Tufts University

Department of Urban and
Environmental Policy and Planning

Retrofitting for Residential Energy Efficiency in Somerville:

A Program Feasibility Study for the City of Somerville

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The Research Team is excited to observe the continuing evolution of this project. We are honored to be part of the process of developing a successful residential energy efficiency program in the city of Somerville.

Abstract

As the United States works to reduce its greenhouse gas emissions and fossil fuel dependence, the role of energy efficiency in reducing energy consumption must be recognized. In 2006, residential buildings were responsible for 37 percent of the country's electricity consumption[1] and 2,236 million metric tons of carbon dioxide emissions.[2] The city of Somerville's Office of Sustainability and Environment and the Housing Rehabilitation Program commissioned the Tufts University Field Project Research Team to examine the feasibility of implementing a city-run residential energy efficiency retrofit program. Through various research methods, five challenges were identified that the city must overcome in order to implement a successful program. The development of this program will be a two-part process over the next two and a half years. Part I will utilize existing funding to educate the community and to garner support from various stakeholders. Part II will design a long-term strategic plan for developing a sustainable "one-stop shop" program that will consolidate the city's efforts to support energy efficiency efforts. Creating a centralized, cost-effective and dynamic nucleus for the city's energy efficiency efforts will enable Somerville's residential energy efficiency program to expand its scope in the long-term.

1 U.S. Department of Energy. (n.d.). *Buildings Share of U.S. Electricity Consumption*. Retrieved March 26, 2010, from Buildings Energy Databook: http://buildingsdatabook.eren.doe.gov/TableView.aspx?table=1.1.9

2 U.S. Department of Energy. (n.d.). *Carbon Dioxide Emissions for U.S. Buildings*. Retrieved March 26, 2010, from Buildings Energy Databook: http://buildingsdatabook.eren.doe.gov/TableView.aspx?table=1.4.1

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Executive Summary

Despite the recent celebration of the 40th anniversary of Earth Day, the global community faces an energy crisis with potentially dire environmental, social and economic consequences. The United States is currently working to reduce its greenhouse gas emissions and fossil fuel dependence. While the development of clean and renewable energy technology is part of the solution to developing a greener economy, reducing energy consumption and increasing energy efficiency in the residential, commercial and industrial sectors has tremendous potential for mitigating the effects of the impending energy crisis. In 2006, residential buildings were responsible for 21 percent of the country's primary energy consumption[1] and 37 percent of the country's electricity consumption.[2] Also in 2006, residential buildings were responsible for emitting 2,236 million metric tons of carbon dioxide,[3] which is equivalent to the annual emissions of 427 million U.S. passenger vehicles.[4]

Most of the energy consumed in residential buildings is used for lighting, heating and cooling services. The high level of energy consumption in the U.S.'s residential building sector is largely a result of a national housing stock that does not use energy efficiently. Recognizing the harmful environmental, social and economic impact of such high inefficiency, U.S. leaders at the federal, state and local level have expressed growing interest in retrofitting American homes to make them more energy efficient. President Obama echoed the importance of residential energy efficiency in a speech given in Alexandria, Virginia on December 15, 2009:

> The simple act of retrofitting these buildings to make them more energy-efficient—installing new windows and doors, insulation, roofing, sealing leaks, modernizing heating and cooling equipment—is one of the fastest, easiest and cheapest things we can do to put Americans back to work while saving families money and reducing harmful emissions.[5]

Following this lead, the city of Somerville, Massachusetts is looking to expand its current efforts to promote residential energy efficiency retrofits. To further this goal, the city's Office of Sustainability and Environment (OSE) and the Housing Rehabilitation Program (HRP) recruited the Tufts University Field Project Research Team (Research Team) to examine the feasibility of implementing a city-run residential energy efficient retrofit program.

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1 U.S. Department of Energy. (n.d.a), op cit.

2 Ibid.

3 U.S. Department of Energy. (n.d.b), op cit.

4 U.S. Environmental Protection Agency. (2010, March). *Greenhouse Gas Equivalencies Calculator.* Retrieved March 26, 2010, from http://www.epa.gov/RDEE/energy-resources/calculator.html#results.

5 U.S. Department of Energy. (2009, December 15). *The President on Retrofitting Buildings.* Retrieved March 26, 2010, from http://apps1.eere.energy.gov/news/daily.cfm/hp_news_id=222.

The Research Team was charged with two primary tasks: (1) to evaluate the existing housing conditions in Somerville to determine the feasibility of implementing an energy efficient residential retrofit program and (2) to provide recommendations to the city for ways to overcome challenges to the implementation of such a program. In addition to these tasks, the city also requested an exploration of any additional funding sources that may be available currently to support the city's efforts.

Through interviews, a literature review, a survey and a project materials analysis, the Research Team identified five core challenges the city needs to address in order to implement a successful residential energy efficiency program. The five challenges are: Information; Expertise; Split-Incentives; Financial; and Demographic and Housing Stock. Each of these challenges present particular obstacles to the implementation of an energy efficiency residential retrofit program in Somerville.

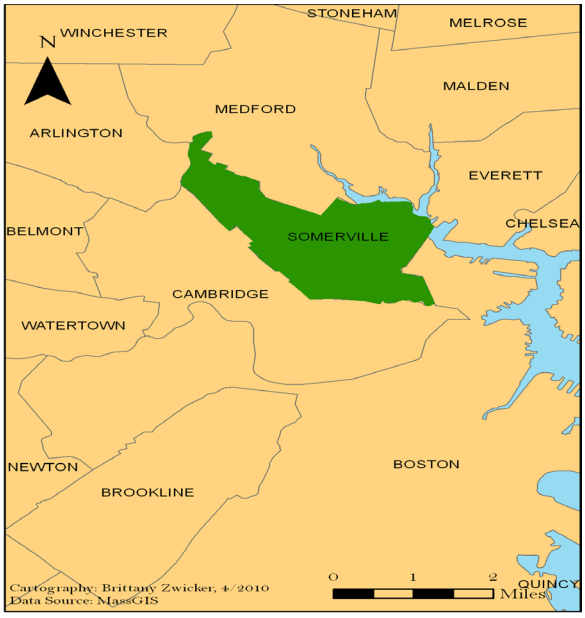
After analyzing these obstacles and investigating potential solutions, the Research Team developed specific recommendations for how the city might overcome the challenges to developing a city-run residential energy efficiency program. The recommendations include a two-part planning and development process, which will last from the spring of 2010 until the fall of 2012, at which time the current federal funding the city has secured is set to expire. The primary goals of Part I of the program's development will be to utilize existing funding to garner support from the community, including a community education program, to coordinate stakeholders and to begin to organize a long-term strategic plan for a sustainable residential energy efficiency program. The goal of Part II, which will occur simultaneously with Part 1 over the next two and a half years, will be to create a long-term strategic plan that will consolidate all of the city's energy efficiency efforts into a "one-stop shop" program. This two-part planning and development process will serve as the most effective approach to creating a centralized, cost-effective and dynamic nucleus for the city's energy efficiency efforts that will enable Somerville's residential energy efficiency program to expand its scope in the long-term.

Chapter 1
Introduction to Report

Introduction to the City of Somerville

The city of Somerville is located just north of Boston in Middlesex County, Massachusetts. With 76,000 residents living in just 4.1 square miles, Somerville is the most densely populated city in New England at approximately 18,500 people per square mile.[1] Additionally, within this tightly packed area is a large immigrant population; 27 percent of the population is foreign born and 32 percent speak a language other than English at home. Somerville's population density and large immigrant population directly affect how successful residents are at taking advantage of city-run programs and will affect the development of a residential energy efficiency program.

Figure 1: *Map of Somerville*



Source: Zwicker, B. (2010, April). Map of Somerville

Somerville Statistics

- 76,000 residents
- 4.1 square miles in area
- 2008 median household income of $60,674
- 10% households live below the poverty line
- 27% of population is foreign born
- 32% speak a language other than English

Project Overview

The city of Somerville's Office of Sustainability and Environment (OSE) and the Housing Rehabilitation Program (HRP) commissioned this report to examine the feasibility of developing a city-run residential energy efficiency retrofit program in Somerville. The city's interest in such a program stems from several recent state and local legislative initiatives. In 2008, Massachusetts Governor Deval Patrick signed into the law the Global Warming Solutions Act. This act set economy-wide greenhouse gas emission reduction goals for Massachusetts and initiated the Green Communities Act, a comprehensive energy reform bill. Recognizing the significant impact that energy efficiency can have on reducing greenhouse gas emissions and ensuring that energy demand is met, Massachusetts declared energy efficiency to be the state's "first fuel" for meeting its energy needs.[2]

1 Keane Jr., T. M. (2008). *The Model City.* Retrieved April 2, 2010, from City of Somerville: http://www.somervillema.gov/spotlight.cfm?id=65.

2 Massachusetts Department of Energy Resources. (2010). *Energy Efficiency in Massachusetts: Our First Fuel.* Retrieved from http://www.mass.gov/Eoeea/docs/doer/Energy_Efficiency/MA%20EE%20story%202-1-10.pdf .

In line with the state's leadership in developing policies and reforms to tackle climate change, the city of Somerville, under Mayor Joseph A. Curtatone's leadership, has taken significant strides to address energy and environmental issues in the community. Mayor Curtatone recently signed the U.S. Conference of Mayors Climate Protection Agreement, the goal of which is to decrease participating cities' greenhouse gas emissions to 1997 levels.[3] In November 2009, as part of the American Recovery and Reinvestment Act, OSE received a $651,000 Energy Efficiency and Conservation Block Grant from the Department of Energy. OSE plans to use a significant portion of this funding to jumpstart the city's efforts to expand energy efficiency retrofits in residential buildings. In addition to OSE's interest in developing a residential energy efficiency retrofit program, HRP is also interested in incorporating energy efficiency projects into its current operations.

Addressing Climate Change and Increasing Energy Consumption with Energy Efficiency

Commercial, residential, and industrial buildings are responsible for 48 percent of the energy consumed in U.S., with residential buildings alone accounting for 21 percent of the country's energy consumption.[1] Energy efficiency measures performed in buildings are cost-effective ways to reduce energy consumption and can be the first steps used to reduce greenhouse gas emissions and the U.S.'s increasing energy consumption. In a 2009 report, McKinsey & Company found that energy efficiency retrofit measures in U.S. buildings could reduce consumer energy demand in the U.S. by 23 percent by 2020 and save a total of $680 billion. Further, McKinsey & Company found that this reduction in consumer energy demand will result in a reduction of 1.1 gigatons of greenhouse gas emissions annually,[2] which is like taking 1.9 million passenger vehicles, or the entire U.S. fleet of passenger vehicles and light trucks, off the road each year.[3]

[1] Architecture 2030. (n.d.) *The Building Sector: A Hidden Culprit.* Retrieved from http://www.architecture2030.org/current_situation/building_sector.html.

[2] McKinsey & Company. (2009, July). *Unlocking Energy Efficiency in the U.S. Economy.* Retrieved from http://www.mckinsey.com/clientservice/electricpowernaturalgas/downloads/US_energy_efficiency_full_report.pdf

[3] U.S. EPA. (2010, March), op cit.

Anticipating the challenges that would obstruct residential energy efficiency efforts, OSE and HRP requested an analysis to determine the feasibility of developing a city-run residential energy efficiency program in Somerville, as well as recommendations for the implementation of such a program. OSE and HRP face many of the same challenges in incorporating residential energy efficiency efforts into their respective programs. However, each program has unique circumstances, resources and capabilities. These differences were considered when conducting the research and analysis for this report.

3 Mayors Climate Protection Center. (n.d.) *The U.S. Conference of Mayors Climate Protection Agreement.* Retrieved from http://www.usmayors.org/climateprotection/list.asp.

With initial funding secured for the development of a residential energy efficiency retrofit program, OSE had specific requests for information that it believed would be useful for tackling expected challenges. These requests were:

- To determine what additional funding mechanisms could support the OSE energy efficiency retrofit program once the initial funding runs out after the first three years;
- To analyze the federal, state and utility financial energy efficiency rebates and incentives that exist for Somerville residents;
- To examine the split-incentives problem to determine how it is exhibited in Somerville and develop recommendations for how the problem can be resolved or ameliorated; and
- To review case studies of successful energy efficiency programs nationwide, especially programs with similar demographic and housing characteristics as Somerville, and identify their best practices.

HRP's vision for how it will incorporate energy efficiency efforts into its current operation is less concrete than OSE's vision. To facilitate HRP's understanding of how to successfully integrate energy efficiency retrofit measures into its current health, safety and building code priorities, HRP's requests were:

- To determine what need exists for energy efficiency upgrades in Somerville's low-income housing stock;
- To determine whether the most common repairs and replaced materials in HRP's rehabilitation projects can be replaced with more energy efficient systems and materials within the program's current budget;
- To determine whether there are additional funding mechanisms HRP could use to expand its capacity to pursue energy efficiency retrofits; and
- To design a brochure or reference guide to educate Somerville residents of all income levels about energy efficiency products, energy efficiency rebates and incentives, and projected cost savings from energy efficiency projects.

Research Questions and Methodology

Based on the client's requests, as summarized above, this report aims to address two broad research questions:

1. How can the city of Somerville use existing resources and program structures to improve residential energy efficiency retrofit efforts in the *short-term*?

2. What measures can the city of Somerville take over the *long-term* to ensure the success of a residential energy efficiency program?

The following research methodologies were employed to address these research questions: (1) interviews; (2) literature reviews; (3) a case study analysis; (4) a materials analysis; and (5) a homeowner survey. Interviews and literature reviews were done to determine the city's past and current efforts to address energy efficiency work, the context in which residential energy efficiency has emerged, the challenges to addressing residential energy efficiency in Somerville and how other organizations and municipalities have addressed these challenges. The interviews were conducted with city officials, as well as with directors of residential energy efficiency programs and experts in the energy efficiency field. A list of these interviews is attached as Appendix 2. Much of the information gleaned from the interviews and literature reviews was also used to inform a case study analysis of residential energy efficiency programs throughout the country. The lessons learned from these case studies are presented and discussed in the report's recommendations found in Chapters 4 and 5. Appendix 3 provides further information on the methodology applied to conduct these case studies, as well an overview of each case study program.

Research Methodologies

(1) Interviews

(2) Literature reviews

(3) Case study analysis

(4) Materials analysis

(5) Homeowner survey

A project and materials analysis was performed using specifications from past HRP projects to determine how HRP has previously approached energy efficiency retrofitting in their home renovation projects. A more detailed explanation of how the materials analysis was conducted is presented in Appendix 4. Finally, a homeowner survey uncovered information about residents' attitudes toward energy efficiency, and an analysis of the city's Assessor database produced information about the city's housing stock and demographics. The questions asked in the homeowner survey, along with a discussion of the methodology chosen for this survey, are found in Appendix 5.

The information collected for this report highlights the challenges that the city of Somerville will face when trying to implement a city-run residential energy efficiency program. This information forms the basis of the recommendations provided to the city in this report.

Organization of the Report

The report begins in Chapter 2 with an analyzes of the city's efforts to address residential energy efficiency retrofits. Chapter 3 defines and analyses the challenges to residential energy efficiency efforts in Somerville. Chapters 4 and 5 present short and long-term recommendations for the city of Somerville.

Chapter 2
Somerville Residential Energy Efficiency Efforts

Under Mayor Curtatone's leadership, Somerville has made significant efforts to determine areas in which it can become a more sustainable community. As part of these efforts, the Somerville Housing Division's Housing Rehabilitation Program (HRP) and the Mayor's Office of Sustainability and Environment (OSE) are currently reviewing and developing strategies for how to successfully develop and implement city-run residential energy efficiency retrofit projects. This chapter reviews and analyzes existing municipal programs, including HRP and OSE, and their respective approaches to promoting residential energy efficiency.

The Menotomy Weatherization Assistance Program

The U.S. Department of Energy's (DOE) Weatherization Assistance Program (WAP) is a federally funded program that provides home energy conservation services to low-income households. The goal of the program is to make homes more energy efficient and to reduce monthly energy bills. State governments distribute DOE grants to regional and municipal WAPs. The Menotomy WAP serves the communities of Cambridge, Somerville, Waltham, Arlington, Belmont and Watertown. In addition to federal grant funding, the Menotomy program also leverages utility funding through NSTAR Gas and Electric.[1]

The Menotomy program offers residents weatherization services such as insulation installments, window replacement, heating system repairs and replacements and asbestos removal. Between January 2004 and March 2009, the Menotomy program serviced a total of 667 units, 138 of which were in Somerville.[2] On average, the program spent $1,437.33 per unit in Somerville.[3] Approximately 28 Somerville households are served each year.

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In order to be eligible for the Menotomy program, a household's gross family income must be 60 percent or less of the median household income in Massachusetts and the household must have already applied for fuel assistance. However, Supplemental Security Income (SSI) and Aid to Families with Dependent Children (AFDC) program recipients are eligible for the program's services regardless of their household income. Homeowners, as well as tenants

1 Davis, H. (2008). *City Council Committee Report.* (City of Cambridge) Retrieved from http://www.cambridgema.gov/cityClerk/CommitteeReport.cfm?instance_id=438.

2 Town of Arlington. (n.d.). Town of Arlington Menotomy Weatherization program: Somerville Completions DOE 2004-2008. Sent via email from Emmanuel Owusu, city of Somerville Housing Division on February 19, 2010.

3 Ibid.

who have their landlord's permission, are eligible for services from the program.[4]

Energy Efficiency in Residential Buildings

According to the U.S. Energy Information Administration, energy efficiency is the process by which "either energy inputs are reduced for a given level of service or there are increased or enhanced services for a given amount of energy inputs."[1]

There are several proven ways to increase the energy efficiency of a residential building structure. These methods include: (1) sealing a building's exterior or "envelope"; (2) adding insulation to walls and attics; (3) replacing HVAC systems; and (4) outfitting a building with appliances that require less energy to operate.

Typically, the more energy efficiency retrofits that are made to a home, the more efficient it becomes. However, the varying types of retrofits impact the level of energy efficiency that can be achieved. Deep-energy retrofits, in contrast to more basic changes such as replacing appliances, adding insulation and utilizing air-sealing techniques to make a home up to 70 percent more efficient. However, these retrofits also cost significantly more than the more basic retrofits. According to Synergy Companies Construction, the estimated cost for one deep-retrofit project in Arlington, Massachusetts was approximately $100,000, whereas just replacing inefficient appliances may have cost only a couple thousand dollars.[2]

Despite the high price tag for a deep-energy retrofit, the Massachusetts Energy Efficiency Advisory Council found several incentives that helped reduce the cost of deep-retrofits for one particular project in Medford, Massachusetts. The Council found that up to 75 percent of the cost of a deep-retrofit project, in this example, a value of $42,000, could be subsidized by state and utility incentives. The council also found that educating residents about ways to reduce their energy use through changes in lifestyle, lighting and appliances could result in further energy consumption reductions.[3]

[1] U.S. Energy Information Administration. (2004, August 17). *Energy Efficiency - Glossary*. Retrieved from http://www.eia.doe.gov/emeu/efficiency/ee_gloss.htm

[2] Lamonica, M. (2010, March 12). *'Deep-Energy Retrofits' Take Root in Homes*. CNET News. Retrieved from http://news.cnet.com/8301-11128_3-20000306-54.html

[3] Legg, D. *Deep Energy Retrofit Pilot Benefits, Challenges and Context*. (n.d.) Massachusetts Energy Efficiency Advisory Council. [Powerpoint presentation]. Retrieved from: http://www.ma-eeac.org/docs/Docs%201-21-10/PAs%20Presentation%20on%20Deeper%20Energy%20Retrofit%20Pilots%20Jan%2012%202010.pdf

The Housing Rehabilitation Program

Currently, HRP's goal is to "improve the city's existing housing stock and to create and maintain affordable homeownership and rental units" by providing incentives to property owners for housing repairs and upgrades.

The city of Somerville currently does not have any city departments or programs that are primarily focused on energy efficiency issues. However, the Housing Division is interested in adding an energy efficency component to HRP.[5] Currently, HRP's goal is to "improve the city's existing housing stock and to create and maintain affordable homeownership and rental units" by providing incentives to property owners for housing repairs and upgrades.[6] Households that qualify and are approved for the program receive a zero percent interest, deferred payment loan of up to $25,000 that is payable to the Commonwealth of Massachusetts only when the property is sold or transferred. Somerville

4 Town of Arlington. (n.d.). *Weatherization Guidelines* . Retrieved from http://www.town.arlington.ma.us/Public_Documents/ArlingtonMA_PLanning/weatherization/weatherization09.

5 City of Somerville. (n.d.). *Somerville Comprehensive Plan 2010-2030*. Retrieved from http://www.somervillema.gov/section.cfm?org=OSPCD&page=1385.

6 City of Somerville. (n.d.). *Housing Programs and Services- Housing Division*. Retrieved from http://www.somervillema.gov/Division.cfm?orgunit=HOUSING.

households with a maximum gross annual income of 80 percent of the state median income are eligible to participate in the program.[7] HRP receives annual funding from two Department of Housing and Urban Development (HUD) programs, the Community Development Block Grant (CDBG) Program and the HOME Investment Partnerships (HOME) Program.[8]

HRP assists property owners with a wide range of housing repairs and improvements to the interior and exterior of properties. The program's first priority is to ensure that the housing unit is in compliance with HUD Housing Quality Standards, as well as applicable building and sanitary codes. HRP often facilitates the replacement of building materials that can affect the energy efficiency of a building, such as windows and doors. However, such replacements are done only if these repairs are necessary to bring a building up to housing code standards.

HRP's direct involvement in housing repairs and retrofits makes the program a natural instrument for facilitating greater efforts to implement energy efficiency retrofits in the city. However, there are two factors currently limiting HRP's involvement in energy efficiency work. These factors are limited funding and the fact that the first priority of the program is to help low-income homeowners complete essential home repairs, not to help homeowners complete energy efficiency retrofits. The program's current policy sets a $25,000 spending cap per household.[9] Additionally, there is typically an 18 to 24 month-long waitlist consisting of approximately 50 households.[10]

HRP is limited further because it does not know what the specific needs are for energy efficiency upgrades in the city's low-income housing stock. While the city of Somerville's Assessor Department has basic data indicating the condition of the Somerville housing stock, neither the Assessor Department nor HRP have statistics indicating what specific types of energy efficiency retrofits are needed most in the low-income Somerville housing stock. Additionally, HRP finds that while most residents are aware of and concerned about increasing energy prices, this concern does not often translate into a consideration of energy efficiency retrofits for their homes.[11]

HRP's direct involvement in housing repairs and retrofits makes the program a natural instrument for facilitating greater efforts to implement energy efficiency retrofits in the city.

However, limited funding and the fact that the first priority of the program is to help low-income homeowners complete essential home repairs, not to help homeowners complete energy efficiency retrofits, currently limit HRP's involvement in energy efficiency work.

7 Ibid.

8 Whitney, Walter, Housing Rehabilitation Program Manager and Philip Ercoloni, Director of Housing Division. (2010, February 18). Somerville, MA.

9 Ibid.

10 Owusu, Emmanuel. Email from Emmanuel Owusu, city of Somerville Housing Division on March 31, 2010.

11 Whitney, Walter Housing Rehabilitation Program Manager and Philip Ercoloni, Director of Housing Division, op cit.

Figure 2: *Allocation of OSE Energy Efficiency and Conservation Block Grant*

Allocation of OSE Energy Efficiency and Conservation Block Grant		
Allocation of Block Grant Funding	**Program Specifics**	**Costs (for 3 years)**
Energy recovery work at a local school		$67,000
The development of a city energy "Roadmap"		$55,362
Energy efficiency residential retrofit program (Goal is to service 1,000 households)*	Educational Materials and Audit Reports	$5,000
	Administration Costs for Project	$52,638
	Technical Assisance Advocate	$196,000
	Energy Efficiency Retrofits (labor and materials)	$225,000
	Renewable Energy Installations ($500 program match grants)	$50,000
Total OSE Costs		$651,000
Total Block Grant Budget		$651,000
* The goal for the retrofit program is to service 1000 households - this includes providing finiancial assistance in the form of grants and/or giving technical advice via the OSE Technical Advocate.		
Source: City of Somerville (2009, June 18). EECBD Activity Worksheet.		

The Office of Sustainability & Environment

In 2006, Mayor Curtatone established the Mayor's Office of Sustainability and Environment (OSE). OSE was intended to facilitate "developing and implementing a comprehensive environmental vision and agenda" for the city of Somerville.[12] OSE is responsible for administering several of the city's environmental programs, which include Somerville recycling programs, the city household hazardous waste collection program and an Energy Performance Contract with Honeywell Building Solutions to address energy efficiency in municipal-owned buildings.

As part of the 2009 American Recovery and Reinvestment Act, OSE received a $651,000 Energy Efficiency and Conservation Block Grant from the Department of Energy.

As part of the 2009 American Recovery and Reinvestment Act, OSE received a $651,000 Energy Efficiency and Conservation Block Grant from the Department of Energy. OSE has designated that block grant to be used for three purposes: (1) energy recovery work at a local school; (2) the development of a city energy plan or "roadmap"; and (3) the implementation of a residential energy efficiency and renewable energy residential retrofit program.[13]

OSE's intention to use part of the block grant funds for an energy efficiency and renewable energy residential retrofit program ("OSE Retrofit Program") is meant to initiate the development of a long-term city-run residential retrofit program. OSE recognizes that although there are many existing state, federal and utility incentive programs available to residents to help facilitate energy efficiency work, the city can supplement these programs by helping to educate residents about

12 Mayor's Office of Sustainability and Environment. (2007, April). *Sustainable Somerville: An Environmental Strategic Plan*. Retrieved from http://www.somervillema.gov/CoS_Content/documents/ENVIRO_STRAT_PLAN_0407Final.pdf.

13 City of Somerville (2009, June 18). EECBD Activity Worksheet.

OSE Retrofit Program Goals

Considering the program's initial three-year budget, OSE expects to serve approximately 1,000 residents. These residents will receive advice and information from the Technical Advocate on energy efficiency and/or renewable energy loans.

By serving these 1,000 residents, the city expects:

- To save 1.2 million kilowatt-hours of energy from the energy efficiency retrofits while generating 200 kilowatts from renewable energy installations. To put these energy savings in perspective, the average annual electricity consumption for a U.S. residential utility customer was 11,040 kWh in 2008.[1] OSE's savings projections would be equivalent to taking over 100 homes off the grid.
- To see a reduction of 881 metric tons of greenhouse gas emissions.[2] The average residential electricity consumption per household in the U.S. results in the annual emission of 8.24 metric tons of carbon dioxide emissions (the most common greenhouse gas).[3] Therefore, OSE expects to see emissions reductions that are equivalent to approximately 100 homes converting to non-greenhouse gas-emitting energy sources.

[1] U.S. Energy Information Administration. (n.d.). *Frequently Asked Questions – Electricity*. Retrieved from: http://tonto.eia.doe.gov/ask/electricity_faqs.asp#electricity_use_home

[2] Owusu, Emmanuel, op cit.

[3] U.S. Environmental Protection Agency. (n.d.). *Green Power Equivalency Calculator Methodologies*. Retrieved from Green Power Partnership: http://www.epa.gov/greenpower/pubs/calcmeth.htm

these incentives and helping low to mid-income residents take full advantage of these incentives.

The portion of the block grant that OSE is using to develop the OSE Retrofit Program is stipulated to last for three years. Over this three-year period, OSE intends to develop three program areas that will help residents complete energy efficiency and renewable energy home retrofits. These developments are: (1) having a Technical Assistance Advocate available to educate residents on energy efficiency opportunities; (2) providing financial assistance in the form of grants to help residents overcome the initial financial barrier to completing home energy efficiency retrofits; and (3) providing financial assistance in the form of grants for renewable energy installations. Some aspects of the OSE Retrofit Program are intended to be available for all Somerville residents, while other parts of this program will be restricted to households whose income falls between 60 percent and 120 percent of Massachusetts' median household income.

OSE has designated the block grant to be used for three purposes:

(1) Energy recovery work at a local school

(2) The development of a city energy plan or "roadmap"

(3) The implementation of a residential energy efficiency and renewable energy residential retrofit program

OSE Retrofit Program Goals

The primary role of the Technical Assistance Advocate will be to provide educational support and technical assistance to all Somerville residents. OSE envisions that the Advocate will serve as the gatekeeper of the utility incentive programs for the residents, as well as guide residents on how to make the most

appropriate and cost-effective energy-saving decisions for their home.[14] The financial assistance part of the retrofit program will provide grants to residents who lack the upfront financing needed to complete larger and more costly energy efficiency projects. This portion of the retrofit program will only be available to residents with household incomes that are between 60 percent and 120 percent of state median household income. OSE hopes that this income restriction will allow people who do not qualify for the Menotomy program to take advantage of energy efficiency retrofit incentives available through this alternate program.

Although OSE has a clear outline for how its retrofit program will operate using the block grant funding over the program's three year period, at this time many of the details of the retrofit program have not been clearly defined and articulated. OSE expects to develop the retrofit program further in the spring and summer of 2010 and anticipates having each of the three program areas operating by the fall of 2010. Furthermore, OSE hopes that with additional funding and financial support, the retrofit program will be able to continue operating, and even expand, when the block grant funding runs out. Unfortunately, at present, OSE does not have funding to sustain the program past 2012.[15]

As OSE continues to design, and ultimately manage, its retrofit program, and as HRP determines how it can integrate energy efficiency work into its current efforts, city officials must consider the challenges and limitations that both programs will likely face.[16] Chapter 3 reviews in detail the challenges that OSE and HRP must overcome in order to successfully develop a city-run residential energy efficiency program.

14 City of Somerville (2009, June 18), op cit.
15 Lutes, David, Director of Office of Sustainability & Environment. (2010, March 10). Somerville, MA.
16 City of Somerville (2009, June 18), op cit.

Chapter 3
Challenges to Residential Energy Efficiency Efforts

Across the United States significant barriers have limited the implementation of wide-scale residential energy efficiency retrofits. These barriers include a lack of information, a lack of professional expertise, the split-incentives challenge in rental properties and financial limitations. The city of Somerville not only has to contend with these barriers in its efforts to retrofit its housing stock, but these challenges are exacerbated by the fact that the city has a diverse population, little to no new residential construction, an old housing stock and a low median household income. While these barriers and conditions are not unique to Somerville, collectively they present significant hurdles that the city must overcome in order to achieve broad reductions in residential energy consumption.

The Information Challenge

The information challenge is two-pronged. First, some residents do not know what residential energy efficiency is and how it can help them save on utility bills. Second, among those who are interested in achieving greater efficiency, the diverse options and incentives available can be confusing and become an "information overload." The Office of Sustainability and Environment (OSE) Director, David Lutes, notes that "there are a number of reasons why people don't do energy efficiency projects in their homes and a lot of it has to do with not wanting to spend the time to understand what the benefits are."[1] This observation was also noted in a 2007 report from Efficiency Vermont, an independent, non-profit organization under contract to the Vermont Public Service Board, which evaluated the efficacy of residential energy efficiency loan programs from across the United States. This evaluation determined that these loan programs reached less than a tenth of their customers, showing that even for existing financing programs the information is not reaching its intended audience.[2]

OSE Director, David Lutes, notes: "There are a number of reasons why people don't do energy efficiency projects in their homes and a lot of it has to do with not wanting to spend the time to understand what the benefits are."

Somerville's residents are faced with this same information challenge. Though they could be saving money and reducing greenhouse gas emissions by pursuing energy efficiency retrofits, unfortunately many do not take the necessary steps because of a lack of easily accessible and "user friendly" information regarding energy efficiency. There are numerous loan options, tax credits, rebates and other incentives available for energy efficient appliances and improvements both in Somerville and throughout the country. Despite the availability of these

1 Lutes, David, Director of Office of Sustainability & Environment, op cit.

2 Fuller, M. (2008, August). *Enabling Investments in Energy Efficiency: A study of programs that eliminate first cost barriers for the residential sector.* Efficiency Vermont, p. vii.

incentives, many residents do not know about them or find the information about them confusing. Consequently, potentially beneficial resources and incentive programs go unused. For example, a 2009 study of 5,000 residential projects across the country revealed that 25 percent of homeowners did not know about the federal $1,500 home energy efficiency tax credit and 40 percent were not planning to take advantage of it.[3]

The Expertise Challenge

In addition to the lack of an effective consumer education program, there is a general lack of knowledge and expertise about energy efficiency in the construction industry, both in Somerville and across the country. While energy efficiency techniques in buildings have existed for decades, it is only recently that there has been an increasing demand for energy efficiency retrofitting.[4] Contractors have been reluctant to invest in the training and equipment needed to enter the retrofitting market because of the lack of demand and the lower profitability of small scale home retrofits.[5] An internet search for experienced energy efficiency contractors in Somerville revealed there are no contractors based in Somerville who specifically perform residential energy efficiency retrofits, although there are contractors experienced in residential energy efficiency retrofits located in the broader Boston area who service Somerville.[6] However, as a result of the recent economic downturn, there is a large percentage of unemployed construction workers that could be retrained to address the growing need for energy efficiency experts in the construction sector.[7]

3 Construction Deal, Inc. (2009, August 12). *We Discover Homeowners are Unaware and Not Taking Advantage of the $1,500 Tax Credit for Energy Efficient Home Improvements*. Retrieved March 25, 2010, from Construction Deal: http://www.constructiondeal.com/blog/.

4 Home Performance Resource Center. (2010, March). *Workforce Development Recommendations*. Retrieved April 12, 2010, from Home Performance Resource Center: http://www.hprcenter.org/publications/best_practices_workforce_ development.pdf.

5 Thorne, J. (2003). *Residential Retrofits*. Washington, DC: American Council for an Energy-Efficient Economy.

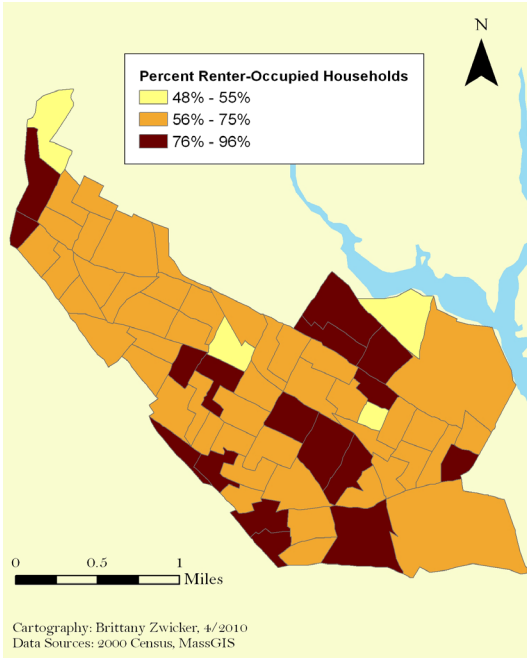
6 A YellowPages.com search was conducted to find a residential contractor in Somerville that does weatherization or energy efficiency retrofits, using the terms: "weatherization contractor", "weather stripping contractors", "energy efficiency contractors", "energy conservation consultants" and "energy conservation products & services", which did not return any contractors. A further search of "home remodeling" contractors showed no mention of energy efficiency services.

7 In Massachusetts, the unemployment rate for construction workers was almost 26 percent in December of 2009. Hendricks, B., & Golden, M. (2010, March). *Taking on the Tool Belt Recession*. Washington, D.C.: Center for American Progress.

The Split-Incentives Challenge

Somerville is unique in that it has an exceptionally high rental population. Presently, 65 percent of Somerville's housing units are occupied by renters.[8] The split-incentives challenge relates to this demographic. Split-incentives results from the divide between landlords and tenants over whether, or how, energy efficiency retrofits will take place in a home. Landlords generally do not pay utility bills. Consequently, landlords have little incentive to invest in energy efficiency retrofits since they do not benefit from utility cost savings. Conversely, renters have little incentive to invest in buildings they don't own, let alone buildings they may not live in for more than a few years.[9] Given Somerville's high rental population, it is essential that the city address the split-incentives problem in order to implement an effective energy efficiency program.

Figure 3: *Percent of Renter Population by Census Block Group in Somerville*



Source: Source: Zwicker, B. (2010, April). Percent of Renter Population by Census Block Group in Somerville.

Municipalities across the country are grappling with the split incentives challenge. In commercial real estate, "green leases" are being used to tackle the split incentives issue and, while some energy efficiency programs are attempting to use "green leases" in the residential sector, challenges have arisen. Landlords and tenants often see "green leases" as complex and not worth the trouble, especially when the energy savings cannot be guaranteed.[10] In addition, residential tenants typically do not sign leases for longer than one-year terms, making it difficult to consider upgrades that require payback periods longer than a year. In addition to exploring the "green lease" option for tackling the split incentives issue, other municipalities are also looking to use energy efficiency ordinances to address this challenge. However, these approaches are still relatively new and it is unclear if they will bridge the incentive gap between landlord and tenant.

8 U.S. Census Bureau. (2006-2008). *Fact Sheet.* Retrieved March 25, 2010, from U.S. Census Bureau: http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=Search&geo_id=16000US2562535&_geoContext=01000US|04000US25|16000US2562535&_street=&_county=somerville&_cityTown=somerville&_state=04000US25&_zip=&_lang=en&_sse=on&ActiveGeoDiv=geoSelect&_useEV=&pctx.

9 Institute For Sustainable Communities. (2009). *Scaling Up Building Energy Retrofitting In U.S. Cities.* Living Cities.

10 Valdez, R. (2009, April 27). *Split Incentive Stalls Energy Efficiency in Rental Housing.* Retrieved March 10, 2010, from Sightline Daily Northwest News That Matters: http://rss.sightline.org/daily_score/archive/2009/04/27/split-incentive-stalls-energy-efficiency-in-rental-housing.

Split-Incentive Solutions

Green Leases: "Green leases" are contracts that are supplemental to standard rental lease agreements. These contracts are made between landlords and tenants and are used to make energy efficient retrofits beneficial to both parties.[1] For example, in a traditional rental lease agreement, when a water heater in a unit breaks, the landlord is responsible for replacement. The landlord is typically concerned with the upfront cost of replacing the water heater because the landlord does not pay to operate it. Consequently, the landlord will likely purchase a less efficient, cheaper water heater. However, operating under a "green lease," the landlord and the tenant work together to determine the landlord's added upfront cost for the more efficient hot water heater and the tenant's cost savings. They come to an agreement on an additional amount each month that the tenant will pay in rent, which is less than the utility savings, but enough to pay back the landlord's investment over a agreed upon time period.

Residential Energy Conservation Ordinances (RECOs): RECOs are ordinances that set minimum standards for energy efficiency in residential buildings, which are enforced at the time of sale of a building. RECOs are currently in place in Burlington, Vermont, Berkeley, San Francisco and state-wide in Wisconsin. Depending on how often rental buildings are sold, RECOs could ensure rental units are retrofitted. RECOs have faced political opposition from landlords and there is the potential for rents to rise. Higher rents could harm tenants if the energy efficiency cost savings are not enough to offset the higher rents and could also put Somerville's rental market at a disadvantage compared to neighboring towns.[2]

Energy Disclosure Ordinance: Energy Disclosure Ordinances require a building owner to disclose the energy use of a building to potential renters and buyers. The city of Seattle recently passed this type of ordinance, building off a Washington State law. The purpose is to allow renters to make more informed decisions when they are choosing a home and to encourage property owners to make energy efficient upgrades. Seattle also provides assistance to property owners, ensuring they have the tools they need to retrofit.[3]

[1] SPUR. (2010). *Create A Residential "Green Lease" Program.* Retrieved March 25, 2010, from SPUR: Ideas and Action for a Better City: http://www.spur.org/publications/library/report/critical_cooling/option7

[2] Institute For Sustainable Communities. (2009), op cit.

[3] Office of the Mayor: Mike McGinn. (2010, February 1). *Energy Disclosure Ordinance identifies energy waste,.* Retrieved March 20, 2010, from Seattle.Gov:

The Financing & Funding Challenges

The lack of capital available to do energy efficiency in the residential sector presents a significant challenge to Somerville residents. There are several financial barriers that can prevent wide-scale residential energy efficiency retrofitting from taking place. The first is that families often do not have the upfront capital needed to make the investment in retrofits.[11] The currently available financing options, like utility company loans, private loans and Energy Efficiency Mortgages, have not been enough to entice most homeowners to retrofit their homes, even when coupled with incentives and rebates.[12] Some criticisms of the current financing mechanisms are that they have income

11 Institute For Sustainable Communities, op cit.

12 Ibid.

and credit restrictions, that they are tied to the homeowner and not the home, and that most mechanisms do not provide enough capital or long enough pay back periods, especially when it comes to deep retrofits, which can cost up to $100,000.[13]

Furthermore, there is also the financial challenge the city faces with funding a residential energy efficiency retrofit program. The development of a residential energy efficiency retrofit program entails administrative costs, outreach efforts and, potentially, a means to finance loans. Although OSE has secured a federal grant to support energy efficiency retrofits, this funding will expire in the fall of 2012. Thus, the city must continue to explore additional program funding mechanisms, such as additional federal funding, state funding and private funding sources, in order to support a robust, sustained, city-wide program that can help guide residents through the retrofit process and provide appropriate financing tools.

Current Financing Options

Mass Save HEAT Loan: Mass Save HEAT Loans are zero percent interest loans of up to $15,000 that are paid back over seven years for qualified energy efficiency measures. Limitations of this program include the fact that it has qualification restrictions and currently it is only funded through the end of 2010.[1]

Wainwright Bank: Wainwright Bank offers secured "green loans" of up to $100,000, with five, ten and fifteen year terms. 50 percent of the work must be for "green" purposes and there are qualification restrictions. [2]

Energy Efficiency Mortgage (EEM): EEM loans allow homebuyers to borrow more money to purchase a certified energy efficient home, but are typically limited to new construction. The lender requires that the home be audited and rated to ensure that the monthly energy savings are enough to cover the additional mortgage payment for the upgrade. The amount of capital that can be loaned is five percent of the property's value, up to $8,000. The program also has additional qualification restrictions.[3]

Energy Improvement Mortgage (EIM): EIM loans allow homeowners to borrow more money to purchase a home or when refinancing their home. [4]

[1] Mass Save. (2010). *Smarter choices. Better living.* Retrieved March 27, 2010, from Mass Save: http://masssave.com/residential.aspx

[2] Cambridge Energy Alliance. (2010, April 2). *Cambridge Residents: Financing Improvements.* Retrieved March 25, 2010, from Cambridge Energy Alliance: http://cambridgeenergyalliance.org/residents/financing

[3] EPA and DOE. (n.d.). *What is an Energy Efficient Mortgage?* Retrieved March 25, 2010, from Energy Star: http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.energy_efficient_mortgage

[4] Ibid.

13 This information is based on a MA DOER and NSTAR pilot project that performed a deep retrofit on a 3,000 sqft duplex in Arlington, MA. The project was completed in March of 2009 and cost $33 per sqft. Environmental Building News and Fine Homebuilding. (2009). *An Old House Gets a Superinsulation Retrofit.* Retrieved April 6, 2010, from Green Building Advisor.com: http://www.greenbuildingadvisor.com/homes/old-house-gets-superinsulation-retrofit.

Potential Financing Options

Property Assessed Clean Energy (PACE): PACE is a bond initiative that municipalities can use to create revolving loan funds for energy efficiency retrofits. PACE loans are paid back through an annual assessment on the owner's property tax and have long payback periods, typically 20 years, which allows residents to perform deep retrofits.[1] Currently PACE bonds are not an option in Massachusetts, but legislation to enact PACE bonds was introduced in the Massachusetts House in 2009 (Bill H4393).[2]

On-Bill Financing: On-bill financing is a repayment system that allows residents to repay an energy efficiency loan through an added charge on their monthly utility bill.[3] On-bill financing has the potential to address the split-incentive issue and deep retrofits because repayment is tied to the meter[4] and can operate on a long-term basis.[5] However, it is unclear how these loans will be funded (i.e. by the city, utility company or private bank), what happens if the full payment is not made (i.e. is the utility bill paid first and are utilities cut off), what the qualifications for the loan are and what happens when renters move.[6]

[1] PR Newswire. (2009, November 17). New York State Passes PACE Finance Enabling Legislation. Retrieved November 28, 2009, from PR Newswire: http://www.prnewswire.com/news-releases/new-york-state-passes-pace-finance-enabling-legislation-70276767.html

[2] Commonwealth of Massachusetts. (2010). House, No. 4393. Retrieved April 23, 2010, from Legislative Tracking System: http://www.mass.gov/legis/186history/h04393.htm

[3] On-bill financing is also known as Tariffed Installed Payment (TIP) and "Pay As You Save" (PAYS®).

[4] "Tied to the meter" simply means that the repayment of the retrofit loan is paid back by the utility customer of that particular meter and is not tied to a specific person. The loan stays with the unit where the energy efficiency improvements were made and where the cost savings will be realized, transferring from one utility customer to the next.

[5] Institute For Sustainable Communities, op cit.

[6] Massachusetts Energy Efficiency Advisory Council. (2010). Welcome. Retrieved April 21, 2010, from EEAC: http://www.ma-eeac.org/index.htm

Somerville Demographic & Housing Stock Challenges

Somerville's demographics and the characteristics of the city's housing stock exacerbate the barriers to large-scale energy efficiency retrofits listed above. The city's diverse population, lack of new residential construction, old housing stock and relatively low median household income will all need to be considered when implementing the program.

Somerville is small in area, but has a large population. With approximately 18,500 people per square mile, Somerville is the most densely populated city in New England.[14] Living within this tightly packed city is a large immigrant population (27 percent of the city population is foreign born and 32 percent speaks a language other than English at home).[15] The existence of a large non-native

14 Keane Jr., T. M., op cit.

15 Ibid.

Current & Potential Funding Options

Federal Funding: The American Recovery and Reinvestment Act of 2009 (ARRA) is the most recent federal funding effort that supports energy efficiency programs. ARRA provided $20 billion in funding to create or save a total of four million jobs by 2012. ARRA supported three energy efficiency programs: (1) the State Energy Program (SEP); (2) the Weatherization Assistance Program (WAP); and (3) the Energy Efficiency and Conservation Block Grant (EECBG) program.[1] SEP funds are controlled and distributed at the state level; Massachusetts has already earmarked its $54.9 million share of the funds for state projects. WAP funding was increased by $122 million for Massachusetts and is being distributed to the regional WAP programs.[2] EECBG funds have already been allocated to the city of Somerville and are in part being used by the Office of Sustainability and Environment.

State Funding: Massachusetts has earmarked $2.1 billion in state and ARRA funds for energy efficiency initiatives through 2012. While it is unclear exactly how all of these funds will be used, there will be opportunities for the city of Somerville and its residents to take advantage of state programs derived from these funds.[3] State regulation of the utility companies plays another role in energy efficiency programs throughout the state. The Green Communities Act requires that utility companies make energy efficiency the first solution before they can pursue new power plants.

Private Funding: Sources of private funding for municipalities, such as grants, are limited and difficult to track down. Private grants are available to non-profit organizations and community groups for energy efficiency programs. 80 percent of Cambridge Energy Alliance's funding is through private sources like the Henry P. Kendall Foundation, the Barr Foundation and The Chorus Foundation.[4]

Bonds: Federal Qualified Energy Conservation Bonds (QECBs), which have a zero percent interest rate[5] and can be used for "implementing green community programs (including the use of loans, grants, or other repayment mechanisms to implement such programs)."[6]

[1] Sarah Black, S. V. (December 2009). *Energy Efficiency Program Options for Local Governments under the American Recovery and Reinvestment Act of 2009*. Washington, DC: American Council for an Energy-Efficient Economy.

[2] Commonwealth of Massachusetts. (2010). *Energy and Environmental Affairs: Energy Funding Opportunities.* Retrieved March 27, 2010, from Mass.gov: http://www.mass.gov/?pageID=eoeeamodulechunk&L=5&L0=Home&L1=Grants+%26+Technical+Assistance&L2=Guidance+%26+Technical+Assistance&L3=Agencies+and+Divisions&L4=Department+of+Energy+Resources+(DOER)&sid=Eoeea&b=terminalcontent&f=doer_pub_info_grants&csid=Eoe

[3] Massachusetts Department of Energy Resources. (2010, January 28). *Energy Efficiency in Massachusetts: Our First Fuel.* Retrieved March 15, 2010, from Mass.gov: http://www.mass.gov/?pageID=eoeeaagencylanding&L=5&L0=Home&L1=Grants+%26+Technical+Assistance&L2=Guidance+%26+Technical+Assistance&L3=Agencies+and+Divisions&L4=Department+of+Energy+Resources+(DOER)&sid=Eoeea

[4] Cambridge Energy Alliance. (n.d.). *Frequently Asked Questions.* Retrieved April 23, 2010, from Cambridge Energy Alliance: http://www.ripower.org/aquidneck/Appendix%20B%20CEA%20FAQ.doc

[5] Commonwealth of Massachusetts. (2010). *Administration and Finance: Qualified Energy Conservation Bonds.* Retrieved March 28, 2010, from Mass.gov: http://www.mass.gov/?pageID=afterminal&L=6&L0=Home&L1=Budget,+Taxes+%26+Procurement&L2=Oversight+Agencies&L3=Massachusetts+Recovery+and+Reinvestment+Office&L4=ARRA+Programs&L5=ARRA+Bond+Programs&sid=Eoaf&b=terminalcontent&f=recovery_arrta_qualified_energy

[6] Internal Revenue Service . (2009). *Qualified Energy Conservation Bond Allocations for 2009.* Retrieved April 22, 2010, from IRS.gov: http://www.irs.gov/pub/irs-drop/n-09-29.pdf

English speaking population presents an implementation challenge because of the added cost and work that is required in translating outreach materials and conducting educational seminars in additional languages. However, such additional efforts must be made to ensure this segment of the population is informed about the benefits of energy efficient retrofitting and the incentives that are available to them.[16]

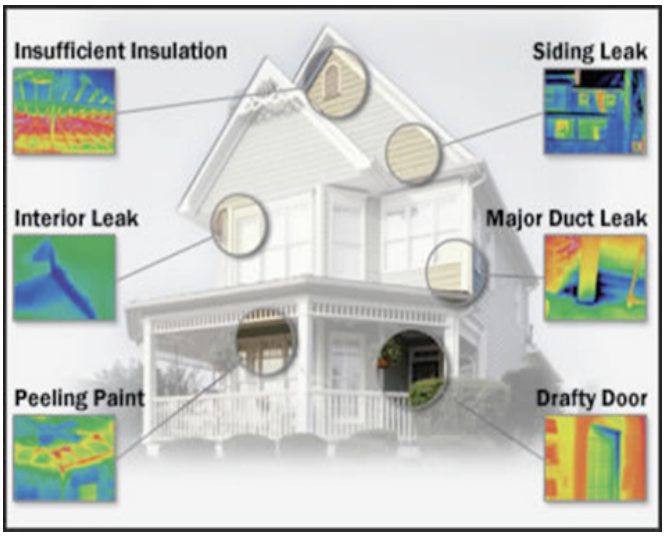
58% of Somerville's housing units are located in small multi-family buildings that have two to four-units.

85% of the city's buildings were built before 1920.

Somerville's high population density is also problematic. While some cities have implemented more energy-focused building codes to promote energy efficiency efforts in new buildings, Somerville has virtually no undeveloped land for new residential construction. According to 2008 U.S. Census Bureau data, there were only 30 building permit applications submitted to the city of Somerville between 2005 and 2008.[17] Thus, even if the city implemented a strong energy efficient building code for new construction, there would be little impact made to the overall efficiency of the city's buildings since so few new buildings are being constructed in the first place. As such, it is essential for Somerville to focus the majority of its energy efficiency efforts on retrofitting existing homes and buildings, not on developing new construction guidelines.

The type of housing stock in Somerville also affects the nature of residential energy efficiency retrofits. Almost 58 percent of the city's housing units are located in small multi-family buildings that have two to four-units. The remainder of the city's housing stock is either large multi-unit buildings or single-family homes.[18] Because of the range of housing ownership and occupancy characteristics, residential energy efficiency efforts will require increased coordination to ensure

Figure 4: *Typical Problems of an Older Home*



Source: The Building Doctors (2010, April 4). Typical Problems of an Older Home . Retrieved May 1, 2010, from http://thebuildingdoctors.com/?cat=3

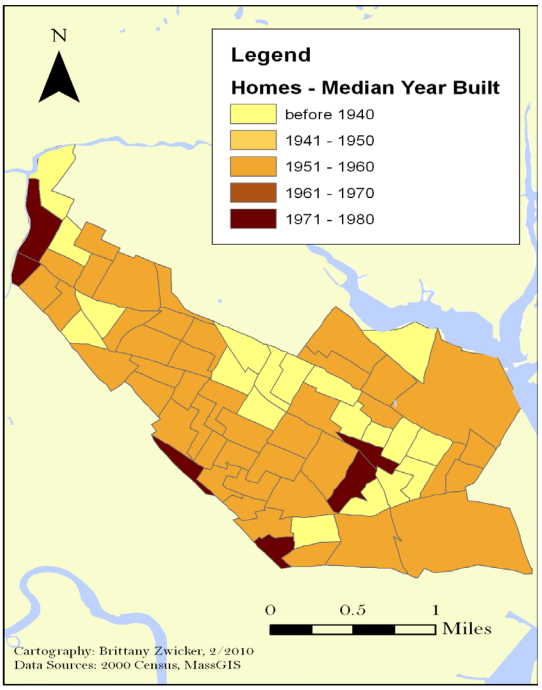
16 Campbell, M., Finnigan, J., Hall, N., & Wellner, P. (n.d.). *Ni hao! Howdy! ¡Hola!: Tales from Community Outreach Events.* Retrieved April 22, 2010, from Opinion Dynamics Corporation: http://www.opiniondynamics.com/resources/conferencePapersAndPresentations/Energy/Tales%20from%20Community%20Outreach%20Evenrs_J%20Finnigan.pdf.

17 U.S. Census Bureau. (2010). *Building Permits.* Retrieved April 16, 2010, from U.S. Census Bureau: http://censtats.census.gov/bldg/bldgprmt.shtml?.

18 U.S. Census Bureau. (2006-2008), op cit.

that tenants, landlords and homeowners are all committed to the retrofitting of their homes/building and that they are all contributing equitable shares to the project.

Figure 5: *Median Age of Home by Census Block Group in Somerville*



Source: Zwicker, B. (2010, February). Median Age of Home by Census Block Group in Somerville

The city's aging housing stock also presents challenges to residential energy efficiency efforts. 85 percent of the city's buildings were built before 1920.[19] Due to the aging condition of Somerville's housing stock, it is likely that pre-retrofit repairs will need to be performed on many homes to bring them up to health and safety code before any energy efficiency retrofits can take place. The city of Boston faced a similar challenge during a pilot program for residential energy efficiency, where an estimated 50 percent of the homes involved in the pilot program had to have pre-weatherization repairs before any energy efficiency measures could be pursued.[20] While the demographics of the city's housing stock present challenges to an energy efficiency program, they can also be seen as an opportunity. If many of the homes in Somerville have gone decades without renovations, added insulation, heating system upgrades or other, more energy efficient changes, then there is potential for the city to observe significant gains in the overall city energy efficiency if these homes are retrofitted.

The city's generally low income levels are also of consequence. In 2008, the median household income in Somerville was $60,674 and 10 percent of the city's families were living below the poverty line.[21] While some of these families qualify for WAP, many do not. Further, many of these residents do not have the capital or credit to fund the upfront cost to pay for energy efficiency retrofits.[22]

19 City of Somerville. (2008). *Five Year Consolidated Plan 2008-2013, Section One: Housing*. Retrieved March 18, 2010, from City of Somerville: http://www.somervillema.gov/CoS_Content/documents/B%20Housing%20Final.pdf.

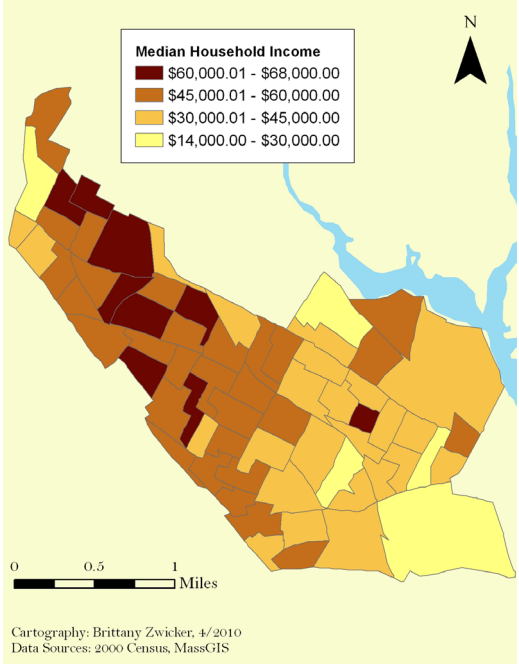
20 Scheuller, C. (2010) Next Step Living. *MIT Energy Conference*. Boston.

21 U.S. Census Bureau. (2006-2008), op cit.

22 Green Justice Coalition. (2009, July 14). *Living Up to the Challenge: An Issue Brief Addressing Massachusetts' 3-year Statewide Energy Efficiency Plans*. Boston.

Ultimately, the information, expertise, split-incentives, financial, demographic and housing stock challenges present significant barriers that the city of Somerville must overcome in order to increase the energy efficiency of the city's housing stock. The following two chapters present recommendations for ways the city of Somerville can approach these barriers and create an effective and holistic residential energy efficiency retrofit program.

Figure 6: *Median Incomes by Census Block Group in Somerville*



Source: Zwicker, B. (2010, April). Median Incomes by Census Block Group in Somerville.

Introduction to Program Development Recommendations

The scope and complexity of the issues presented in Chapter 3 suggest that the city of Somerville will be unable to overcome all of the existing challenges in the short-term. Instead, a successful city-wide residential energy efficiency program will have to be an incremental effort sustained over the coming years. The Office of Sustainability and Environment (OSE) plans to hire an outside consultant to develop an Energy Roadmap, which will help the city develop a broad understanding of Somerville's current and future energy needs. A component of the Energy Roadmap will advise the city on how it can further develop OSE's residential energy efficiency program. Using this Roadmap as a guide, OSE expects the city will be able to effectively position itself to facilitate the pursuit of other energy projects, such as investment in renewable energy, improvement of energy management and an increase in the bulk purchasing of energy efficiency equipment. OSE expects the Roadmap to be completed by the fall of 2010. The recommendations that follow in Chapters 4 and 5 are intended to be a resource for the consultant to utilize when designing the Energy Roadmap.[1]

In order to achieve its goals, the city of Somerville should develop its residential energy efficiency program in two parts that will be executed between now and the fall of 2012, when OSE's current funding expires. In Part I of the program's development, the city should utilize existing program structures and financing mechanisms to begin addressing the issues discussed in Chapter 3. Because OSE's funding will expire in the fall of 2012, it is essential that Part II of the program's development create the foundation for a sustainable enery efficiency program that has a dependable funding source. Part II will create a centralized, single-agency energy efficiency program. This centralized program will allow the city to address the aforementioned challenges more efficiently and cost-effectively, and it will establish a single location where residents can go to obtain information related to residential energy efficiency. This two-part system will allow the city to immediately begin to address residential energy inefficiency concerns, while simultaneously creating a structure to facilitate a long-term, sustainable residential retrofit program. The ultimate goal is that the city will begin to implement its long-term strategic plan for residential energy efficiency by the fall of 2012.

1 Lutes, David, Director of Office of Sustainability and Environment, op cit.

Summary of Program Development Recommendations

Part I

Raise Awareness

- Conduct outreach programs to educate residents and contractors
- Incorporate energy efficiency education as part of HRP's operations
- Develop relationships with immigrant communities and community organizations
- Coordinate with existing Somerville energy efficiency efforts

Implement Marketing Strategy

- Consolidate pertinent information on residential energy efficiency on the city's website and 311 information phone service
- Distribute city energy efficiency brochure
- Provide information in a variety of languages

Develop Energy Efficiency Workforce

- Offer "green jobs" training programs for energy efficiency
- Encourage local businesses to hire "green jobs" program graduates
- Require only contractors experienced in energy efficiency retrofits to be allowed to bid on city-sponsored projects

Tackle the Split Incentives Challenge

- Support the implementation of on-bill financing
- Encourage the use of "green leases"

Address Housing Stock Challenges

- Encourage the use HRP as a vehicle to complete pre-weatherization tasks
- Require energy audits as part of HRP
- Require the use of contractors experienced in energy efficiency retrofits in HRP rehabilitation projects

Find Additional Financing & Funding Mechanism

- Determine how to coordinate multiple financing options for homeowners
- Work directly with the utility companies' energy efficiency incentive and rebate programs

Part II

Design a long-term strategic plan that creates a centralized "one-stop shop" residential energy efficiency program

- Determine best "one-stop shop" model for Somerville
- Begin implementation of strategic plan

Chapter 4
Program Development Recommendations Part 1

In Part I of the development stage of the city's residential energy efficiency program, the city should utilize existing program structures and financing mechanisms to begin addressing the challenges discussed in Chapter 3.

Raising Awareness

As was highlighted in Chapter 3, one of the challenges to developing a successful energy efficiency retrofit program is that there is a general lack of public knowledge about energy efficiency. During Part I, both the Housing Rehabilitation Program (HRP) and the Office of Sustainability and Environment (OSE) can use their existing program structures and networks to promote community awareness of energy efficiency.

As a long-standing program in Somerville, HRP has the benefit of already being well known in the community. In Part I, HRP can encourage energy efficiency by educating residents and contractors about the merits of retrofits and the opportunities available to implement such retrofits in the city of Somerville. Even if HRP does not have the resources to fund energy efficiency retrofits outright, the program can still use its position to distribute an informational brochure, samples of which are attached as Appendix 8, and help connect HRP applicants to the Menotomy Program, OSE's technical advisor and contractors that are experienced in energy efficiency retrofits. This report also recommends that HRP change its policy to explicitly include energy efficiency as one of its core goals. By incorporating energy efficiency education as part of HRP's overall mission, energy efficiency will become highly prioritized, even if the program itself cannot pay for efficiency retrofit efforts in the short-term. Further support for such a policy change will be articulated along later in this report along with the recommendations for dealing with the aging housing stock.

HRP can encourage energy efficiency by educating residents and contractors about the merits of retrofits and the opportunities available to implement such retrofits in the city of Somerville.

OSE's Technical Assistance Advocate will play a critical role in increasing community awareness. Hiring an Advocate who is familiar with the technical aspects of energy efficiency in buildings, energy efficiency incentives and community engagement will ensure that the Advocate will be able to help residents navigate through the process of learning about and implementing energy efficiency retrofit projects. Furthermore, it will be important that the Advocate develop networks within the various immigrant communities, such as the Haitian, Brazilian and Portuguese communities, in order to ensure that these groups are fully supported by the program. Lastly, as OSE develops its

retrofit program, it must consider which responsibilities the Advocate will have and determine whether just one advocate is sufficient to adequately serve the Somerville community.

The city can also raise awareness about energy efficiency by conducting outreach programs. Engaging and/or partnering with existing Somerville community groups can accomplish this goal of increased outreach and awareness. Such an approach will help facilitate the city's efforts to address some of the language and cultural barriers that stem from the city's diverse population. One such group is the Community Action Agency Somerville (CAAS), a non-profit organization dedicated to addressing poverty in Somerville. In addition to running several community programs, CAAS has the resources to provide information to residents in various languages, such as Haitian, Creole, Portuguese and Spanish.[1] Thus, CAAS could be a strong ally for conducting outreach and community education on energy efficiency issues and tactics.

Another important organization to approach is the Somerville Community Corporation (SCC). The SCC is a community development corporation "dedicated to maintaining diversity and preserving affordability in Somerville by building and preserving housing, organizing for necessary policies and funding, and giving residents the financial skills they need to survive."[2] Other potential alliances include the Haitian Coalition of Somerville, Centro Presente and the Somerville Housing Authority.

Best Practice: Develop Partnerships with Community Groups

Energy Coordinating Agency (Philadelphia, PA)

The Energy Coordinating Agency (ECA) has developed strong relationships with local Community Development Centers (CDCs) in order to promote their energy efficiency efforts. ECA has partnered with the Philadelphia CDCs to develop a network of Neighborhood Energy Centers (NECs) in each CDC. These NECs serve as one-stop-shops for all low-income energy services.

City of Tallahassee (Tallahassee, FL)

The Tallahassee Housing Division's Homeowner Rehabilitation Program provides funding to three area non-profit organizations that are responsible for hiring contractors, and ensuring that repairs are made in compliance with building codes.

Note: See Appendix 3 for more information on these organizations.

1 Community Action Agency Somerville. (n.d.). Retrieved from http://www.caasomerville.org.

2 Somerville Community Corporation. (n.d.) Retrieved from http://www.somervillecdc.org/AboutUs/overview.html#impact.

Lastly, in an effort to increase community awareness and simplify the home retrofit process, it is critical for OSE to coordinate with existing residential energy efficiency efforts in Somerville. NSTAR, the primary provider of electricity and natural gas in Somerville, currently offers various energy efficiency rebates and incentives for Somerville residents. In 2008, NSTAR invested $4 million in Marshfield, Massachusetts to promote residential energy efficiency efforts.[3] The success of this pilot program will be the basis for NSTAR's future outreach efforts, which could serve the city of Somerville. The Somerville Home Energy Efficiency Team (SHEET) should also be sought out. SHEET is part of the national non-profit Home Energy Efficiency Team network, which is a grassroots, community-based organization that promotes residential energy efficiency through hands-on weatherization events.[4]

Best Practice: Develop Partnerships with Utility Companies

Cambridge Energy Alliance (Cambridge, MA)

The Cambridge Energy Alliance (CEA) is jointly sponsored by the city of Cambridge and a local utility company, NSTAR. This co-sponsorship allows CEA to aggregate financial resources and energy services to help businesses and homeowners increase their buildings' energy efficiency and save money on utility bills.

Efficiency Vermont (VT)

Efficiency Vermont is a statewide provider of energy efficiency services funded by an energy efficiency charge on Vermont residents' electric bills. Before the partnership with Efficiency Vermont, each utility company used these funds to perform efficiency services themselves. This partnership enables all the state's residents to receive the same services.

Center for ReSource Conservation (Boulder, CO)

The Center for ReSource Conservation's Residential Energy Action Program has partnered with their local utility company, Xcel Energy, to offer energy audits at 60 percent below the market price.

City of Houston (Houston, TX)

The city of Houston has partnered with CenterPoint Energy, the Houston metro area's electricity distribution company, to offer free energy efficiency retrofits to low-income families through its Residential Energy Efficiency Program. This program is funded through the federal government's American Recovery and Reinvestment Act and the state's Weatherization Assistance Program. Most of the retrofits completed through this program consisted of simple energy efficiency measures, such as caulking windows, insulating walls and weather-stripping.

Note: See Appendix 3 for more information on these organizations.

3 Hatch, S. (2008, March 30). Marshfield to be test site for new energy-saving plan. *Boston Globe*. Retrieved from http://www.masstech.org/IS/public_policy/dg/documents/2008-03-NSTAR-MTC-Marshfield-Pilot.pdf.

4 Somerville Home Energy Efficiency Team. (n.d.) Retrieved from http://www.heetma.com.

Partnering with organizations such as NSTAR and SHEET will allow the city to build upon the expertise that currently exists in the community as well as help to connect residents to these resources. Working with organizations that reach beyond the city also establishes a broader knowledge network. This expanded network would encourage participation in national initiatives, such as the EPA's State Energy Efficiency Action Network (SEE Action Network). The mission of the SEE Action Network is to provide assistance for increasing energy efficiency through knowledge-sharing and work groups on a national scale.[5]

Marketing Strategy

It is essential for Somerville to develop an effective marketing strategy to ensure the success of a residential energy efficiency retrofit program. The aforementioned OSE Advocate will likely lead the development of the marketing plan for the OSE Retrofit Program. While OSE's marketing plan will be based largely on the specific goals OSE chooses to pursue over the next two and a half years, it is important that the advocate simplify and consolidate the information pertaining to existing energy efficiency initiatives in the area, as well as available financing options and programs. To consolidate this information, the Advocate must make sure the city's 311 information phone service and the corresponding website are equipped and ready to answer residents' questions about energy efficiency and the availability of retrofit information or incentive assistance through the city. OSE should also create a user-friendly website, perhaps an extension of the existing 311 website that provides up-to-date, comprehensive information about energy efficiency and clear instructions on how to take advantage of existing incentives and rebates. The website could include the information found in the brochure in Appendix 8, and should also contain links that direct residents to other useful websites, such as MassSave.com, that offer current, detailed information on home energy efficiency incentives available in Somerville.

Lastly, it would be beneficial for the city's outreach efforts to join the New England Carbon Challenge. This program was designed to support communities trying to reduce their carbon emissions.[6] As part of the Carbon Challenge, the city would track energy efficiency savings by Somerville community groups, schools and businesses. This public emissions tracking has the potential to increase residents' exposure to Somerville's energy reduction efforts and to create opportunities for events and further community engagement.

5 U.S. Environmental Protection Agency. (2010). *State Energy Efficiency Action Network*. Retrieved from http://www.epa.gov/cleanenergy/energy-programs/seeaction/index.html.

6 New England Carbon Challenge. (n.d.) Retrieved from http://necarbonchallenge.org.

Best Practice: Develop an Up-to-date, Comprehensive Website

Websites to Emulate:

- Efficiency Vermont:
  http://efficiencyvermont.com/pages
- Mass Save:
  http://www.masssave.com/residential
- Green and Save:
  http://www.greenandsave.com
- Indiana Heating and Air-Conditioning Incentive Program:
  http://www.inenergyefficiency.com/home
- CNT Energy:
  http://www.cntenergy.org/buildings/energysavers
- Seattle City Light:
  http://www.seattle.gov/light/conserve/Resident

Workforce Development

Another crucial ingredient for a successful residential retrofit program is an assembled workforce trained in energy efficiency retrofitting. This workforce is critical to producing significant energy and cost savings. The current lack of such a workforce has the potential to significantly hamper the city's efforts to achieve greater energy efficiency. Thus, Somerville should take advantage of opportunities that exist to help propel the development of an energy efficiency-trained workforce.

Towards this end, Somerville should make a concerted effort to increase the number of energy efficiency-focused "green jobs" that could employ people at various skill levels and help to chip away at the city's unemployment rate. In December 2009, the unemployment rate for construction workers in Massachusetts was almost 26 percent,[7] and, as of February 2010, Somerville's overall unemployment rate was nine percent.[8] These statistics suggest that there are Somerville residents willing to be retrained as experts in energy efficiency retrofitting. The demand for jobs exists, all that is needed is an organized effort to coordinate and execute the training process. As an example for catalyzing such an effort, the Roxbury Community College in Boston currently offers two certificate programs for people seeking careers in the green jobs sector. Somerville should work with local contractors and businesses to encourage them to employ successful graduates of green job training programs for Somerville residents.

7 Home Performance Resource Center. (2010, March). *Home Performance Resource Center*. Retrieved 31 2010, March, from HPRCenter.org: http://www.hprcenter.org.

8 Bureau of Labor Statistics. (n.d.) Retrieved from: http://www.bls.gov/news.release/metro.t01.htm.

Best Practice: Promotion of Green Job Training Programs

Greater Cincinnati Energy Alliance (Cincinnati, OH)

The Greater Cincinnati Energy Alliance partners with educational institutions, the city government, non-profit organizations, workforce development agencies and energy professionals to develop green job training programs that allow workers to become skilled in trades related to energy and efficiency services.

Energy Coordinating Agency (Philadelphia, PA)

The Energy Coordinating Agency's Green Jobs Training Center prepares people to be a part of the energy efficiency workforce while simultaneously providing energy audits and energy efficiency retrofits to qualified households through the supervised work of students in the program.

Note: See Appendix 3 for more information on these organizations.

Another means to increase the number of energy efficiency professionals in the Somerville area is to engage contractors through educational workshops. These workshops could inform local contractors of the city's intentions and future goals for increasing the number of residential energy efficiency retrofits, thereby advising the workforce of a niche market.

Three policy changes are needed to increase HRP's focus on energy efficiency:

(1) Make energy efficiency a program goal

(2) Require all homes that participate in HRP to do an energy audit before a contractor evaluates and makes specifications for a home

(3) Require contractors who do repairs for HRP to be certified in energy efficiency retrofitting

This report recommends that the technical Advocate investigate the feasibility of requiring that only contractors experienced in energy efficiency retrofits are allowed to bid on city-sponsored residential energy efficiency retrofit projects and give special preference to those who employ local residents. Requirements such as these would not only ensure that energy efficiency is the focus of any work performed, but also create job opportunities for Somerville's residents who have made the effort to meet a demand and get energy efficiency training.

Split-Incentives

During Part I, it is important for the city to begin exploring solutions to the renter-landlord split incentive problem. Neglecting to take steps to address this issue will impede the city's goals of significantly increasing residential energy efficiency in Somerville.[9]

One way to mitigate this challenge is to implement on-bill financing through the utility company for the cost of a retrofit project. This approach puts the responsibility for the retrofit payments on the renter, who is also the one benefiting from the cost savings on his or her utility bill. Currently, the Massachusetts Energy Efficiency Advisory Council has an On-Bill Repayment Working Group that is studying the feasibility of this option in the Commonwealth.[10] It is recommended that the Energy Roadmap consultant and

9 U.S. Census Bureau. (2006-2008)., op cit.

10 Energy Efficiency Advisory Council. Retrieved from http://www.ma-eeac.org/obf.htm.

the OSE Advocate follow the developments of this working group and advocate for the implementation of on-bill financing.

Another means to engage this issue is to encourage the use of "green leases", which were described in Chapter 3, among the city's rental sector. If the city decides to move forward and promote "green leases", it is important for the city to coordinate workshops to educate landlords and tenants about what "green leases" are, their benefits to the tenant and landlord and how they can be used to improve city-wide energy efficiency efforts.

The last recommendation is for the city to consider the feasibility of implementing an energy efficiency ordinance akin to those discussed in Chapter 3. The city should combine the two types of ordinances. Doing so would require landlords to disclose a home's energy efficiency performance to interested renters, and would set enforceable minimum energy efficiency standards for rented homes. Such an ordinance will allow consumers to make more informed

Best Practice: Intentional Inclusion of Renters & Rental Units

Center for Neighborhood Technology (Chicago, IL)

The Center for Neighborhood Technology's Energy Savers program acts as an energy efficiency one-stop shop for owners of multifamily rental buildings, providing a comprehensive energy assessment of the building along with financial guidance and oversight for any construction needs. They also provide an annual performance report to the building owner to show the building's energy consumption after retrofits are completed.

City of Seattle (Seattle, WA)

The city of Seattle's HomeWise weatherization program provides services to low-income households, as well as offers its services to residents who live in rental units through its Energy Conservation Services for Rentals (ECSR) program. ECSR serves buildings of any size, from single family homes to large apartment complexes, with income restrictions based on tenant income rather than that of the landlord. Maximum amount of funding is based on the number of eligible units. At least 50% of tenant households must meet income eligibility requirements (based on heat source and size of household). Costs to owners are typically limited to a share of window, door and refrigerator replacement costs.

City of Tallahassee (Tallahassee, FL)

Through their residential energy programs, the city of Tallahassee offers ceiling insulation grants of $500, which are available to renters. These programs also offer free home energy audits to all residents, including renters. The city also offers Urban League Weatherization Grants, which are available to low-income families who own or rent and live in the city limits or county.

Note: See Appendix 3 for more information on these organizations.

decisions about the homes they choose to rent. This, in turn, would shift the rental market towards favoring energy efficient homes.

Financing

Retrofit-financing options must have a long payback term so the monthly or yearly payments are less than the monthly or yearly savings realized by the resident.

Although the split incentives issue will require some degree of special financing, retrofits in owner-occupied housing will also require improved financing strategies to make retrofits affordable. In general, retrofit-financing options must have a long payback term so that the monthly or yearly payments are less than the monthly or yearly savings realized by the resident. Some current examples of financing for energy efficiency include the utility company-funded HEAT Loan, which is a no interest loan of up to $15,000 paid back over 7 years, and the Green Loan® offered by Wainwright Bank, which is a fixed rate home equity loan of up to $100,000 paid back over 15 years. Since it is so essential to have accessible financing to leverage residential energy efficiency retrofits, the city should begin looking at the financing options that are currently available to Somerville residents and consider the limitations of these loans. The city must consider the following questions when assessing loan possibilities: Where will funding come from to help residents complete energy efficiency retrofits in the future? And who will administer these financing options?

The city of Somerville should also determine how to coordinate multiple financing options. This would mean working with utility companies to determine the options for leveraging energy efficiency funding from the payments required from the utilities under the Green Communities Act and combining that money with loans. Finally, beyond ensuring that financing is available, the city must

Best Practice: PACE-Type Program

Long Island Green Homes (Babylon, NY)

The Long Island Green Homes program provides area homeowners with the funds to perform retrofits on their properties at no upfront cost. Homeowners are given a PACE-type loan to cover up to $12,000 of the cost of the retrofits, which is then repaid through savings on their energy bill. Certified energy auditors determine the projected savings on energy bills as a result of the efficiency improvements. From this information a repayment period is established with a low 3 percent interest rate. The loan agreement is placed on the deed of the home and if the home is sold the outstanding balance transfers to the new owners.

ClimateSmart Loan Program (Boulder, CO)

Boulder County's ClimateSmart Loan Program provides loans of up to $50,000 with a 15 year payback period to homeowners specifically for home energy efficiency and renewable energy improvements. This loan is paid back through a property tax increase, and the debt is tied to the home rather than the owner.

Note: See Appendix 3 for more information on these organizations.

connect homeowners that are interested in retrofits with the financing, potentially as part of the outreach and educational programs that were previously discussed.

Aging Housing Stock

The quality of Somerville's housing stock presents a major barrier to a successful energy efficiency retrofit program. OSE should encourage qualified residents to use HRP as a vehicle to complete pre-weatherization tasks. It is recommended that, as part of Part I, three policy changes are made to increase HRP's focus on energy efficiency: (1) make energy efficiency a HRP program goal; (2) require all homes that participate in HRP to do an energy audit before a contractor evaluates and makes specifications for a home; and (3) require contractors who do repairs for HRP to be certified in energy efficiency retrofitting.

Three policy changes are needed to increase HRP's focus on energy efficiency:

(1) Make energy efficiency a program goal

(2) Require all homes that participate in HRP to do an energy audit before a contractor evaluates and makes specifications for a home

(3) Require contractors who do repairs for HRP to be certified in energy efficiency retrofitting

Requiring energy audits will allow the city to begin collecting baseline data on its housing stock. The collection of data related to energy consumption and efficiency is important for tracking the ongoing success of the program, as well as demonstrating the need for additional funding to further promote energy efficiency retrofits in low-income households. Furthermore, requiring the use of contractors experienced in energy efficiency retrofits in HRP rehabilitation projects will help to ensure that any opportunities for energy efficiency, aside from or as part of the general rehabilitation work, will be pursued, thus increasing HRP's effect on improving the energy efficiency of Somerville's housing stock.

Program Funding

In addition to determining how residents could finance energy efficiency retrofits, OSE and HRP must also consider how their energy efficiency retrofit program will be funded. During Part I, OSE and HRP will depend almost exclusively on the funding that they currently have. However, a study of statewide energy efficiency programs done by the American Council for an Energy-Efficient Economy found that in order to achieve a one percent increase in energy savings per year, the best of these programs had to invest $20 to $40 per person per year for incentives, rebates and other services.[11] For Somerville, with a population of 76,000, that per capita amount translates to an investment of between $1.5 and $3 million per year to achieve significant results.[12] Clearly, this amount of money is currently not available for the city of Somerville.

In order to achieve a one percent increase in energy savings per year, the best residential energy efficiency programs had to invest $20 to $40 per person per year.

OSE however does have ideas for other funding options that could help support the long-term operation of the residential energy efficiency program. In addition to providing grants to residents, OSE hopes to work directly with the utility

11 Kushler, Martin, Patti Witte and Dan York. (2004, April). *Five Years In: An Examination of the First Half-Decade of Public Benefits Energy Efficiency Policies*. Washington D.C.: American Council for an Energy-Efficient Economy.

12 Keane Jr., T. M., op cit.

companies' energy efficiency incentive and rebate programs, such as MassSave, to develop a cost-sharing program for the residents. One idea from OSE is that

it could become the "front door" to the utility incentive programs, meaning that residents would contact OSE to request an NSTAR service and then OSE would contact NSTAR to arrange the necessary service or incentive.[13] This arrangement should be considered in Part I of the program's development, and ultimately should be integrated into the city's long term strategic plan that will be developed in Part II of the program's development.

Best Practice: Alternative Funding Sources

Long Island Green Homes (Babylon, NY)

The Long Island Green Homes (LIGH) program uses a very innovative source of funding to finance its retrofit program. The town of Babylon has a state-mandated solid waste reserve fund, which LIGH was able to tap into when the city expanded the definition of "solid waste" to include the carbon component of energy waste in 2008. As a result, $2 million from the solid waste reserve fund was allocated for use as a revolving fund to finance the Long Island Green Homes program.

ClimateSmart Loan Program (Boulder, CO)

The ClimateSmart Loan Program is funded through a voter-approved ballot measure, which established a "Clean Energy Options Local Improvement District" and allowed Boulder County to issue up to $40 million in special assessment bonds for this local improvement district. The ClimateSmart Loan Program administers loans that were made possible through this special district.

Note: See Appendix 3 for more information on this organization.

Conclusion

In addition to following the recommendations for Part I of the program's development, the city should also develop and finalize a long-term strategic plan for its residential energy efficiency retrofit program. In Part II of the program's development, the city should develop a plan that delineates the city's long-term goals for the retrofit program and a plan for how the city will secure future long-term funding for the program. The following chapter will present recommendations for how the city should develop a centralized, easily accessible "one-stop shop" program for energy efficiency information as part of its long-term strategic plan.

13 Lutes, David, Director of Office of Sustainability & Environment, op cit.

Future Research Tasks for Energy Roadmap Consultant and OSE Technical Advisor

- Analyze proposed solutions to the split incentives challenge
- Begin the process of tracking the city's greenhouse gas emissions from residential buildings
- Study the feasibility of tracking residential energy consumption for future data analysis
- Examine the feasibility of tracking post-weatherization energy performance
- Examine the feasibility of requiring energy efficiency certified contractors in HRP projects
- Further investigate the potential for a green jobs training program
- Formalize partnerships with local community groups
- Explore additional financing options for homeowners
- Follow the developments of the Massachusetts Energy Efficiency Advisory Council and get involved in advocating for on-bill financing

Chapter 5
Program Development Recommendations Part II

In Part II of the development of the city's residential energy efficiency program, this report recommends the city of Somerville design a long-term strategic plan that will create a centralized, cost-effective and dynamic nucleus for the city's energy efficiency efforts. This will enable the city continue, and possibly expand, its efforts to promote residential energy efficiency retrofits in the long-term.

Currently the respective structures of the Housing Rehabilitation Program (HRP) and the Office of Sustainability and Environment (OSE) do not facilitate a coordinated effort. HRP's funding limitations affect its present capacity to expand the program's services. HRP at this time has only one employee. This fact, coupled with the high demand for the program's services (there is currently an 18 to 24 month waitlist consisting of approximately 50 households) and the limited resources on which HRP currently operates, limits the program's ability to expand.[1] Additionally, the design of the program itself limits the role HRP can have in promoting energy efficiency. The program operates like a bank, and it has a hands-off approach when it comes to clients deciding which contractors to hire and what types of additional work they may want to do. While there is effort on the part of the HRP Manager to advocate for energy efficiency upgrades, and referrals to the Menotomy weatherization program are made when appropriate, there is no documentation available to determine how effective these efforts are in promoting energy efficiency.[2] Therefore, the city should consider the additional benefits that a "one-stop shop" could offer to residents looking to make their homes more energy efficient.

The primary task to be accomplished in Part II of the program's development is the completion of a long-term strategic residential energy efficiency plan, which will secure the future of the program and make it easily accessible and navigable for all residents. The goals of the long-term strategic plan should be to: (1) secure long-term, self-sustaining funding to continue program operations; (2) develop a financing mechanism that makes deep retrofits possible through long payback periods; (3) ensure that residents of all income levels can be supported through the program; and (4) assist renters and landlords looking to retrofit their residences.

1 Owusu, Emmanuel, op cit.

2 Whitney, Walter, Housing Rehabilitation Program Manager and Philip Ercoloni, Director of Housing Division, op cit.

A case-study analysis of energy efficiency programs throughout the country reveals that a "one-stop shop" approach can help mitigate some of the challenges to implementing a successful residential energy efficiency retrofit program.[3] Therefore, this report recommends the adoption of the "one stop shop" model for Somerville's long-term plan. Several reports on energy efficiency advocate for a "one-stop shop" approach, and some cities are currently using this model.[4] The "one-stop shop" is a popular business model that allows an institution to provide many services at one location. With an energy efficiency "one-stop shop" program, a Somerville resident would be able to come to the "shop" to obtain information and support for possible retrofits in their residence. An energy efficiency "one-stop shop" could also coordinate funding, expertise and methodology for retrofitting projects all under one institutional roof.

One of the reasons the "one-stop shop" model works for energy efficiency retrofits is that the process of obtaining a retrofit is currently complicated, as discussed in Chapter 3. The navigation of a successful residential retrofit consists of five main steps:

Figure 7: *Path to Property Optimization*

. *Source: Greenandsave.com. Path to Property Optimization. Retrieved from greenandsave.com.*

3 See Appendix 3 for the case study profile analysis.

4 Institute For Sustainable Communities, op cit.; Green for All and COWS. (n.d.). *A Short Guide to Setting Upa City-scale Retrofit Program.* Retrieved from: http://cambridgeenergyalliance.org.

Step 1: Assess the Needs of the Home

An energy auditor and a residential contractor experienced in energy efficient retrofitting need to conduct a thorough evaluation of the home. This entails various inspections and tests, including the use of special infrared cameras, door blowers and insulation inspectors. Based on the results of the evaluation, a prioritized list of problematic areas will be created. This list should include specified products that should be installed during the retrofit. The auditor and contractor should be able to provide an estimate of how much energy the home is expected to save. The energy savings then become the basis for determining the return on investment made in the retrofit.

Step 2: Quote the Project Cost

The contractor will further evaluate the results of the inspection and determine the cost of doing the retrofits. The cost of the job will include labor and materials. The final cost should carry a contingency cost (typically 10 percent of the cost of the project), which is intended to cover any unforeseen expenses.

Step 3: Determine Project Financing

There are several ways to determine how to finance a retrofit project, as was discussed in Chapter 3. The homeowner must determine if the cost of the project can be reduced by any of the rebates and incentives that are available and adjust the total cost for the project accordingly. Next, the homeowner must determine what capital is available to fund this project and/or which financing mechanisms are most suitable for them.

Step 4: Engage in Retrofit

After financing is secured, the retrofit work must be completed. In this step, it is critical that energy efficiency techniques are applied correctly to ensure that these retrofits will cause energy consumption reductions. For example, it is inefficient to install an energy efficient window if the frame is not sealed and caulked properly. Since homeowners often do not know much about home energy efficiency retrofitting, the homeowners would benefit greatly from an expert that can manage and execute the retrofit work successfully.

Step 5: Monitor Project Outcome

Finally, the home needs to be inspected once the job is completed to ensure the retrofits are performing as expected. Homeowners should also have their homes re-audited at least every few years to ensure their home continues to operate efficiently.

This five-step process is often difficult for most homeowners to manage independently. It is not only a technically difficult process, but it also involves coordinating various professionals. The "one-stop shop" model can provide unbiased knowledge and assistance to homeowners seeking retrofits. Additionally, the "one-stop shop" can provide services to other residents, such as renters, construction workers and residents interested in learning more about energy efficiency. Renters could come to the "shop" to learn about "green leases" and to receive advice on how to negotiate with their landlord for a more energy efficient home. An out-of-work construction worker can come to the "shop" to find out about local green workforce training programs and to learn about job openings with local green contractors. A community member could come to the "shop" to learn how to promote energy efficiency in their neighborhood, community group or place of worship. The "shop" should ultimately serve all the members of the community, regardless of their role in retrofitting process. Furthermore, this "one-stop shop" should be open to homeowners of all income levels. This differs from the OSE and HRP, as both of the programs have income level restrictions.

There are several different ways the city can organize a "one-stop shop" program. However, the three criteria that must be considered when developing a "one-stop shop" are:

- How well can the organizational structure organize existing community groups, contractors, the utility companies, homeowners, renters and low-income residents?
- How sustainable is the funding for the program? How likely is it that the program will be able to operate independently for the long-term?
- How well can the program reach people of varying incomes? Will the program cater to a certain population to the exclusion of others, or will it be able to reach out to a variety of people through different financing tools?

Three "one-stop shop" models were developed and analyzed based on the aforementioned criteria.

Model I: City Agency

The city agency model would create a new agency within the city of Somerville. It would likely be a combination of HRP and OSE. Combining the two departments under one agency is the first logical step for the city of Somerville. The benefit of combining these two departments include: (1) the likely combination of the two agencies' existing budgets; (2) coordination among staff; and (3) autonomy in operations. This model would also be able to coordinate the knowledge and expertise needed to support the varying needs of residents.

The disadvantages of this model are that long-term funding may not be secure, since the city is always subject to potential budget cuts due to fluctuations in tax base, and the funding volatility that often exists in a city agency that is dependent upon short-term grants. Additionally, with limited access to money outside of the governmental structure, the program would likely operate on federal grants. This dependence on grant funding could leave the program subject to income restrictions, which would thus limit the number of residents that could be served.

Model II: Non-Profit Partnership

The non-profit partnership model would coordinate the existing city agencies with a new or existing non-profit organization. Two successful examples of this model include the city of Cambridge, Massachusetts and its partnership with the Cambridge Energy Alliance (CEA)[5] and the city of Charlottesville, Virginia with the Local Energy Action Program (LEAP).[6]

The Philadelphia organization, Energy Coordinating Agency (ECA), is another example of this model. ECA works to help people conserve energy by weatherizing homes, conducting energy education workshops, providing green job training at their Green Jobs Training Center and serving as a provider of LEED and Energy Star for Homes certification.[7] ECA has developed strong relationships with the local Philadelphia Community Development Centers (CDCs). These CDCs have their own Neighborhood Energy Centers that serve as "one-stop shops" for all low-income energy services. Further, ECA's Green Jobs Training Center, which is funded in part through the Knight Foundation, allows it to train a new energy efficiency workforce while at the same time providing energy audits and energy efficiency retrofits for qualified households.

The benefits of partnerships such as these include: (1) increased access to experts and specialists that are outside of the current city government departments; (2) increased funding diversity; (3) lack of shareholder performance expectations which would exist in a public-private partnership, discussed later; and (4) additional outreach services. In addition to operating solely on municipal funding, a non-profit can apply for certain types of grants that are restricted to 501 c-3 organizations. A non-profit can also charge fees for services, which can then be used to support the long-term operation of the program and/or services offered to low-income residents. Furthermore, since the non-profit is not expected to meet performance expectations, the organization can take on riskier projects, since there aren't stakeholders demanding a certain rate of return on their investment. Another benefit is that a non-profit organization can utilize its professional

5 Cambridge Energy Alliance. (n.d.)., op cit.
6 Local Energy Alliance Program. (n.d.) Retrieved from http://www.leap-va.org.
7 Energy Coordinating Agency. (n.d.) Retrieved from http://www.ecasavesenergy.org.

standing to create relationships with interested stakeholders and use its role in the community to provide additional outreach services.

The disadvantages of this program structure are similar to the disadvantages of the city agency model in the sense that both have long-term funding volatility. This is particularly true during difficult economic periods. During these times, a non-profit organization can experience a decrease in the number and scale of donations, which in turn seriously impacts an organization's ability to function. Furthermore, non-profits are also heavily dependent on grants and may miss certain segments of the resident population based on the income restrictions of some grants. However, charging a fee for the services provided could potentially offset this issue. Ultimately, the diverse funding possibilities make the non-profit partnership model less vulnerable than an independent non-profit organization that is not partnered with a city.

Model III: Public-Private Partnership

The public-private partnership model would coordinate the existing city agencies with an existing private company. An example of this model is the partnership between the city of Boston and Next Step Living in the Renew Boston Rental Property Retrofit Program.[8] Next Step Living works with cities and towns to develop and implement tailored residential energy efficiency programs. With the goal of achieving deep and lasting community impact, they help municipalities leverage available outside local, state, federal and utility funding. This structure is used in real estate development, for instance, when CDCs partner with a developer consultant on a project to assist the organization with expertise it does not posses. The advantage of this program model includes: having access to city funding, as well as venture capital, equity investments and private foundations for additional funding. This could help ensure the availability of different types of capital, which would provide stability for the program, as well as reach homeowners that are sometimes excluded by grants with income restrictions. Similar to the non-profit organization model, this model would allow for the coordination of stakeholders and would additionally add investment interest. However, it may not be as effective in community outreach as the non-profit partnership model.

One of the disadvantages of this model is that long term funding is volatile due to the nature of private capital. The financing and organization of this model would demand a return to the equity investors. It is uncertain what the return would be, but this type of capital tends to be impatient, and time is something energy efficient retrofits need. Further, this structure would reduce the program's access

8 Renew Boston Rental Property Retrofit Program. (n.d.) Retrieved from http://m.cityofboston.gov/news/Default.aspx?id=4487

to riskier projects, which could exclude certain segments of the population from participating. Currently it is unclear what the investment potential in energy efficient retrofits would be. Still, this structure would facilitate assistance of residents of varying income levels.

Conclusion

The three "one-stop shop" models presented above illustrate how the city of Somerville has several options for how it can deliver a "one-stop shop" energy efficiency program to the city's residents. Each of these models has advantages and disadvantages with respect to their designs and abilities to achieve specific goals. In Part II of the development of the city's residential energy efficiency program, the city, specifically the Energy Roadmap consultant and the OSE Advocate, must determine which model best aligns with the city's resources, goals and objectives and then develop a long-term strategic plan that is based on this model, with the goal of implementing this new plan by the fall of 2012.

Conclusion

The findings in this report indicate that Somerville is primed to be a leader in home retrofits for energy efficiency in Massachusetts. While the implementation of a residential energy efficiency program will be a difficult task, careful planning and innovative policy and program solutions will help the city address the most significant barriers. Ultimately, a residential energy efficiency program will help the city take active strides towards reaching their greenhouse gas emissions reductions goals, while also dramatically reducing the city's energy consumption, saving residents money, helping to improve the community's housing conditions and helping to drive the local economy. The average age and condition of Somerville's housing stock makes the city a perfect place to implement a residential energy efficiency program. Since much of the housing stock needs significant retrofitting, considerable energy savings from these retrofits will be achieved. Furthermore, a Somerville residential energy efficiency program will also help reduce the energy burden of low to moderate-income residents, as well as offer new employment opportunities for Somerville's construction industry.

This report is intended to inform both city officials and the city of Somerville's Energy Roadmap consultant of the challenges to operating an energy efficiency home retrofit program, as well as provide solutions that can help address these challenges. Moving forward, this report recommends that the city immediately begin to implement Part I strategies for the development of the program. Simultaneously, the city should work with the Energy Roadmap consultant to advance Part II of the program's development, a long-term strategic plan with a "one-stop shop" program model that should be launched and functioning by the end of 2012 to ensure that the city continues to move forward with its energy efficiency efforts.

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Appendix 1 : Resources for Further Information

General Information

Department of Energy (DOE) Solution Center: DOE site that provides free online training.

http://www1.eere.energy.gov/wip/solutioncenter/webcasts

Efficiency Cities Network (ECN): Informal network of government staff, researchers and technical assistance providers and NGOs on policy and the path to high-road energy efficiency retrofits in urban settings. The website provides resources and conference calls on energy efficiency retrofits.

http://www.efficiencycities.org

Efficiency First – Massachusetts Chapter: National nonprofit trade association, with a Massachusetts chapter that is tracking legislation and other energy efficiency measuring taking place within the state.

http://www.efficiencyfirst.org/chapters/massachusetts

Home Performance Center: A resource center that provides reports and research to assist organizations in the creation of energy efficiency retrofit programs.

http://www.hprcenter.org

Local Governments for Sustainability (ICLEI): An association of local governments which is committed to sustainable development and climate protection. The website provides information, reports and webinars on energy efficiency and financing programs.

http://www.icleiusa.org/action-center/icleis-2009-innovative-financing-webinar-series

Massachusetts Energy Efficiency Advisory Council (MA-EEAC): This agency is the state's advisory council on utility and municipal energy efficiency programs.

http://www.ma-eeac.org/index.htm

Massachusetts Division of Energy Resources (DOER): State agency that works to achieve energy efficiency, clean energy and the development of those industries in the Commonwealth.

http://www.mass.gov/DOER

Southeast Energy Efficiency Alliance (SEEA): An energy efficiency advocacy organization that promotes energy efficiency and clean energy in the Southeast.

http://www.seealliance.org/index.php

State Energy Efficiency (SEE) Action Network: An EPA and DOE led group whose mission is to help the nation achieve all cost-effective energy efficiency by 2020, assisting states in advancing policies and practices that bring energy efficiency to scale.
http://www.epa.gov/cleanenergy/energy-programs/seeaction/index.html

Energy Alliance Models

Cambridge Energy Alliance (CEA): An energy alliance that is widely regarded as a leader in energy efficiency and a model for replication.

http://cambridgeenergyalliance.org

Local Energy Action Program (LEAP): A newly-founded energy alliance in Charlottesville, VA, funded through the Southeast Energy Efficiency Alliance with approximately the same amount of money as Somerville's OSE is planning to use for their energy efficiency program.
http://www.leap-va.org/

Greater Cincinnati Energy Alliance (GCEA): A newly-founded energy alliance dedicated to reducing energy consumption in Cincinnati and Northern Kentucky.
http://greatercea.org/

Incentives for Massachusetts

Database of State Incentives for Renewables & Efficiency (DSIRE): DSIRE is a comprehensive online database of utility, federal, state and local incentives available in Massachusetts.

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

Mass Save: Utility company funded website that provides a list of the incentives available to Somerville residents.

http://masssave.com

Utility Bill Assistance Programs

Energy Bucks: Utility sponsored program that offers fuel assistance, utility discount rates and weatherization services for qualified Massachusetts residents.

http://www.energybucks.com/energybucks.php?lang=eng

U.S. Department of Housing and Urban Development (HUD): HUD website that provides a list of sites that offer utility bill assistance to qualifying families in Massachusetts.

http://www.hud.gov/local/ma/renting/energyprgms.cfm

Private Loans

Cambridge Energy Alliance: CEA's website which provides financing options for residential energy efficiency improvements.

http://cambridgeenergyalliance.org/residents/financing

Wainwright Bank: A local bank that provides a Green Loan™ for financing residential energy efficiency improvements. http://www.wainwrightbank.com/html/personal/loans/green.html

Federal Grants

Grants.gov: The U.S. Government's website where new and existing grant opportunities can be found and researched.

http://www.grants.gov/search/advanced.do

Bonds

Qualified Energy Conservation Bonds (QECBs): Mass.gov website that provides information about QECBs.

http://www.mass.gov/?pageID=afterminal&L=6&L0=Home&L1=Budget,+Taxes+%26+Procurement&L2=Oversight+Agencies&L3=Massachusetts+Recovery+and+Reinvestment+Office&L4=ARRA+Programs&L5=ARRA+Bond+Programs&sid=Eoaf&b=terminalcontent&f=recovery_arrta_qualified_energy_conservation_bonds&csid=Eoaf

Energy Conservation Ordinances (ECO)

Austin, Texas: A guide to the city's energy efficiency ordinance.

http://www.abor.com/gov_affairs/ABoRBrochure.pdf

Berkeley, California: A compliance guide developed by the city of Berkeley for residential property owners, buyers and sellers.

http://www.ci.berkeley.ca.us/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/Residential%20Energy%20Conservation%20Ordinance%20Compliance%20Guide%202008.pdf

Residential Energy Conservation Ordinance (RECO) Factsheet: A factsheet on RECOs put together by Leadership Institute for Ecology and the Economy and the Accountable Development Coalition.

http://www.sonic.net/~ecolead/assets/downloads/RECO/RECO_factsheet.pdf

Seattle, Washington: A city of Seattle website that provides information on its recently passed Energy Disclosure Ordinance (EDO). http://www.seattle.gov/mayor/newsdetail.asp?ID=10497&dept=48

Property Assessed Clean Energy (PACE)

Lawrence Berkeley National Laboratory: A Lawrence Berkeley National Laboratory presentation on PACE financing. http://www.nga.org/Files/pdf/1002CLEANENERGYFULLER.PDF

PACE Now: An organization that advocates for PACE legislation across the country. The website has links to current and pending legislation as well as other PACE related information.

http://pacenow.org

Renewable and Appropriate Energy Laboratory: University of California, Berkeley laboratory that provides information on PACE programs across the country as well as a "how to" guide.

http://rael.berkeley.edu/financing/resources

Energy Efficient Mortgages (EEM)

Energy Star: EPA and DOE's Energy Star website that defines the types of EEMs available. http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.energy_efficient_mortgage

On-Bill Financing

MA-EEAC: EEAC has an on-bill repayment working group that is evaluating the potential for implanting such a payment system for the state.

http://www.ma-eeac.org/obf.htm

Green Jobs Training

Roxbury Community College: Local community college that offers two certificate programs for those seeking careers in the emerging green energy/jobs field. Clean Energy Tech Certificate Programs:

- Alternative & Renewable Energy Certificate Program
- Energy Conservation/Efficiency Certificate Program

http://www.rcc.mass.edu/DCE/Certificates.asp

Building Performance Institute: BPI is a national organization that set standards and conducts training for home energy efficiency retrofits. http://www.bpi.org/home.aspx

Appendix 2: List of Interviews

Cynthia Adams
Executive Director
Local Energy Action Program
Charlottesville, VA
Phone interview on March 31, 2010

Penelope Conner
Vice President of Customer Care
NSTAR
Westwood, MA
Email conversation on April 12, 2010

Alison Corwin
Senior Associate
New Ecology, Inc.
Boston, MA
Phone interview on March 17, 2010

Phil Ercolini
Director of Housing Division
City of Somerville
Somerville, MA
In-person interview on February 18, 2010
Phone interview on March 10, 2010

Penn Loh
Professor
Tufts University Department of Urban & Environmental Policy & Planning
Medford, MA
In-person interview on March 2, 2010

David Lutes
Director of Office of Sustainability and Environment
City of Somerville
Somerville, MA
In-person interview, February 18, 2010
Phone interview on March 10, 2010

Ben Taube
Executive Director
Southeastern Energy Efficiency Alliance
Atlanta, GA
Phone interview on March 23, 2010

Dan Teague
Associate
New Ecology, Inc.
Boston, MA
Phone interview on March 17, 2010

Neil Veilleux
2010 Tufts University Master's Degree candidate
Author of Master's thesis: *Energy Mapping for Community Energy Efficiency Initiatives*
Tufts University
Medford, MA
Phone interview on March 21, 2010

Walter Whitney
Housing Rehabilitation Program Manager
City of Somerville
Somerville, MA
In-person interview on February 18, 2010

Appendix 3: Case Studies

Methodology

The energy efficiency retrofit program case studies included in this appendix were chosen according to whether and how they addressed the specific challenges facing Somerville. Of particular interest were programs that are in similar geographic regions as Somerville. Since heat loss in housing is more of a concern in a cold climate, programs in the Northeast were considered especially relevant. If a program was able to address any of the challenges laid out earlier in this report it was also included. Since the landlord-renter split incentives challenge and that of marketing to non-English speaking residents are especially big challenges for the city of Somerville, any programs that addressed these issues were also included. Finally, case studies that used program models with a holistic approach to energy efficiency, as well as case studies that pursued a piecemeal approach to energy efficiency retrofitting are featured.

One potential flaw in the case study methodology is the lack of conclusive evidence for the effectiveness of each of the programs. Due to the nature of energy efficiency trends, many cities have only recently begun to aggressively pursue residential retrofit programs. Most of the programs are new or even in the development stages, and there has either not been time to collect data on greenhouse gas emissions reduced or number of homes served or that information is not publicly available. Despite the limitations in the case studies, these examples of residential energy efficiency retrofits nevertheless provided valuable information for how the city of Somerville could develop a successful energy efficiency program.

Case Study Profiles

Energy Alliance Models

Cambridge Energy Alliance, Cambridge, MA

Cambridge Energy Alliance (CEA) is an organization that is jointly sponsored by the city of Cambridge and the area's utility company, NSTAR. This co-sponsorship allows CEA to aggregate financial resources and energy services to help businesses and homeowners increase their building's energy efficiency, thereby saving money on their energy bills. Comprehensive energy audits are provided for all Cambridge buildings, generally for free. CEA also has professional Energy Advisors that act as information hubs, providing help to residents for accessing further information, including all available incentives and rebates for the recommended measures, a range of options for financing the project, financial tools to help determine cost and payback and contracting services available through partners and other sources. The program expects to facilitate retrofits that will lead to 30% reductions in energy bills.

Best Practices:

- Partnership with utility company to stretch resources
- Energy Advisor acts as information hub
- One-stop shop aggregation of resources, information and services

For more information visit http://www.cambridgeenergyalliance.org

Greater Cincinnati Energy Alliance, Cincinnati, OH

Greater Cincinnati Energy Alliance (GCEA) offers educational, project management and financing services for the retrofitting of buildings with energy efficient and renewable technologies throughout Greater Cincinnati and Northern Kentucky. They take "a grassroots, community-based approach toward changing the mindset about energy efficiency and renewable energy." The organization predicts that "buildings can save 25-30% in energy costs by with cost-effective retrofits that pay for themselves from their savings over 5-7 years." GCEA is funded through the American Reinvestment and Recovery Act of 2009 and the Greater Cincinnati Foundation.

The GCEA focuses on the energy efficiency needs of many different sectors, including residential, non-profits, small business/commercial and difficult-to-reach renters. For residential units, GCEA offers education, financing advice and opportunities, as well as energy and retrofit services. They offer free or reduced cost home energy assessments to homeowners. Additionally, they promote the use of "Green Leases" that cater to owners of rental properties to overcome the split incentives challenge. GCEA also partners with academic institutions, non-profit organizations and the city of Cincinnati to develop green job training programs that allow workers to become skilled in trades related to energy and efficiency services.

Best Practices:

- Partnership with workforce development programs
- Green Lease promotion to address split-incentive challenge

For more information visit http://www.greatercea.org

Local Energy Action Program (Charlottesville, VA)

The Local Energy Action Program (LEAP) is a non-profit/government partnership. While still in development phase, LEAP's plans are to include a market-making/job creation approach and a focus on building science, systems and usage behavior. Its first emphasis is on energy efficiency and a 20% - 40% efficiency gain per structure, while its second emphasis is to phase in renewable energy generation.

Potential Recommendations for Somerville: Watch how program develops and the effects that it has in the Charlottesville community. LEAP's goal is "designed to achieve 30% - 50% market penetration and a 20% - 40% efficiency gain in 5-7 years." Additionally, LEAP was given a $500,000 start-up grant, an amount similar to that which Somerville's Office of Sustainability and Environment has for their own energy efficiency retrofit program.

Best practices:

- Local government/non-profit partnership

For more information visit http://www.leap-va.org

City and State Government Energy Efficiency Programs in Climates Comparable to Somerville

Center for Neighborhood Technology, Chicago, IL

The energy efficiency programs are run through Center for Neighborhood Technology's 501 c(4) CNT Energy division. This entity works to connect consumers and communities to energy efficiency information and services, and educational programs. Currently they are funded through a combination of grants, utility and government funding.

Energy Savers, a program under CNT Energy, works with multifamily buildings by providing a free comprehensive energy assessment of the building, along with financial guidance and oversight for any construction that takes place. Though retrofits are usually paid for by the building owner, CNT Energy also has grant funding available for income-eligible properties. The organization provides financial guidance and information on applicable rebates and incentives. They will also provide an annual performance report to the building owner to monitor the building's energy consumption after the retrofits are completed.

Best Practices:

- Focus on rental units

For more information visit http://www.cntenergy.org

Efficiency Vermont, VT

Efficiency Vermont is a statewide provider of energy efficiency services. It provides both technical assistance and financial incentives to residents and businesses in Vermont. The organization is funded by an energy efficiency charge on Vermont residents' electric bills, revenue that previously went to provide energy efficiency services through electric utility companies. This funding allows Efficiency Vermont to replace the energy efficiency services that were once provided through the various electric companies, and enables all of the state's residents to receive the same energy efficiency services.

Best Practices:

- Partnership with utilities
- Comprehensive and user-friendly website

For more information visit http://efficiencyvermont.com/pages

Long Island Green Homes, Babylon, NY

The Long Island Green Homes (LIGH) program is an ambitious plan to perform energy efficiency retrofits on all of the town's 65,000 homes. This program provides area homeowners with the funds to perform retrofits on their properties at no upfront cost, and connects them with trained workers to make the improvements.

The town of Babylon has a state-mandated solid waste reserve fund, which LIGH was able to tap into when the city expanded the definition of "solid waste" to include the carbon component of energy waste in 2008. As a result, $2 million from the solid waste reserve fund was allocated to be used as a revolving loan fund to finance the Long Island Green Homes program.

Homeowners that participate in the program are given a PACE-type loan to cover up to $12,000 of the cost of the retrofits, which is then repaid through savings on the homeowner's energy bill at a low, 3 percent interest rate. The loan agreement is placed on the deed of the home and, if the house is sold, the outstanding balance transfers to the new owners.

The town of Babylon recently announced that they are expanding the program to provide funding for the installation of solar panels on homes that have already been retrofitted or that meet certain energy efficiency requirements. So far, participants have seen their energy bills drop an average of $984/year.

Best Practices:

- Alternative sources of funding not dependent on foundation support
- PACE-type program tying the loan for energy efficiency to the house instead of to owner

For more information visit http://www.ligreenhomes.com, or http://www.townofbabylon.com/uploads/pdffiles/CaseStudy_BabylonNYGreenHomes.pdf

Low-Cost Weatherization and Education Program, Chicago, IL

The city of Chicago distributes weatherization kits, which include temporary weatherization items like plastic for windows and weatherstripping, to residents and trains them on how to use all of the items in the kits. Once a resident has been trained on to how to use all of the items in the kits, usually through a workshop, the resident can request more kits to give to friends, family, and community members as long as the resident agrees to train those to whom they give kits. Program participants are required to fill out an installation confirmation that asks where they live and which items they used from the kit. The pilot program was hugely successful, with 7,000 kits distributed and requests for many more.

Potential recommendations for Somerville: As part of a larger effort to promote EE in the city, Somerville could take lessons learned from this program and develop a similar "kit" and education program that ensured follow-up, records of materials used, and where in the city the efforts are being made. Since the weatherization materials in Chicago's kits are temporary measures they could not be considered permanent upgrades. The City of Somerville should continue to observe the program and note successes that emerge.

Best Practices:

- Begins to address information challenge

For more information visit http://chicagoconservationcorps.org/blog/c3-community

Other Effective Programs

Center for ReSource Conservation, Boulder, CO

The Center for ReSource Conservation's Residential Energy Action Program (REAP) is a collaborative effort between Center for ReSource Conservation, ClimateSmart, the Boulder County government and other local municipalities. The organization has partnered with Xcel Energy, the area's electricity provider, to offer energy audits at 60% below the market price. Additionally, REAP provides free one-on-one energy counseling, contractor referrals and bid reviews, assistance with rebate forms, an updated energy profile of resident's gas and electricity usage and information on the ClimateSmart Loan Program.

The ClimateSmart Loan Program is run through Boulder County and provides loans of up to $50,000 with a 15 year payback period for energy efficiency and renewable energy

improvements to homes. This loan is paid back through a property tax increase, and the debt is tied to the home rather than the owner. This loan program is funded through a voter approved ballot measure which established a "Clean Energy Options Local Improvement District" and allowed Boulder County to issue up to $40 million in special assessment bonds for this local improvement district.

Best Practices:

- Partnership with non-profit organization, utility company and local government
- PACE-type program tying loan for energy efficiency to house instead of to owner

For more information visit http://www.conservationcenter.org or http://www.bouldercounty.org/bocc/cslp/cslp_residential.html

City of Houston, TX

The city of Houston has partnered with CenterPoint Energy, the Houston metro area's electricity distribution company, to offer free energy efficiency retrofits to low-income families through its Residential Energy Efficiency Program (REEP). This program is funded through the federal government's American Recovery and Reinvestment Act and the state of Texas' Weatherization Assistance Program. Qualifying households must have a combined gross income at or below 200% of the 2009 Federal Poverty Level. Most of the retrofits completed through the program consist of simple energy efficiency measures, such as caulking windows, insulating walls and weatherstripping. In its third year, REEP has successfully weatherized over 7,000 homes and has reduced residential energy bills by an average of 12-18%.

Houston's retrofit program has dramatically reduced the consumption of energy in the homes of 641 low-income residents through simple energy efficiency improvements, such as weather stripping windows and doors, insulating attics and hot water pipes, and caulking windows. The city estimates that the program has led to a reduction of 1,100 tons CO2e emissions and saves participating residents approximately $870 USD annually.

Best Practices:

- Partnership with utility
- Focus on low-income residents

For more information visit http://www.houstontx.gov/reep/index.html

City of Seattle, WA

The city of Seattle's HomeWise weatherization program targets homes of low-income households, but also offers its services for rental units through its Energy Conservation Services for Rentals (ECSR) program. ECSR serves buildings of any size, from single family homes to large apartment complexes with income restrictions based on tenet income rather than that of the landlord. Maximum amount of funding is based on number of eligible units within a multi-unit building. At least 50% of tenant households

must meet income eligibility requirements, which are based on heat source and the size of the household. Costs to owners are typically limited to a share of window, door and refrigerator replacement costs.

Best Practices:

- Intentional inclusion of rental units
- Comprehensive, user-friendly website

For more information visit http://www.seattle.gov/housing/HomeWise, or http://www.seattle.gov/light/conserve/Resident

City of Tallahassee, FL

The city of Tallahassee's Homeowner Rehabilitation Program was designed to enhance and strengthen neighborhoods through the substantial rehabilitation of owner-occupied housing. Assistance is provided to residents in the form of a zero-interest, forgivable loan. Up to $40,000 may be spent per unit to bring the home into compliance with current building codes and ordinances. The city's Housing Division provides funding to three area non-profit organizations that are responsible for hiring contractors and ensuring that repairs are made in compliance with building codes.

Through their residential energy programs, the city of Tallahassee also offers ceiling insulation grants of $500, which are available to renters. These programs also offer free home energy audits to all residents, including renters, and Urban League Weatherization Grants, which are available to low-income families who own or rent and live within the city or county limits.

Best Practices:

- Partnership with non-profit entities
- Intentional inclusion of renters

For more information visit http://www.talgov.com/ecd/housing/homerehab.cfm or http://talgov.com/you/energy/energy_programs.cfm

Energy Coordinating Agency, Philadelphia, PA

The Energy Coordinating Agency (ECA) runs the Philadelphia Weatherization Assistance Program, and provides additional services to residents, such as Utility Bill Payment Assistance. ECA also sponsor energy education workshops that provide material packs (caulk and caulk gun, weatherstripping, widow kit and Mortite) to participants, and train participants in how to use the packs to retrofit their homes. ECA also produces DIY energy conservation guides for distribution. Most of their services are free to low-income participant, but are fee-based otherwise. ECA has also developed a Green Jobs Training Center (funded in part through the Knight Foundation) which prepares people to be a part of the energy efficiency workforce, while simultaneously providing energy audits and energy efficient retrofits for qualified households through the supervised work of students in the program.

ECA has developed strong relationships with local Community Development Centers in order to promote their energy efficiency efforts. They have partnered with Philadelphia-area community development corporations (CDCs) to develop a network of Neighborhood Energy Centers (NECs) in each CDC. These NECs serve as one-stop-shops for all low-income energy services.

ECA's three-year long Weatherization, Rehabilitation and Asset Preservation (WRAP) pilot program in a South Philadelphia neighborhood concluded in 2006 (for more information visit: www.ecasavesenergy.org/sites/www. ecasaves energy.org/files/Final%20WRAP%20Report%20-%20March%202007-1.pdf). This program was funded through the William Penn Foundation and Ford Foundation, with additional funding from government sources and other foundations. During the pilot's three years, 141 houses were retrofitted, resulting in average energy savings of 15% (up to 25% in houses that received the most comprehensive services), and each house is expected to save between $300 and $400 in utility costs per year. The energy services included roof repair, insulation and white roof coating; tree planting in neighborhood streets and vacant lots; energy conservation services from both the local gas and water utilities; heating system repair and replacement; budget counseling; and energy payment assistance.

ECA marketed this program though extensive media coverage, door to door fliers, and referrals from City Councilors, non-profits, schools and churches. ECA also relied on the partnering CDCs to spread the word to residents.

Best Practices:

- Partnership with CDCs and other community groups to market the program
- Coordination with workforce training program

For more information visit http://www.ecasavesenergy.org

Programs to Follow

City of Minneapolis, MN

The city of Minneapolis received a $705,000 Energy Efficiency and Conservation Block Grant from the federal government. They are still seeking proposals through an RFP to create, implement and administer a residential energy efficiency program that will include a revolving loan fund.

For more information visit http://www.ci.minneapolis.mn.us/recovery/c-proj_103.asp

Appendix 4: HRP Materials Analysis

Methodology

As part of the research for this report, the city of Somerville's Housing Division asked for an analysis of the home repair work conducted over the past 10 years through the Housing Rehabilitation Program (HRP). The objective of this research was to illustrate what work is typically done on the homes and what opportunities, if any, there were for energy efficiency upgrades. The city provided specification sheets detailing the work that was done on 48 homes (the same 48 household contacted for the homeowner survey). The work done on these homes was completed between 2000 and 2008, with 58 percent of the work having been performed in the last five years.

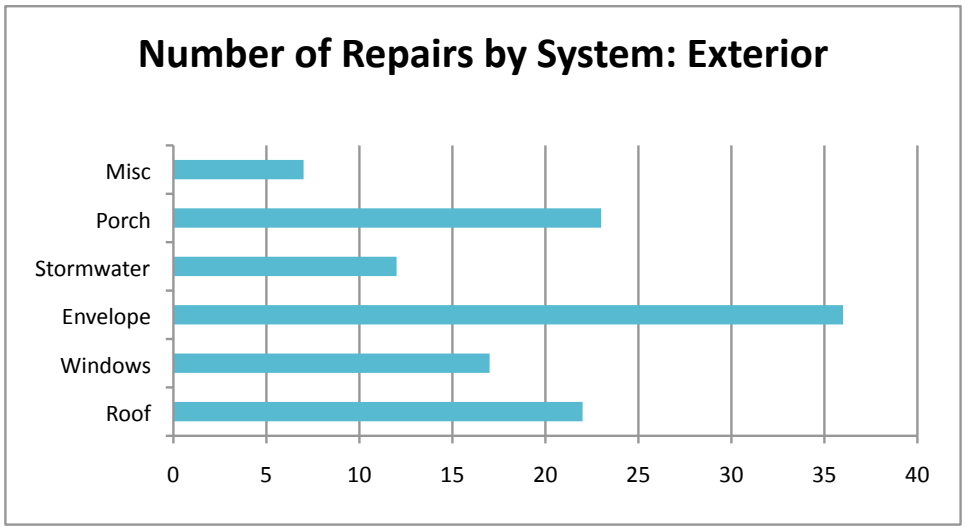
The first step in the analysis was to compile a list of repairs for each home based on the information provided in the specification sheets. A repair was defined as a line item within the specification sheet that made an improvement to the home. The specification sheets divided the repairs into two types of work: interior and exterior. Interior work included all repairs made inside the home, including bathrooms, kitchens, electrical, plumbing, HVAC (Heating, Ventilation and Air Conditioning) systems, common spaces, bedrooms and miscellaneous interior repairs. Exterior work includes all repairs relating to the roof, windows, the overall building envelope (including the foundation), stormwater (gutters, downspouts, etc.), the porch and other miscellaneous exterior repairs. Each repair was taken from the specification sheets and organized into a list as either interior or exterior work.

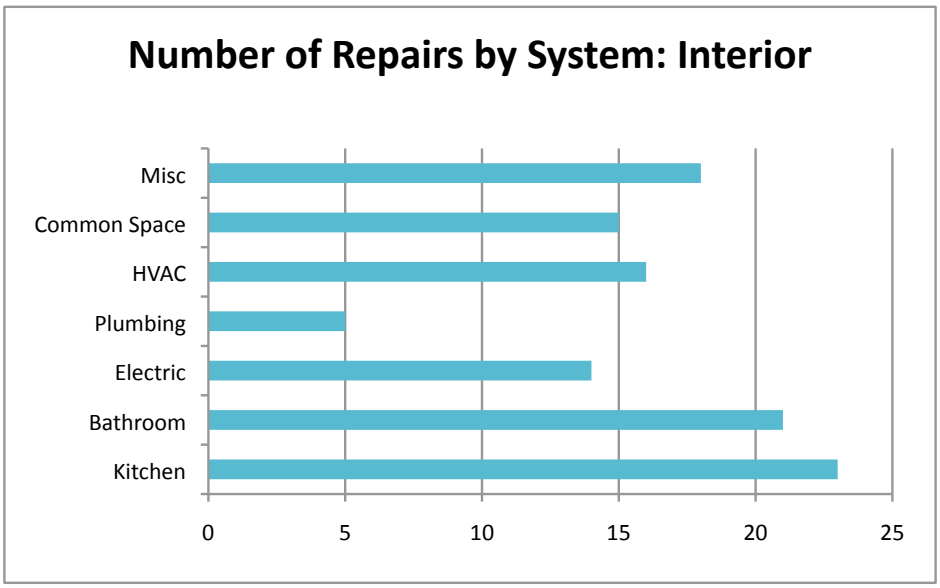
The next step was to group individual repairs together in appropriate categories, reflecting what "repair system" the individual repairs belonged to. For example, there are six main individual repairs that went into repairing a roof or a "roofing system," so for the purposes of this analysis all of these repairs were grouped together as one "roofing system" repair. For interiors, the repair systems were: kitchen, bathroom, electrical, plumbing, HVAC, common space and miscellaneous. For exteriors, the systems were: roof, windows, envelope, stormwater, porch and miscellaneous. This grouping method allowed for a better review of the overall work that was done to each of the homes.

In addition to organizing the repair information, it was also noted which repairs offered an opportunity for energy efficiency. For example, replacing the existing hot water heating system with a more efficient gas fired, forced hot water boiler would be considered an "energy efficient" repair. According to discussions with the city, no repairs undertaken by the HRP were intentionally done for energy efficiency purposes. Energy efficient products were specified only as a result of updated building codes that required such products. The intention of notating these energy efficient repairs was to get a sense of what opportunities for energy savings were realized through the HRP. The recording of this data can serve as

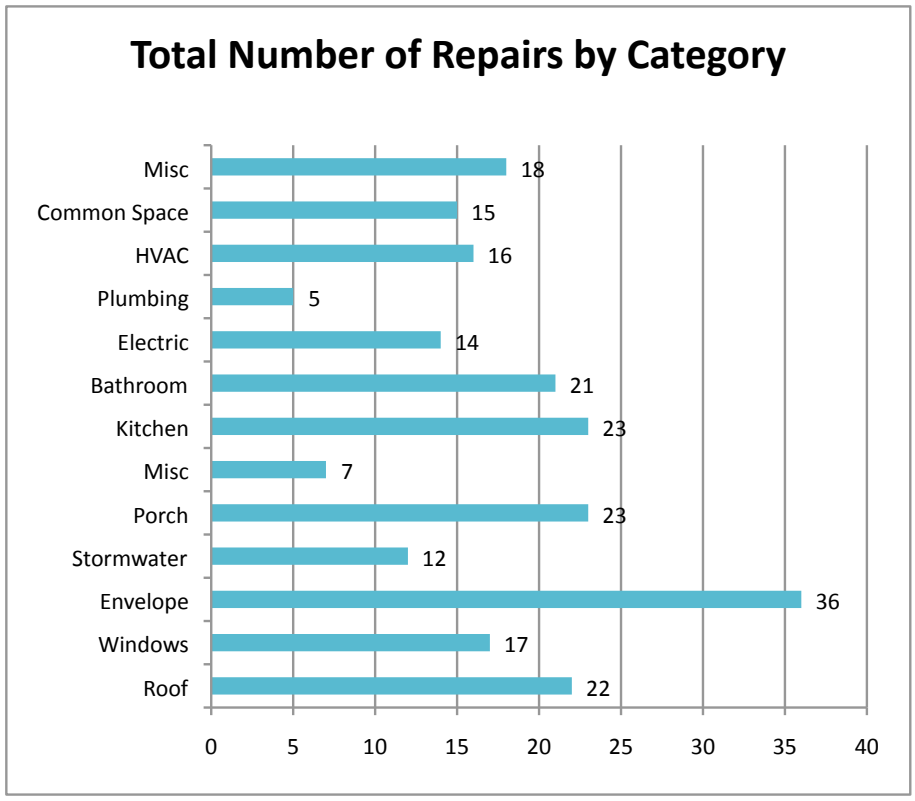
a baseline and can now be used to make comparisons in future energy efficiency work done by the RHP.

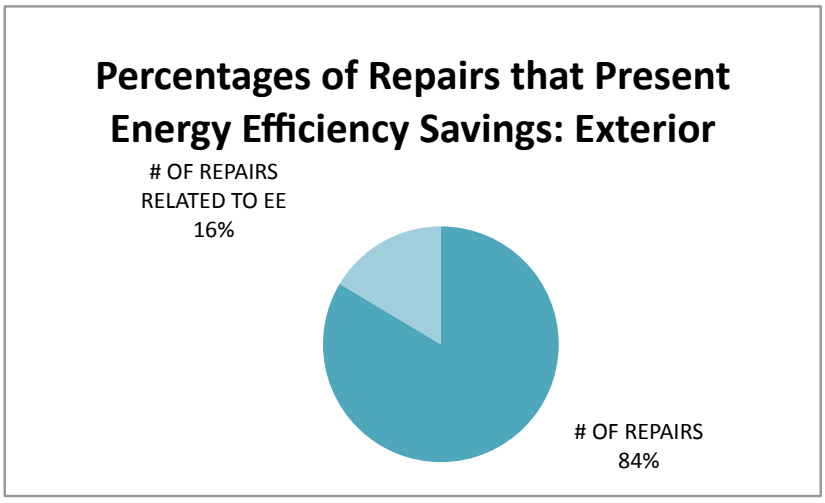
After grouping the individual repairs together as one repair system, the repairs were then coded in order to perform a statistical analysis. For example, if a system received a repair such as an extensive gutting down to the studs and a remodeling of the entire bathroom, the system received a "1." If no repair was done at all, the system received a "0." Further, if a system's repair included an energy efficient item, it was noted in a separate column. The repairs for each "system" were counted and totaled.

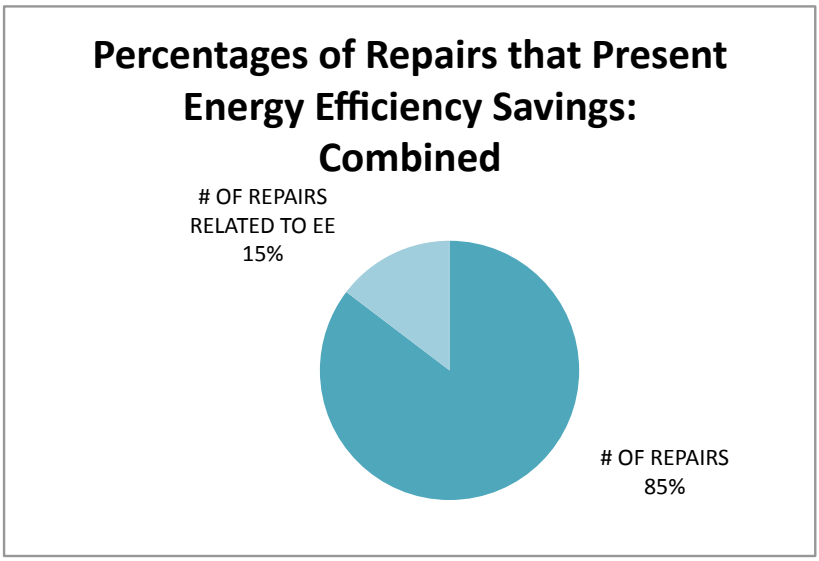


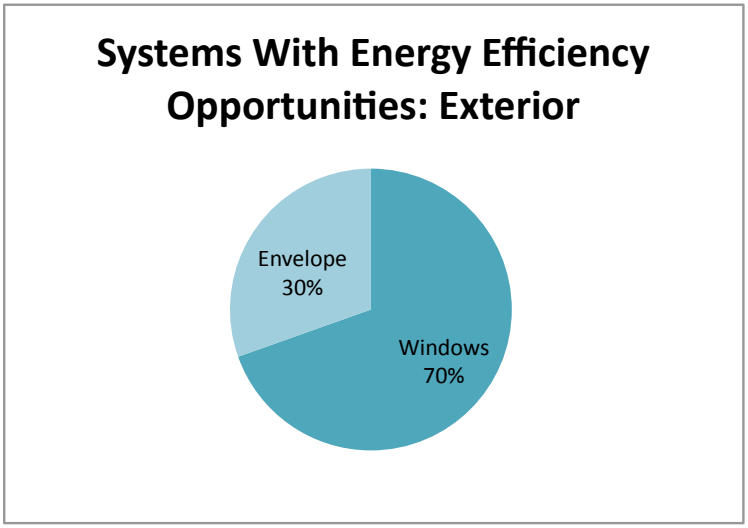


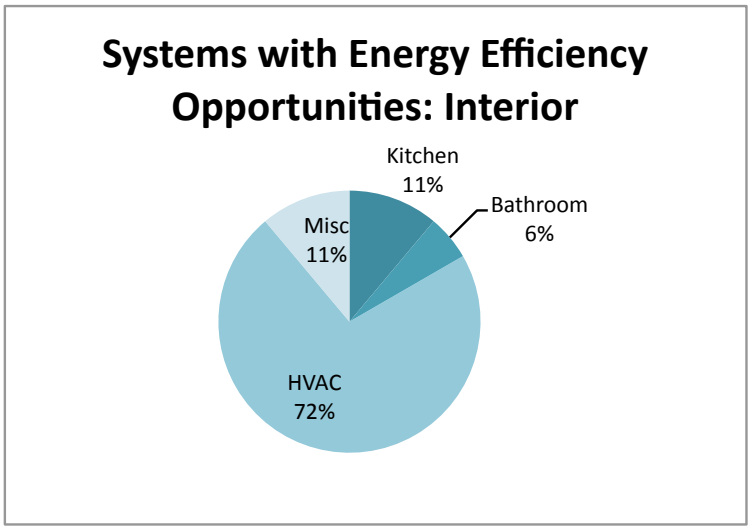
Address	Date	Roof	Windows	Envelope	Stormwater	Porch	Misc	Kitchen	Bathroom	Electric	Plumbing	HVAC	Common Space	Misc	# OF REPAIRS	# OF REPAIRS RELATED TO EE	% of work related to EE
10 Pleasant Ave	06/20/00	0	1	0	0	0	0	1	1	1	0	1	1	1	7	2	28.6%
94 Governor Winthrop Road	08/03/01	0	1	1	0	0	0	0	1	1	1	0	1	0	5	2	40.0%
7 Bowdoin Street	03/08/02	0	1	2	1	1	1	1	1	0	0	3	0	0	10	4	40.0%
23 Henderson Street	04/30/02	0	1	1	0	0	0	1	1	1	0	0	1	0	6	1	16.7%
23 Garrison Ave	06/11/02	0	1	2	0	1	0	1	0	1	1	0	0	0	7	1	14.3%
110 West Adams Street	02/28/03	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	100.0%
25 Main Street	06/04/03	0	0	1	0	1	0	1	1	0	0	1	0	0	5	2	40.0%
17-17A Jay Street	06/11/03	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	100.0%
16 Grant Street	07/15/03	0	1	0	0	1	0	0	0	1	0	0	1	1	5	1	20.0%
79 Albion Street	07/23/03	0	0	0	1	1	0	1	1	0	0	0	0	1	5	0	0.0%
39 Day Street	10/17/03	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	100.0%
85 Lowell Street	10/28/03	1	0	1	1	0	0	0	0	0	0	0	0	0	3	0	0.0%
121 West Adams Street	11/03/03	1	1	1	1	1	0	1	0	0	0	1	0	1	8	3	37.5%
56 Trull Street	12/30/03	1	1	1	0	0	1	1	0	0	0	0	1	1	7	1	14.3%
32 Jay Street	05/07/04	0	0	1	1	0	0	1	1	0	0	1	0	1	6	0	0.0%
37 Belmont Street	07/13/04	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	100.0%
16 Lee Street	08/02/04	1	0	3	0	0	0	0	1	0	0	0	1	1	7	0	0.0%
42 Garrison Ave	08/12/04	1	2	1	1	1	0	1	0	1	1	0	0	0	9	1	11.1%
25 Partridge Ave	09/07/04	1	0	1	0	1	0	1	0	0	0	0	0	1	5	1	20.0%
28 Rossmore St	09/29/04	1	0	0	1	0	0	1	1	1	0	0	1	0	6	0	0.0%
32 Fenwick Street	02/23/05	1	0	0	0	0	1	1	0	0	0	1	0	1	5	1	20.0%
19 Vinal Ave	02/28/05	0	1	1	0	2	0	1	0	0	0	0	1	1	7	1	14.3%
27 Maple Ave	05/06/05	1	0	0	0	0	0	1	1	0	0	0	0	0	3	0	0.0%
52 Partridge Ave	05/19/05	0	0	0	0	0	0	0	0	0	0	1	0	1	2	1	50.0%
28 Bartlett Street	08/22/05	0	1	1	0	0	1	1	0	0	0	0	0	0	4	1	25.0%
95 Hudson Street	08/24/05	1	1	1	0	0	0	0	1	0	0	0	0	0	4	1	25.0%
31 Winslow Ave	11/03/05	3	1	1	1	0	0	1	0	0	0	0	1	1	9	0	0.0%
13 Cottage Avenue	11/14/05	0	1	3	1	1	0	0	0	0	0	0	0	0	6	1	16.7%
47 Boston Street	02/02/06	1	0	0	0	1	0	0	1	0	0	0	0	0	3	0	0.0%
27 Saint James Ave	04/10/06	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.0%
137 Summer Street	05/23/06	0	1	1	0	1	0	1	1	1	1	0	1	0	8	1	12.5%
22 Joseph Street	07/17/06	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0.0%
24 Summer Street	09/12/06	1	0	2	0	1	0	0	1	0	0	0	0	0	5	0	0.0%
33 Simpson Ave	09/26/06	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.0%
38 Pinckney Street	11/29/06	0	0	0	1	1	1	0	1	0	0	1	0	1	6	2	33.3%
207 Morrison Ave	12/04/06	0	0	0	0	1	0	0	0	1	0	0	0	0	2	0	0.0%
87 Wheatland Street	01/16/07	1	1	1	0	0	0	0	0	0	0	0	0	0	3	1	33.3%
18 James Street	03/28/07	1	0	3	0	1	0	0	1	1	0	0	1	0	8	1	12.5%
1024A Broadway	04/26/07	1	0	1	1	0	1	1	1	0	0	0	0	1	7	1	14.3%
3 Washington Ave	05/17/07	0	0	0	0	0	0	1	1	1	0	0	1	1	5	0	0.0%
62 Marion St	05/31/07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
29 Gilman Street	6/8/07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
28 Robinson Street	07/11/07	0	0	0	0	1	0	0	0	1	0	1	1	1	5	0	0.0%
71 Bailey Road	07/12/07	0	0	1	0	1	0	1	1	1	1	0	1	1	8	2	25.0%
188 Lowell Street	07/23/07	0	0	1	0	1	0	1	1	1	0	0	0	0	5	1	20.0%
21 Richardson Street	12/10/07	1	0	3	0	1	1	0	0	0	0	0	1	0	7	0	0.0%
11R Albion Street	04/17/08	1	0	0	1	1	0	1	0	0	0	0	0	0	4	1	25.0%
7 Adams Street	04/17/08	0	0	0	0	0	0	0	1	0	0	1	0	1	3	0	0.0%
		22	17	36	12	23	7	23	21	14	5	16	15	18	227	39	17.2%
		9.69%	7.49%	15.86%	5.29%	10.13%	3.08%	10.13%	9.25%	6.17%	2.20%	7.05%	6.61%	7.93%			


Total Number of Repairs by Category
Misc
Common Space
HVAC
Plumbing
Electric
Bathroom
Kitchen
Misc
Porch
Stormwater
Envelope
Windows
Roof
18
15
16
5
14
21
23
7
23
12
36
17
22
0
5
10
15
20
25
30
35
40


Percentages of Repairs that Present Energy Efficiency Savings: Exterior
OF REPAIRS RELATED TO EE 16%
OF REPAIRS 84%


Percentages of Repairs that Present Energy Efficiency Savings: Combined
OF REPAIRS RELATED TO EE 15%
OF REPAIRS 85%


Systems With Energy Efficiency Opportunities: Exterior
Envelope 30%
Windows 70%


Systems with Energy Efficiency Opportunities: Interior
Kitchen 11%
Bathroom 6%
Misc 11%
HVAC 72%

Appendix 5: HRP Homeowner Survey

Methodology

As part of the research for this report, the city of Somerville's Homeowner Rehabilitation Program (HRP) requested an energy efficiency needs assessment study for low-income residents. Specifically, the city wanted to know whether qualifying residents for HRP would benefit significantly from energy efficiency retrofitting to their homes. Additionally, the city was interested in assessing residents' general attitudes towards energy efficiency. A survey was designed to address these requests from the city.

The city provided contact information for 48 households that participated in HRP over the last 10 years. It is important to note that this contact information did not include all of the participants from the past 10 years; HRP estimates that 25 rehabilitation projects are completed each year. Rather, this sample of participants was simply the available contact information that the city was able to provide the time the research took place.

A phone survey method was chosen over other survey methods, such as a mailed survey or an in person survey. A phone survey method was selected because it is often less costly than other methods and generally has a higher response rate than other methods. The survey asked participants questions about the age of their home, the age of the HVAC systems in their homes, their experience with HRP and their attitudes on, and their interest in, energy efficiency upgrades.

Additional information on the condition of each house contacted in the survey was collected from the city of Somerville's Assessor's database.[1] The Assessor database provided information on each home's age, heating system type, heating fuel type, style of house, size of living area. The database provided information on 44 of the 48 houses in the survey.[2] The information from the Assessor's database was compared to the information collected from the survey, as well as the information on Somerville housing as a whole.

Results

The 48 households in the survey sample were called over a series of 5 days from March 23, 2010 through March 27th, 2010. Many of the phone numbers provided by the city were wrong numbers and several of the phone numbers reached homes that were no longer occupied by the residents who had participated in HRP. Furthermore, there were some homeowners who did not want to participate in the survey and other homeowners never answered the phone. The accumulation of these conditions led to a very low overall response rate. The basic characteristics of the survey sample (small sample size and non-random samples)

1 City of Somerville, Board of Assessors. (n.d.) Assessors Online Database for Somerville, MA. Retrieved March 28,2010, from http://data.visionappraisal.com/SomervilleMA/DEFAULT.asp.

2 Four of the 48 house were not listed in the Assessor's database.

and the low response rate to the survey (seven responses were obtained) make it such that none of the results from the survey are statistically significant. Although the survey results are not adequate for a statistical analysis, a review of the survey responses does provide some anecdotal understanding of additional retrofitting needs of houses that have participated in HRP. Key findings from the survey responses include:

- One respondent went through the Menotomy program after receiving HRP services. This respondent felt that the retrofits done through the Menotomy program were satisfactory. This respondent was the only respondent that had considered doing energy efficiency retrofits on his or her own.
- Two respondents cited lack of money as the reason they had not consider energy efficiency retrofits during the HRP process.
- Two other respondents believed their house did not need to increase its energy efficiency.
- One respondent had a chairlift installed as part of HRP. This respondent reported that there were not any discussions of further home improvements with HRP besides the chairlift. Further, this respondent did not seem to fully understand the role HRP has in the installation of the chairlift.
- While most respondents did not remember exactly when HVAC systems were installed, respondents did replace one or more items associated with energy efficiency within the past 10 years.

Supplementing the information gathered from the survey, the Assessor's database provides useful information on the housing conditions of the homes studied in the phone survey. For example, like Somerville as a whole, sample data for the HRP sample revealed that most of the buildings that received services from HRP had been built prior to 1939. All but one of the buildings in the sample (98 percent) had been built in or before 1930. Additionally, 31 of the 45 buildings in the sample (69 percent) were built in or before 1910, whereas overall in Somerville 67 percent of the building with housing units had been built in or before 1910.[3]

The general condition of the 48 homes that were in the Assessor's database was also analyzed. In general, the buildings rehabilitated in HRP were of a lower grade than the rest of Somerville's housing stock. Most of the rehabbed houses (82 percent) were rated as "Average" grade by the Assessor's Office, defined as

3 City of Somerville (2008), op cit.

a house last remodeled through the mid 1960's. An additional 11 percent were rated Average +5 (remodeled through early 1970's), and only 7 percent were rated Average +10 or higher (remodeled after the early 1970's). This is a very different distribution from Somerville's general housing stock.[4]

Consent For Survey and Survey Questions

Hi, my name is _____ and I am a graduate student at Tufts University. I am working with a team of students on a research project for the city of Somerville, Housing Division. We are looking at ways to improve and expand upon the city's Homeowner Rehab Program, including ways to promote energy efficiency upgrades.

We were referred to you by the city as a past participant in the Homeowner Rehab program. We hope that you might be able to provide us with some more information about your house, as well as your experience with this program. Any information you could provide would be very useful in informing our evaluation of the program and creating recommendations for its improvement in the future. The overall results of this survey will be published in a report available on the UEP website, and given to the city for review. Your individual responses, however, will remain confidential, and it is your right to refuse to answer any questions or opt out of the survey entirely. If we are interested in quoting your responses in our report, we will make sure to have you approve the quote in context of the paper before it is published in order to make sure that we are accurately representing you and your responses. If you have any questions on this survey, please contact Walter Whitney, the Director of Homeowner Rehab program, at 617-625-6600 x2369.

Questions asked in the phone survey:

- When was your house built?
- How large is your house/how many floors?
- How long have you owned your house?
- While you have owned the house, have you upgraded any of the following? If so, when?
    - Boiler/furnace
    - Hot water heater
    - Windows
    - Exterior doors

4 Ibid.

- Insulation
- Plumbing
- Electrical System
- Basement (vapor barriers)

• What kind of heating source do you have? (gas vs. oil)

• What kind of renovations did you do through the rehab program?

• How much input did you have in what work was done on your home? What choices were you given?

• What other upgrades would you have wanted to do if there had been more money available?

• Did you consider doing any energy efficiency upgrades to your house through the housing rehab program?

• Have you considered doing any EE upgrades outside of the rehab program? For example, through utilities?

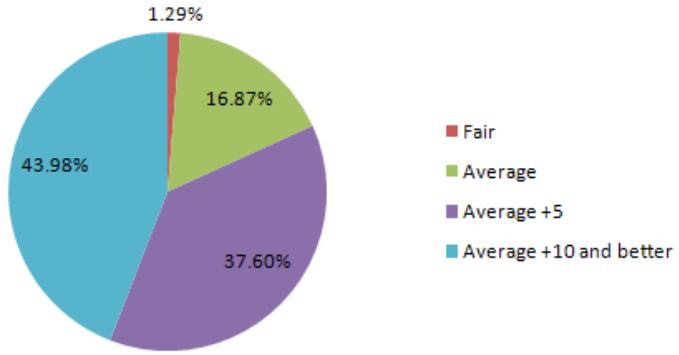
If not, why not?

• If there had been more funding available to you as a part of the rehab program, would you have considered doing EE upgrades?

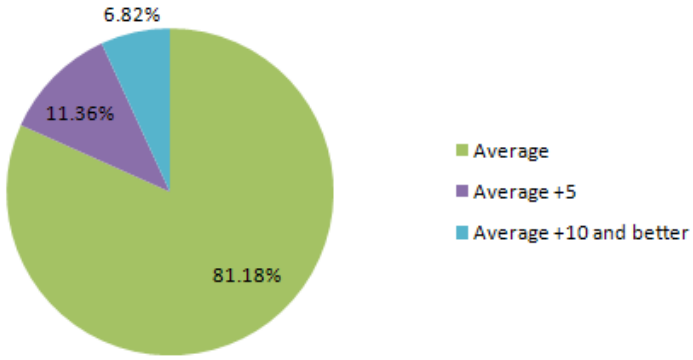
• Do you feel comfortable disclosing how much your energy bill is at peak times like the coldest winter months?

• Do you feel like your home is heated efficiently, or do you notice cold air leaking into your house in cold months?

Condition of Somerville Housing Stock



Condition of HRP Housing



Appendix 6: Memorandum of Understanding

Memorandum of Understanding

between

Tufts University Field Projects Team No. 4

and

City of Somerville – Housing Division

I. Introduction

Project Number: Field Project Team 4

Project Title: Somerville Housing Division – Harvesting Energy Efficiency in the City's Housing Stock

Client: City of Somerville, MA

This Memorandum of Understanding (the "MOU") summarizes the scope of work, work product(s) and deliverables, timeline, work processes and methods, and lines of authority, supervision and communication relating to the Field Project identified above (the "Project"), as agreed to between (i) the UEP graduate students enrolled in the Field Projects and Planning course (UEP-255) (the "Course") offered by the Tufts University Department of Urban and Environmental Policy and Planning ("UEP") who are identified in Paragraph II(1) below (the "Field Projects Team"); (ii) City of Somerville, further identified in Paragraph II(2) below (the "Client"); and (iii) UEP, as represented by a Tufts faculty member directly involved in teaching the Course during the spring 2010 semester.

II. Specific Provisions

(1) The Field Projects Team working on the Project consists of the following individuals:

1. Erin Brandt email address: [redacted]
2. Marcus Rozbitsky email address: [redacted]
3. Rowan Spivey email address: [redacted]
4. Jennifer Warner email address: [redacted]
5. Brittany Zwicker email address: [redacted]

(2) The Client's contact information is as follows:

Client name: of Sustainability	City of Somerville: Housing Division/Office
Key contact:	Emmanuel Owusu
Email address:	[redacted]
Telephone number:	[redacted]
Fax number:	[redacted]
Address:	City Hall Annex
	50 Evergreen Ave., Somerville, MA 02145
Web site:	somervillema.gov

(3) The goal/goals of the Project is/are:

To determine the feasibility of creating a City-run residential green rehabilitation program in Somerville, MA. The project will look specifically at how the City of Somerville Housing Division's Homeowner Rehabilitation Program and the City of Somerville Office of Sustainability and Environment Energy Efficiency Program can contribute to the development and deployment of a residential green rehabilitation program.

(4) The methods and processes through which the Field Projects Team intends to achieve this goal/these goals is/are:

- Review the Housing Division's CDBG/HOME Homeowner Rehabilitation Program and determine what financial and administrative opportunities exist for supporting a green rehabilitation program.
- Review the OSE's Energy Efficiency and Conservation Block Grant (EECBG) Program and determine what financial and administrative opportunities exist for supporting a green rehabilitation program.
- Review any other financial or administrative bodies that could potentially support a green rehabilitation program, through loans, rebates, and other financial incentives, such as:
  - Federal Government Support (i.e. ARRA funding)
  - Massachusetts State Government Support
  - Somerville City Government Support

        - Utilities (i.e. rebate programs)
        - Residential and Advocacy Groups (i.e. Cambridge Energy Alliance)
        - Foundations willing to fund energy efficiency projects
    - Conduct a green housing needs assessment, which will include estimates of energy usage for each major category of housing stock in Somerville, identification of items that need to be replaced to reduce energy consumption.
    - Review and assess the strengths and weaknesses of other municipal energy efficiency programs and to determine to what extent those programs, or particular aspects of them, are transferable to the City of Somerville.
    - Consider barriers to entry in existing Somerville housing rehabilitation program and other EE home retrofits in general.

(5) The work products and deliverables of the Project are (this includes any additional presentations for the client):

    - Final report (40-60 pages)
    - Green Product Manual describing materials used most often as part of housing rehabilitation in Somerville, including benefit/cost data (that is, cost compared to energy saved), if available.
    - Policy recommendation and presentation to Mayor Curtatone

(6) The anticipated Project timeline (with dates anticipated for key deliverables) is:

Feb. 9	MOU signed by team and client
March 1	Initial project outline finalized by UEP team
March 3 – March 19	Meeting with instruction team and client (to be scheduled)
April 9	First draft of deliverables submitted to client by UEP team
April 26	Deliverables submitted to client for review
May 3	Client returns comments on deliverables to UEP team
May 10	Final deliverables submitted to client
After May 10	Presentation to Mayor Curtatone, city officials (to be scheduled)

(7) The lines of authority, supervision and communication between the Client and the Field Projects Team are (or will be determined as follows):

Emmanuel Owusu will serve as the UEP team's primary contact and information channel with the City of Somerville, as well as serving as the client's primary supervisor. Jennifer Warner from Tufts University will serve as the Client's primary contact with the Field Projects Team.

(8) The understanding with regard to payment/reimbursement by the client to the Field Projects Team of any Project-related expenses is:

The Field Projects Team is undertaking the Course and the Project for academic credit and therefore compensation (other than reimbursement of Project-related expenses) may not be provided to team members. If reimbursement is needed, the Tisch College of Citizenship and Public Service at Tufts University will reimburse the UEP team.

III. Additional Representations and Understandings

A. Because the Course and the Project itself are part of an academic program, it is understood that the final work product and deliverables of the Project (the "Work Product") – either in whole or in part – may and most likely will be shared with others inside and beyond the Tufts community. This may include, without limitation, the distribution of the Work Product to other students, faculty and staff, release to community groups or public agencies, general publication, and posting on the Web. Tufts University and the Field Projects Team may seek and secure grant funds or similar payment to defray the cost of any such distribution or publication. It is expected that any issues involving Client confidentiality or proprietary information that may arise in connection with a Project will be narrow ones that can be resolved as early in the semester as possible by discussion among the Client, the Field Projects Team and a Tufts instructor directly responsible for the Course (or his or her designee).

B. The data provided by the City of Somerville remains the property of the City and will only be used by the UEP team for purposes of this project. Client will be allowed to review all research and notes of the UEP team upon request. The Client cannot alter the final text of the report. Upon finalization and publication, the Client may refer to the report by the established title, citing all contributing authors. The report shall be considered property of the authors' and Tufts University.

C. It is understood that this Project may require the approval (either through full review or by exemption) of the Tufts University Institutional Review Board (IRB). This process is not expected to interfere with timely completion of the project.

IV. Signatures

For CITY OF SOMERVILLE
By: EMMANUEL OWUSU
Date FEBRUARY 8, 2010

Representative of the Field Projects Team Jennifer Warner
By: [PRINTED NAME – *only one team member's signature is necessary*]
Date 2/8/, 2010

Tufts UEP Faculty Representative
By: [PRINTED NAME of the Instructor Working With Your Team]
Date FEB. 9, 2010

Appendix 7: Institutional Review Board Documents

Tufts University

Office of the Vice Provost

Social, Behavioral, and Educational Research
Institutional Review Board

Re: IRB Study # 1002056
Title: Somerville Housing Division - Harvesting Energy Efficiency Team
PI: Rowan Spivey
IRB Review Date: 2/25/2010

February 25, 2010

Dear Rowan,

This is the official notification that your project, *Somerville Housing Division - Harvesting Energy Efficiency Team*, protocol # 1002056 does not meet the definition of human subject research under tl Code of Federal Regulations Title 45 Part 46.102(f); therefore is not subject to review by the Institutional Review Board.

Please be sure to file this notification.

Sincerely,

Yvonne Wakeford, Ph.D.
IRB Administrator

20 Professors Row, Medford, MA 02155 | TEL: 617.627.3417 | FAX: 617.627.3673 | EMAIL: SBER@tufts.edu

Tufts UNIVERSITY

OFFICE OF THE VICE PROVOST

Social, Behavioral, and Educational Research
Institutional Review Board

Re: IRB Study # 1002040
Title: City of Somerville, Housing Division: Harvesting Energy Efficiency in the City's Housing Stock
PI: Erin Brandt
Co-Investigator(s): Rowan Spivey
Faculty Advisor: Rusty Russell
IRB Review Date: 2/18/2010

February 18, 2010

Dear Erin,

This is the official notification that your project, *City of Somerville, Housing Division: Harvesting Energy Efficiency in the City's Housing Stock* , protocol # 1002040 does not meet the definition of human subject research under the Code of Federal Regulations Title 45 Part 46.102(f); therefore is not subject to review by the Institutional Review Board.

Please be sure to file this notification.

Sincerely,

Yvonne Wakeford, Ph.D.
IRB Administrator

20 Professors Row, Medford, MA 02155 | TEL: 617.627.3417 | FAX: 617.627.3673 | EMAIL: SBER@tufts.edu

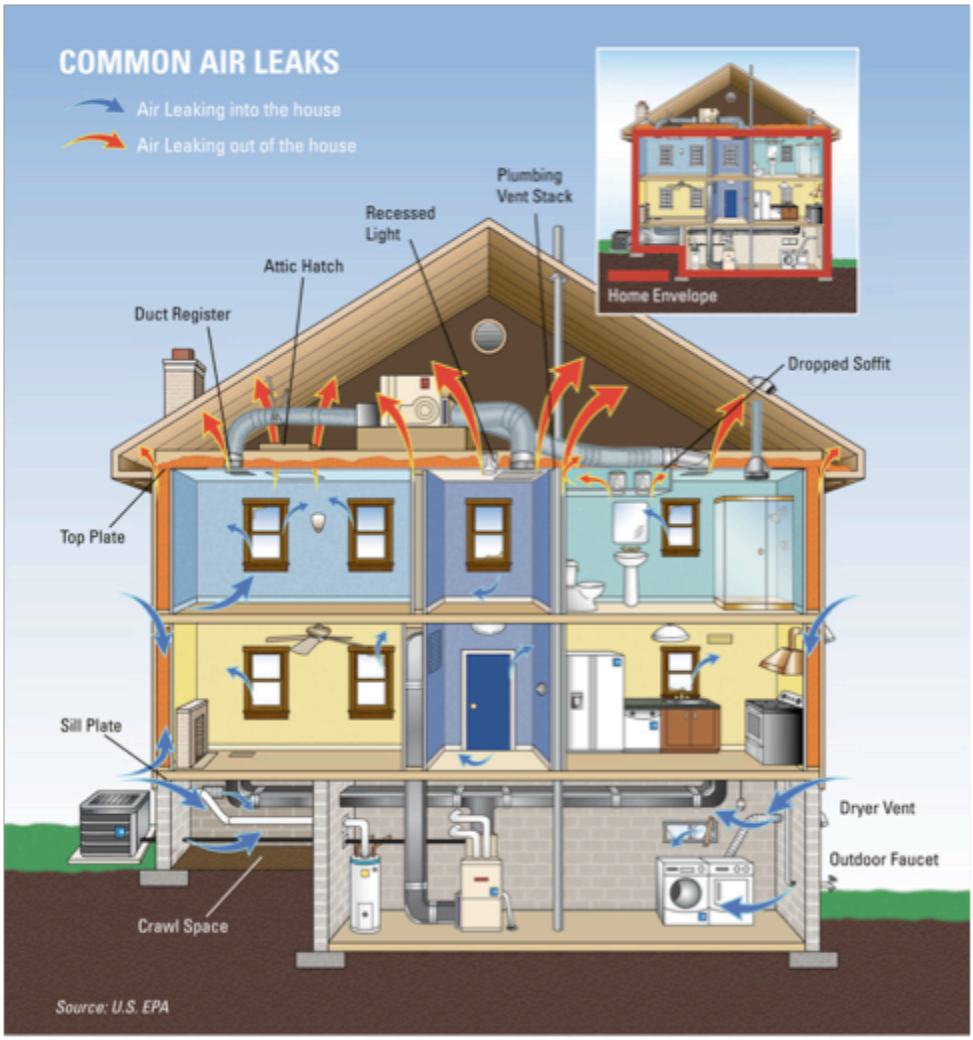
Appendix 8: City of Somerville Energy Efficiency Brochure

See following page for “ready to print” brochure.

Energy Efficiency Retrofit!

Over 80% of Somerville's homes were built before 1960. Their old age means that many of them are drafty and expensive to heat, and they often don't even have insulation in the walls to trap warm air in the home.

The image to the right reveals how a typical home inefficiently uses heat and cooling services because warm or cool air often escapes through holes in a home's walls, windows and roof, or its "envelope." Energy efficiency retrofits can help seal a home's envelope, making the home more energy efficient and reducing homeowner's utility bills.



The City of Somerville is here to help! There are many services and sources of information that can help connect you to an energy efficiency retrofit and lower utility bills!

The City of Somerville Information & Services

311 Information Hotline: The 311 hotline service will answer basic questions about the city's residential energy efficiency services. Dial 311 for assistance. TTY/Hearing Impaired (only) dial 1-866-808-4851.

The Menotomy Weatherization Program: This program offers weatherization services to income-qualified residents. For more information contact 1-781-316-3436 or visit http://www.town.arlington.ma.us/Public_Documents/ArlingtonMA_PLanning/weatherization/index.

Heating System Replacement Program: This program offers forgivable loans to help income-eligible homeowners replace heating systems. Maximum loans of $4,500 are available to replace inefficient heating systems. Call 617-625-6600 ext 2577 for more information.

Housing Rehabilitation Program: This program helps residents make necessary home repairs and retrofits by offering qualified Somerville residents 0% interest, deferred payment loans that are payable only when the property is sold or transferred. Eligibility for the program is based on total household income and household size. For more information, contact Walter Whitney at 617-625-6600 Ext 2569 or WWhitney@somervillema.gov.

The Office of Sustainability & Environment Residential Energy Efficiency Program: This program offers educational and financial services to assist Somerville residents in completing home energy efficiency retrofits. For more information, contact the Somerville hotline at 311 and ask to speak someone at the Office of Sustainability & Environment Residential Energy Efficiency Program.

Additional Energy Efficiency Resources & Information

Mass Save Incentives: This website will allow Somerville residents to enter in their zipcode and find out what energy efficiency incentives are available to them. Visit http://masssave.com/ or call **1-800-632-8300 for more information.**

U.S. Energy Star: This website provides information on how you can increase energy efficiency in your home, including information on energy efficiency products. Visit www.energystar.gov for more information.

Home Energy Assessments: Utilizing a "house as a system" approach, the Home Energy Assessment looks at your home's thermal envelope (shell insulation and air leakage conditions) and mechanical systems to identify cost effective energy efficiency improvement and/or replacement opportunities. A Home Energy Assessment usually takes 1 - 2 hours to complete, but can vary depending on the size, style, and age of the home. For more information on setting up a Home Energy Assessment, contact 1-866-527-7283**.**

Energy Bucks Program: This program is state-wide initiative that provides fuel assistance, utility discount rates, and weatherization services for income qualified residents. Visit http://www.energybucks.com/energybucks.php?lang=eng or call 1-617-349-6252 for more information.

Wainwright Bank: The Green Loan™ offered by Wainwright Bank offers qualified residents an energy efficiency improvement fixed rate home equity loan available for 5, 10 and 15 years. The loan amount ranges from $5,000 to $100,000 and is available to qualified homeowners. For more information please contact, http://www.wainwrightbank.com/html/personal/loans/green.html.