TX.

Bolduc, John. Environmental Planner, City of Cambridge, MA.

Boyd, Soledad. Senior Organizer, Community Labor United, Boston, MA.

Broomhead, Cal. Climate and Energy Programs Manager, City of San Francisco, CA.

Buckley, Tom. Manager, Customer & Energy Services, Burlington Electric Department, Burlington, VT.

Chretien, Larry. Executive Director, Energy Consumers Alliance of New England (dba Mass Energy Consumers Alliance), Boston, MA.

Conner, Penelope. Vice President of Customer Care, NSTAR, Westwood, MA.

Finlayson, Ian. Manager, Buildings and Climate Programs, Massachusetts Department of Energy Resources, Boston, MA.

Hertel, Joe. Rental Weatherization Program Manager, Department of Commerce, State of Wisconsin.

Kisner, Tim. Project Manager, Energy Efficiency Services, Austin Energy, Austin, TX.

LaPierre, Alice. Energy Efficiency Coordinator, City of Berkeley, CA.

Larson, Heather. Program Manager, Stopwaste.org, Oakland, CA.

Pine, Brian. Assistant Director for Housing and Neighborhood Revitalization, Community & Economic Development Office, City of Burlington, VT.

Wimpey, Ted. Director, Coordinated Statewide Housing Services, Champlain Valley Office of Economic Opportunity, Burlington, VT.

References

Austin Energy. 2009. Rule Number R161-09.35. edited by Austin Energy.

Austin Energy. 2010. Energy Conservation and Disclosure Ordinance - Homes. Austin, TX.

Austin Energy. 2010. A Guide for Homebuyers, Homesellers, and Homeowners. Austin, TX: Austin Energy.

Austin Energy. 2011. *About the Energy Conservation Audit and Disclosure (ECAD) Ordinance*. [cited April 11 2011]. Available from http://www.austinenergy.com/About%20Us/Environmental%20Initiatives/ordinance/index.htm.

Austin Energy Efficiency Upgrades Task Force. 2008. Final Report to the City Council. Austin, TX.

Bamberger, Lori. 2010. Scaling the Nationwide Energy Retrofit of Affordable Multifamily Housing: Innovations and Policy Recommendations. What Works Collaborative.

Barbose, Galen, Charles Goldman, and Jeff Schlegel. 2009. The Shifting Landscape of Ratepayer-Funded Energy Efficiency in the U.S. *The Electricity Journal* 22 (8):29-44.

Biedrzycki, Carol. 2011. Texas Ratepayers' Organization to Save Energy, Executive Director. Telephone Interview. March 17.

Bleviss, D.L., and A.A. Gravitz. 1984. *Energy conservation and existing rental housing*. Washington, D.C.: Energy Conservation Coalition.

Boyd, Soledad. 2011. Community Labor United, Senior Organizer. In-person Interview. February 24.

Broomhead, Cal. 2011a. San Francisco Energy and Climate Programs Manager, Telephone Interview. March 4.

Broomhead, Cal. 2011b. San Francisco Energy and Climate Programs Manager, Personal Email. March 1.

Broomhead, Cal. 2011c. San Francisco Energy and Climate Programs Manager, Personal Email. April 12.

Brown, Rich, Sam Borgeson, Jon Koomey, and Peter Biermayer. 2008. U.S. Building-Sector Energy Efficiency Potential. Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National Laboratory.

Buckley, Tom. 2011. Burlington Electric Department Customer and Energy Services Manager. Telephone Interview. March 1.

Building Codes Assistance Project. 2011. *Massachusetts* [cited May 1 2011]. Available from http://bcap-ocean.org/state-country/massachusetts.

Burlington Electric Department. 2011. *Time of Sale Minimum Energy Efficiency Ordinance for Rental Housing (TOS)* [cited April 13 2011]. Available from https://www.burlingtonelectric.com/page.php?pid=43&name=time_of_sale#q&a.

Butterfield, Karen, and Victoria Eisen. 1987. RECOs: when state and local governments mandate energy conservation. *Energy Auditor & Retrofitter* 4 (1):31-35.

Chretien, Larry. 2011. Energy Consumers Alliance of New England (dba Mass Energy Consumers Alliance in Mass. And People's Power & Light in RI) Executive Director. Personal Interview. March 25.
City of Austin. 2007. Resolution Number 20070215-023.
City of Austin. 2008. Energy Conservation Audit and Disclosure. In *Chapter 6-7*, edited by Austin Energy.
City of Berkeley. 1991. Residential Energy Conservation Ordinance. In *Chapter 19.16*, edited by Planning Department.
City of Berkeley. 2008. Residential Energy Conservation Ordinance (RECO), Berkeley Municipal Code Chapter 19.16, Resolution No. 62,181-N.S. A Compliance Guide for Berkeley's Property Owners, Buyers, and Sellers. edited by Planning Department. Berkeley, CA: City of Berkeley.
City of Boston. 2010a. Sparking Boston's Climate Revolution: Recommendations of the Climate Action Leadership Committee and Community Advisory Committee. Boston, MA.
City of Boston. 2010b. *Renew Boston* [cited December 5 2010]. Available from http://www.cityofboston.gov/environmentalandenergy/renewableenergy/renew_boston.asp.
City of Boston. 2011. *Real Estate Trends* [cited May 1 2011]. Available from http://www.cityofboston.gov/dnd/pdr/real_estate_trends.asp.
City of Boston Assessing Department. 2010. Boston, MA (Land parcels, 2010). Boston, MA: MIT Geodata Repository.
City of Burlington. 1997. Minimum Rental Housing Energy Efficiency Standards Ordinance. In *Chapter 18, Article VII*, edited by Burlington Electric Department.
City of San Francisco. 1991. Residential Energy Conservation Ordinance. In *Ordinance No. 76-09*, edited by Department of Building Inspections.
Commonwealth of Massachusetts. 2008a. Global Warming Solutions Act. In *Chapter 298 of Acts of 2008*.
Commonwealth of Massachusetts. 2008b. Green Communities Act. In *Section 105 of Chapter 169 of Acts of 2008*.
Connelly, Mary Jo. 2008. The Green Justice Solution: A Win-Win Plan to Prevent Climate Crisis and Jumpstart and Equitable and Sustainable Economic Recovery. Green Justice Coalition and Community Labor United.
Conner, Penelope. 2011. NSTAR Vice President of Customer Care. Telephone Interview. March 10.
DeCicco, John, Rick Diamond, Sandra L. Nolden, Janice DeBarros, and Tom Wilson. 1995. *Improving Energy Efficiency in Apartment Buildings*. Washington, D.C.: American Council for an Energy Efficient Economy.
DOER. 2010. An MPG Rating for Commercial Buildings: Establishing a Building Energy Asset Labeling Program in Massachusetts. Boston, MA: Massachusetts Department of Energy Resources.
Dunsky, Philippe, Jeff Lindberg, Emine Piyale-Sheard, and Richard Faesy. 2009. Valuing Building Energy Efficiency Through Disclosure and Upgrade Policies: A Roadmap for the Northeast U.S.: Dunsky Energy Consulting, Northeast Energy Efficiency Partnerships.

Environment Northeast. 2008. Massachusetts 2008 Energy Bill. Boston: Environment Northeast.
EOEEA. 2009. Getting to Zero: Final Report of the Massachusetts Zero Net Energy Buildings Task Force. Boston, MA: Executive Office of Energy and Environmental Affairs.
EOEEA. 2010. Massachusetts Clean Energy and Climate Plan for 2020: A report to the Great and General Court pursuant to the Global Warming Solutions Act Boston, MA: Executive Office of Energy and Environmental Affairs.
EOEEA. 2011. *Piloting New Approaches to Home Energy Efficiency*. Executive Office of Energy and Environmental Affairs [cited April 1 2011]. Available from http://www.mass.gov/?pageID=eoeeaterminal&L=5&L0=Home&L1=Grants+%26+Technical+Assistance&L2=Guidance+%26+Technical+Assistance&L3=Agencies+and+Divisions&L4=Department+of+Energy+Resources+%28DOER%29&sid=Eoeea&b=terminalcontent&f=doer_Energy_Efficiency_New-Approaches&csid=Eoeea.
EOHED. 2011. *Weatherization Assistance Program (WAP)*. Massachusetts Executive Office of Housing and Economic Development [cited April 6 2011]. Available from http://www.mass.gov/?pageID=ehedterminal&L=3&L0=Home&L1=Community+Development&L2=Housing+Energy+Programs&sid=Ehed&b=terminalcontent&f=dhcd_cd_wap_wap&csid=Ehed.
Fuller, M. 2009. Enabling Investments in Energy Efficiency. *California Institute for Energy and Environment*.
Fuller, M.C. 2010. Driving Demand for Home Energy Improvements: Motivating residential customers to invest in comprehensive upgrades that eliminate energy waste, avoid high utility bills, and spur the economy.
Golove, W.H., J.H. Eto, Lawrence Berkeley National Laboratory. Energy, and Environment Division. 1996. *Market Barriers to Energy Efficency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency*: Citeseer.
Goodman Jr, J., and M. Grupe. 1995. Top ten surprises about ownership and financing of rental housing. *Real Estate Finance* 11:42-48.
Granade, H.C., and McKinsey & Company. 2009. *Unlocking energy efficiency in the US economy*: McKinsey & Co.
Guidice, Phil, and Frank Gorke. 2010. Presentation to MIT Course 11.379. Cambridge, MA, October 13.
Hertel, Joe. 2011a. State of Wisconsin Rental Weatherization Program Manager, Telephone Interview. February 18.
Hertel, Joe. 2011b. State of Wisconsin Rental Weatherization Program Manager, Personal Email. April 25.
Hirst, Eric. 1989. Reaching for 100% Participation in a Utility Conservation Programme: The Hood River Project. *Energy Policy* 17 (2):155.
Jay, Jason Jesurum. 2010. Paradoxes of Hybrid Organizing in the Cambridge Energy Alliance, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.

John, DeWitt. 1994. *Civic Environmentalism: Alternatives to Regulation in States and Communities*. Washington, DC: CQ Press.
Kaufman, Leslie. 2010. Massachusetts Sets High Goals for Energy. *New York Times*, January 30, 2010.
Kirschling, Audrey, Karl Pnazek, and Christopher Moore. 1982. Residential energy conservation in the small city: the case for an energy efficient dwelling code. *Community Energy Strategies*:281 - 289.
Kisner, Tim. 2011a. Austin Energy. Project Manager, Energy Efficiency Services. Telephone Interview. March 9.
Kisner, Tim. 2011b. Austin Energy. Project Manager, Energy Efficiency Services. Personal Email. April 25.
Koomey, Jonathan G., Carrie A. Webber, Celina S. Atkinson, and Andrew Nicholls. 2001. Addressing energy-related challenges for the US buildings sector: results from the clean energy futures study. *Energy Policy* 29 (14):1209-1221.
LaPierre, Alice. 2011a. City of Berkeley Building Science Specialist, Telephone Interview. February 23.
LaPierre, Alice. 2011b. City of Berkeley Building Science Specialist, Personal Email. February 23.
LaPierre, Alice. 2011c. City of Berkeley Building Science Specialist, Personal Email. April 13.
Laquatra, Joseph. 1987. Energy Efficiency in Rental Housing. *Energy Policy* 15 (6):549.
Levine, A., and J. Raab. 1981. Solar energy, conservation, and rental housing. Golden, CO: Solar Energy Research Inst.
Mass Save. 2011a. *Residential High-Efficiency Heating Equipment Rebate Program* [cited April 6 2011]. Available from http://www.masssave.com/residential/heating-and-cooling/find-incentives/incentive-details-gas-networks-hehewh?q=76844a47-42b5-4f77-ab62-45a4f89266ef.
Mass Save. 2011b. *Mass Save HEAT Loan Zero Interest Financing for 2011* [cited April 6 2011]. Available from http://www.masssave.com/residential/heating-and-cooling/find-incentives/incentive-details-heat-loan-program?q=e9276d93-0d48-4d83-a7f9-224af7a01aff.
Mass Save. 2011c. *Heating & Cooling: Find Incentives* [cited April 6 2011]. Available from http://www.masssave.com/residential/heating-and-cooling/find-incentives/.
Middle Class Task Force, and Council on Environmental Quality. 2009. Recovery Through Retrofit. Washington, D.C: Office of the Vice President of the United States, Executive Office of the President of the United States.
Molina, Maggie, Max Neubauer, Michael Sciortino, Seth Nowak, Shruti Vaidyanathan, Nate Kaufman, and Anna Chittum. 2010. The 2010 State Energy Efficiency Scorecard. Wasington, D.C.: American Council for an Energy Efficient Economy.
National Academy of Sciences, National Academy of Engineering, and National Research Council. 2010. Overview and Summary of America's Energy Future: Technology and Transformation. Washington, D.C.

National Grid, NSTAR, Unitil, Berkshire Gas, New England Gas Company, Bay State Gas, and Blackstone Gas Company. 2009. 2010-2012 Massachusetts Joint Statewide Three-Year Gas Energy Efficiency Plan.
National Grid, NSTAR, Unitil, Western Massachusetts Electric, and Cape Light Compact. 2009. 2010-2012 Massachusetts Joint Statewide Three-Year Electric Energy Efficiency Plan.
Naucler, T., and P.A. Enkvist. 2009. Pathways to a Low-Carbon Economy: Version 2 of the Global Greenhouse Gas Abatement Cost Curve. McKinsey & Company.
Nexus Market Research, Inc. 2007. MassSave Market Progress and Evaluation Report: Results of the Landlord Survey. Cambridge, MA.
Panoska, Christina. 2008. Residential and Commercial Energy Conservation Ordinances. Southwest Energy Efficiency Project.
Pine, Brian. 2011. City of Burlington Community and Economic Development Office Assistant Director for Housing. Telephone Interview. March 15.
Pitt, D.R. 2010. Harnessing community energy: the keys to climate mitigation policy adoption in US municipalities. *Local Environment* 15 (8):717-729.
Portney, K.E. 2002. Taking Sustainable Cities Seriously: a comparative analysis of twenty-four US cities. *Local Environment* 7 (4):363-380.
Raab, Jonathan. 1994. *Using consensus building to improve utility regulation*. Washington, D.C: American Council for an Energy Efficient Economy.
Renew Boston Facilitation Team, Peregrine Energy Group, Meister Consulting Group, Serrafix Corporation, BlueWave Strategies, and Clean Enery Solutions. 2010. Renew Boston Recommendations, Phase I. Boston, MA.
Schwartz, A.F. 2010. *Housing policy in the United States*. Second ed. New York, NY: Routledge.
Shelley, Steven. 1989. Residential Time of Sale Energy Efficiency Ordinances. Burlington, VT: Burlington Electric Department.
Socolow, Robert H., and Stephen W. Pacala. 2006. A Plan to Keep Carbon in Check. *Scientific American* 295 (3):50-57.
State of Wisconsin. 2008. Rental Unit Energy Efficiency. In *Chapter Comm 67*, edited by Department of Commerce.
Stern, Paul C., and Elliot Aronson. 1984. *Energy use: the human dimension*. Edited by National Research Council. New York: W.H. Freeman.
Suozzo, M., K. Wang, and J. Thorne. 1997. Policy Options for Improving Existing Housing Efficiency.
Thiels, Ginny. 2011. Burlington Electric Department. Personal Email. April 8.
U.S. Census Bureau. 2005-2009a. Median household income in the past 12 months (in 2009 inflation-adjusted dollars), B25119; American Community Survey. Washington, D.C.
U.S. Census Bureau. 2005-2009b. Tenure by occupied housing units, B25003; American Community Survey. Washington, D.C.
U.S. Census Bureau. 2005-2009c. Tenure by Year Structure Built, B25036; American Community Survey. Wasington, D.C.
U.S. Census Bureau. 2005-2009d. Tenure by units in structure, B25032; American Community Survey. Washington, D.C.

U.S. Census Bureau. 2005-2009e. Berkeley city, California: Selected Housing Characteristics: 2005-2009 American Community Survey. Washington, D.C.
U.S. Census Bureau. 2005-2009f. Wisconsin: Selected Housing Characteristics: 2005-2009 American Community Survey. Washington, D.C.
U.S. Census Bureau. 2011a. *Burlington City, Vermont; Selected Housing Characteristics: 2005-2009; American Community Survey* [cited April 17 2011]. Available from http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=16000US5010675&-qr_name=ACS_2009_5YR_G00_DP5YR4&-ds_name=ACS_2009_5YR_G00_&-_lang=en&-_sse=on.
U.S. Census Bureau. 2011b. *San Francisco, CA - 2005-2009 American Community Survey 5-Year Estimates* [cited May 2 2011]. Available from http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=ChangeGeoContext&geo_id=16000US0667000&_geoContext=&_street=&_county=San+Francisco&_cityTown=San+Francisco&_state=04000US06&_zip=&_lang=en&_sse=on&ActiveGeoDiv=&_useEV=&pctxt=fph&pgsl=010&_submenuId=factsheet_1&ds_name=ACS_2009_5YR_SAFF&_ci_nbr=null&qr_name=null&reg=null%3Anull&_keyword=&_industry=.
U.S. Census Bureau. 2011c. *Wisconsin - 2005-2009 American Community Survey 5-Year Estimates* [cited May 2 2011]. Available from http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=Search&geo_id=&_geoContext=&_street=&_county=&_cityTown=&_state=04000US55&_zip=&_lang=en&_sse=on&pctxt=fph&pgsl=010.
U.S. Census Bureau. 2011d. *Berkeley, CA - 2005-2009 American Community Survey 5-Year Estimates* [cited May 2 2011]. Available from http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=ChangeGeoContext&geo_id=16000US0606000&_geoContext=01000US|04000US06|16000US0667000&_street=&_county=Berkeley%2C+CA&_cityTown=Berkeley%2C+CA&_state=04000US06&_zip=&_lang=en&_sse=on&ActiveGeoDiv=geoSelect&_useEV=&pctxt=fph&pgsl=010&_submenuId=factsheet_1&ds_name=ACS_2009_5YR_SAFF&_ci_nbr=null&qr_name=null&reg=null%3Anull&_keyword=&_industry=.
U.S. Census Bureau. 2011e. *Burlington, VT - 2005-2009 American Community Survey 5-Year Estimates* [cited May 2 2011]. Available from http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=ChangeGeoContext&geo_id=16000US5010675&_geoContext=01000US|04000US06|16000US0606000&_street=&_county=Burlington&_cityTown=Burlington&_state=04000US50&_zip=&_lang=en&_sse=on&ActiveGeoDiv=geoSelect&_useEV=&pctxt=fph&pgsl=010&_submenuId=factsheet_1&ds_name=ACS_2009_5YR_SAFF&_ci_nbr=null&qr_name=null&reg=null%3Anull&_keyword=&_industry=.
U.S. Census Bureau. 2011f. *Austin, TX - 2005-2009 American Community Survey 5-Year Estimates* [cited May 2 2011]. Available from http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=ChangeGeoContext&geo_id=16000US4805000&_geoContext=01000US|04000US50|16000US5010675&_street=&_county=Austin&_cityTown=Austin&_state=04000US48&_zip=&_lang=en&_sse=on&ActiveGeoDiv=geoSelect&_useEV=&pctxt=fph&pgsl=010&

_submenuId=factsheet_1&ds_name=ACS_2009_5YR_SAFF&_ci_nbr=null&qr_name=null&reg=null%3Anull&_keyword=&_industry=.
U.S. Department of Energy. 2010. *Energy Efficiency and Conservation Block Grant Program* [cited December 4 2010]. Available from http://www1.eere.energy.gov/wip/eecbg.html.
U.S. Department of Energy. 2011a. *Weatherization Assistance Program* [cited April 6 2011]. Available from http://www1.eere.energy.gov/wip/wap.html.
U.S. Department of Energy. 2011b. *Recovery Act and the Weatherization Assistance Program* [cited May 10 2011]. Available from http://www1.eere.energy.gov/wip/recovery_act_wap.html.
U.S. Department of Energy. 2011c. *About the BetterBuildings Program* [cited May 10 2011]. Available from http://www1.eere.energy.gov/buildings/betterbuildings/about.html.
U.S. Department of Energy, D&R International, Ltd. 2009. 2009 Buildings Energy Data Book. Washington, D.C.: U.S. Department of Energy.
U.S. Department of Energy, Energy Information Agency. 2010. *Householder's Perceptions of Insulation Adequacy and Drafts in the Home in 2001* [cited December 10 2010]. Available from http://www.eia.doe.gov/emeu/recs/recs2001/insulation/insulation.html#householderownership.
U.S. Department of Energy, Energy Information Agency. 2011. *Natural Gas Prices , Massachusetts, 2009* [cited May 12 2011]. Available from http://www.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_SMA_a.htm.
Vermont Energy Investment Corporation. 2009. Cambridge Stretch Code Modeling, June 30.
Wimpey, Ted. 2011. Champlain Valley Office of Economic Opportunity Director of Coordinated Statewide Housing Services. Telephone Interview. March 15.
Wisconsin Department of Commerce. 2011. *Safety and Buildings - Rental Weatherization Property Search* [cited April 13 2011]. Available from http://www.commerce.state.wi.us/SB/SB-RentalWeatherization-Search.html.
Wood, L. 2010. The Innovation is in the Outreach. *Electric Perspectives* 35 (2):6.
Woody, Todd. 2010. Loan Giants Threaten Energy-Efficiency Programs. *New York Times*, July 1.
Worcester Telegram & Gazette. 2011. *Two cities to get free energy consultation* [cited April 1 2011]. Available from http://www.telegram.com/article/20101111/NEWS/11110714/1101/local.