The Detroit Sustainable Urban Neighborhood Project

by

Karyn Boldys
Lauren Terese Cooper
Michela Battaglia Gentile
Melinda Morang
Elizabeth R. Senecal

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Advisor:
Kerry C. Duggan, Senior Advisor
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Abstract

The Detroit Sustainable Urban Neighborhood Project (SUN) proposes sustainability education as the new strategy for urban revitalization in edge communities. This paper describes the planning, implementation, and outcomes of this project. For purposes of this project, the project team defines a sustainable urban neighborhood as one that respects the environment, is economically viable, and fosters a sense of community among its residents. During the summer of 2010, the project team organized a series of environmental education workshops in a low-income community in Detroit, Michigan. The project objectives were: 1) to identify environmental needs and knowledge gaps in a target area, 2) to provide residents with informational resources and knowledge in order to meet environmental needs, 3) to increase awareness of resource use to reduce utility costs, and 4) to connect residents with local services and programs that can help residents' meet their environmental needs. This project's educational program directly benefited the families in the project's target area by increasing awareness of energy and water efficiency strategies and access to environmental education. The key components of this program were: an environmental education workshop series targeting urban environmental issues, a rental property used as a demonstration house, surveys aimed at assessing environmental knowledge level in the community, partnership building with local organizations, materials provision (principally home weatherization kits and rain barrels), community outreach, and an educational resource summarizing information from the workshops.

The project team successfully met their objectives by providing direct communication links between city officials, local environmental organizations, and members of the community, while offering materials discussed during workshops to promote resource use awareness. This success is supported by positive feedback from the workshop presenters regarding the program and Demonstration House. The Demonstration House served as a successful workshop venue by providing a familiar and conveniently located setting, while functioning as a practical learning tool for teaching home energy and water efficiency techniques. Challenges the project team faced included time and budget constraints and lack of existing connections with the local community.

In total, approximately 54 people attended at least one SUN Project event at the Demonstration House. Eight speakers from seven local organizations presented on a range of urban environmental topics and offered numerous giveaways targeted at promoting sustainable energy and water conservation behaviors. Although statistically significant conclusions cannot be drawn from surveys due to the low number of respondents, they do provide qualitatively interesting information, as described in

the paper. The project team concludes by proposing recommendations for future initiatives in edge communities similar to the project's target neighborhood.

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Introduction

In Detroit as in cities across the country, citizens and government officials are looking for solutions to halt the decline of urban communities. The Detroit Sustainable Urban Neighborhood Project (SUN) proposed sustainability education in edge communities as part of a key element of a strategy for urban revitalization. An edge community is one that is located between a viable neighborhood and a less stable one. We hypothesize that bringing cost-effective resource conservation technologies and environmental education into the urban community can directly benefit middle- and low-income families by reducing resource use and utility costs, and by improving the urban environment for healthier communities. The Detroit SUN Project served as a pilot project in creating a sustainable urban neighborhood. The project team defines a sustainable urban neighborhood as a residential area that respects the environment, is economically viable, and fosters a sense of community among its residents. During the summer of 2010, the project team created a model for providing environmental education in an edge community by engaging residents within the target area in sustainability-focused discussions of environmental topics and resource conservation activities.

The Detroit SUN Project had four main objectives:

1) To identify environmental needs and knowledge gaps in a low-income Detroit community.
2) To provide residents with resources and knowledge in order to meet their environmental needs.
3) To increase awareness about resource conservation as a way to reduce utility costs.
4) To connect residents with local services and programs that can help residents' meet their environmental needs.

To address these objectives, the project team promoted cost-effective home energy and water efficiency strategies and awareness of other urban-specific environmental issues. The key educational components of this program were: an environmental education workshop series targeting urban environmental issues, a rental property used as a demonstration house, surveys aimed at assessing environmental knowledge level in the community, partnership building with local organizations, materials provision (principally home weatherization kits and rain barrels), community outreach, and an educational resource summarizing information from the workshops. The following is a brief overview of these components.

The target area for this project was located in a small section in the community of Morningside on the east side of Detroit. The project team chose this area based on its demographic and site characteristics; these characteristics were consistent with the definition of an edge community. Beyond

selecting the target area, the planning stages of this program also involved attending meetings of the Morningside Community Organization and developing the workshops series. The team also immediately began seeking partnerships with local organizations that could provide presenters with the necessary expertise and educational materials for each workshop.

To establish a presence and build strong ties with the residents of the target community, the project team rented a home in the target area. Conveniently located within the neighborhood, the home served as a demonstration tool for home energy and water efficiency techniques and as the education center within the community where workshops were held. Maintaining such a presence in the community during the course of the project was also instrumental in building relationships with residents.

The primary goal of the project events was to demonstrate to the community that implementing simple energy and water conservation strategies improves communities through economic and environmental benefits. The project team held the workshop series during the summer of at the Demonstration House. An open community event at the Demonstration House (the "Community-Q") kicked off the series of workshops. The purpose of this event was to introduce the team members, to explain the scope of the project, to garner residents' interest in the project, and to encourage participation in the future workshop series. There were five subsequent weekly workshops, which covered the following topics:

- Recycling, Illegal Dumping, and City Services
- Water Use Efficiency and Responsibility
- Home Weatherization
- Health and Environment
- Rain Gardens, Rain Barrels and Storm Water Management

The project team chose workshop topics based on initial research, interactions with partner organizations and the team's experience at the Morningside Community Organization meetings.

The final event, a community cleanup, was held on October 30, 2010, in conjunction with the Wayne County Department of Environment C.L.E.A.N. Program. The project team coordinated this event with the Morningside Community scheduled cleanup. Organization members, the team, and volunteers picked up litter and cleaned several illegal dump sites in and near the target area.

We created surveys specific to each workshop topic and distributed them to participants at all project events save the cleanup. The surveys were designed to:

- Gauge participants' knowledge level of each project topic

- Identify knowledge gaps in the project topics
- Identify resource gaps between residents' concerns and available services
- Determine level of interest and/or concern regarding environmental issues

The project team also distributed surveys at a Morningside community meeting and at the community kick-off event to gauge general areas of environmental interests and concerns within the community. Following the completion of the workshop series, the team mailed a follow-up survey to participants of the home weatherization workshop to determine which materials they successfully installed. A final survey was sent to the workshop presenters for their feedback on the workshop series and the demonstration house venue.

The project team provided materials promoting energy and water use efficiency at each workshop, at no cost to participants. The most significant items given out were home weatherization kits and rain barrels. Other items included reusable bags made of recycled material, reusable aluminum water bottles, sink aerators, and others. The team offered these items in order to enable participants to begin implementing what they learned at the workshops immediately in their own homes.

The project's final product was a booklet, completed during the final stages of the project. The booklet combines information from all the project's events into a convenient, accessible format. Each section of the booklet is devoted to a workshop topic, accompanied by contact information for services and organizations related to the topic. The purpose of this booklet was to create a resource to disseminate information about resource conservation topics, connect with local partner organizations, and better implement these strategies in their communities and individual homes. Ultimately, the booklet serves as a template for similar resources that could be reproduced in other cities, and as a means of continued reinforcement of project themes.

A final component of the project was community outreach. The team used multiple media pathways in order to reach a broader audience within the community. Communication with the target area involved canvassing and flyer distribution, a project website, phone calls, e-mail, and holding a community kick-off event.

The following sections detail the methods by which each project component was carried out, as well as a discussion of their effectiveness. Each project component is treated separately and includes the analysis of relevant data collected during the course of the project. The project team then discusses the successes and challenges that the team experienced in planning and implementing the project, as well as several recommendations for future similar work. The project team begins with a review of current

literature on household resource consumption and its implications on low-income urban communities that informed the scope and design of this project.

Literature Review

Introduction

An effective urban environmental education program for low-income residents could address several important issues at once, including large environmental problems such as global warming, financial strain on residents resulting from high utility bills, and physical building infrastructure problems that lead to individual and community-level problems. Very little research has specifically analyzed residential energy consumption in low-income communities in the US – a population that falls below the poverty line and represents roughly one-third of the country's population (Dillahunt, Mankoff, Paulos, & Fussell, 2009). The Detroit SUN Project informs researchers and community development organizations of a unique approach to more effectively engage low-income urban communities in the global conversation of environmental resource conservation. The approach also fosters a greater sense of community development in those neighborhoods, in conjunction with reducing costs associated with residential resource use.

The following literature review summarizes background information that supports the design and implementation of the Detroit SUN Project. The project team first supports the motivation for the project with a discussion of residential resource consumption and its implications for low-income urban communities. This topic is followed by a review of current programs and initiatives that share the aim of reducing the environmental impacts of urban areas and utility costs for low-income households. Recognizing that individual behavior is a significant factor in determining environmental impacts, also discussed are behavior change models that maximize positive environmental impacts of an environmental education program, such as the program that this project implemented. The literature review concludes with a discussion of how this research informs the educational programming of this project.

Resource Consumption, Energy Burden & Neighborhood Environment

Household resource consumption contributes to global environmental issues. In this project, household resource consumption refers to activities that emit greenhouse gases (GHGs) or use water. By reducing GHG emissions to mitigate climate change and reducing water consumption to conserve a global non-renewable resource, residents would be contributing positively to addressing environmental concerns.

Greenhouse gas emissions are of significant environmental concern. GHGs include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (US Energy Information Administration [EIA], 2004). These gases trap solar radiation within the Earth's atmosphere leading to climate change (EIA, 2004). Fossil fuel-based energy derived from petroleum, natural gas and coal produce 100% of US primary energy carbon dioxide emissions (EIA, 2004). In 2008, the national residential sector accounted for 20% of US energy-related carbon dioxide emissions (EIA, 2009a). In 2005, Michigan emitted an amount of GHGs equivalent to roughly 3.5% of the total US emissions (Michigan Department of Environmental Quality [MDEQ], 2009). In 2009, in response to heightened awareness about the effects of GHGs on global warming, the Michigan Climate Action Council set forth benchmarking goals for the state to reduce its GHG emissions in 2020 by 20% below 2005 levels and in 2050 by 80% below 2005 levels (MDEQ, 2009).

The three main drivers of residential GHG emissions are electricity, heating and waste generation (US Environmental Protection Agency [EPA], 2010). The top five uses of residential electricity are space cooling (18%), lighting (15%), water heating (9%), space heating (9%), and refrigeration (8%) (EIA, 2011). In reference to heat-based energy, gas consumption includes, in decreasing order of consumption, space heating (41%), lighting and non-refrigerator appliances (26%), water heating (20%), air conditioning (8%) and refrigeration (5%). Space and water heating make up more than 60% of household gas use (EIA, 2009b). On average, an American throws away 1,130 pounds of waste per year, which is equal to roughly 1,000 pounds of carbon dioxide (CO_2) equivalent per person (EPA, 2010). Home weatherization and energy efficient technologies have the potential to decrease GHG emissions resulting from residential electricity and gas use, and an increased recycling rate of 35% would decrease GHGs by 67 pounds of CO_2 equivalent per person (EPA, 2010).

Water consumption is also a topic of environmental concern. Water supply is threatened on a global scale (Black, 2007; Constible, 2011; UN Water, 2011), is essential for direct-use needs, such as drinking, washing, and cooking, and is also an essential component of fossil-fuel based electricity generation (Power Scorecard, 2000). US households use an average of 350 gallons of water per day from toilets (27%), clothes washers (22%), showers (17%), faucets (15.5%), leaks (13.5%), baths (1.5%), dishwashers (1.5%), and other uses (2.2%) (American Water Works Association, 2010). Efficient water control devices can reduce daily water consumption by 35%, which is equivalent to about 45 gallons per day. National implementation of household water conservation devices could reduce water consumption by over five billion gallons per day, saving over $11 million dollars per day in associated costs (American Water Works Association).

An average American household spends about $1900 per year on utility bills (US Department of Energy [DOE], 2009a). A study showed that in 2001, 11% of US households could not pay their energy bill at least once during the year (Power, 2008). The inability of people to afford energy carries a host of risks. People may have to choose between heating their homes and other vital expenses. Public health concerns arise when energy costs prohibit people from buying necessities such as food and prescriptions. People might also turn to using ovens, stoves, or space heaters to heat their homes, which can be fire hazards (Colton, 2008). Such risks underscore the importance of reducing household resource consumption in order to minimize energy burden.

"Energy burden" is a measure used to determine the impact of energy costs on a household (Power, 2008). Energy burden is the percent of annual income spent on energy utilities and other residential fuels. It is calculated as the ratio of energy cost (measured as the consumption multiplied by the price of the energy source) to income. Energy burdens are not distributed evenly and are typically higher for low-income households. These households use less energy but use a larger proportion of their incomes to pay for it, making energy less affordable[1] (Power).

The term "energy poverty" applies to households that spend more than 10% of their income on energy bills (Roberts, 2008). Low-income households can be forced into energy poverty due to the poor quality of the building structure in which they live, which leads to higher associated energy bills (Roberts). Low-income households pay more money on energy bills per square foot of house than higher income families,[2] and African American households have a higher energy cost intensity per square foot that white or Asian households[3] (EIA, 2009b). Aside from direct monetary support, increasing incomes, and lowering energy prices, the best way to lower energy cost burdens is to invest in energy efficiency (Power, 2008). Since low-income households often lack resources and authority to improve their home's energy efficiency, increasing their knowledge of and access to weatherization programs can help alleviate energy poverty (Colton, 2008). Educating people about ways to save energy can help lower their energy costs (Khawaja & Koss, 2007).

Another important reason to reduce energy bills is that energy bills affect home values (Nevin, 2009; DOE, 2009a; Center for Energy and Environmental Policy, 2006). This is evidenced by the declining numbers of oil-heated homes rising and falling with the price of oil and the fact that often people ask to

[1] Affordability is both an annual and a seasonal problem; even if bills are an affordable percentage of income annually, seasonal variations may not be (heating in winter, for example) (Colton, 2008). In addition, the type of fuel used to heat a home affects the energy burden, fuel oil being the highest (Power, 2008).

[2] Households that fall at or below 150% of the poverty line pay, on average, between $0.19 to $0.27 more on energy bills per square foot of home than households that fall above 150% of the poverty line (EIA, 2009b).

[3] Black households pay $0.11 more per square foot than white households and $0.10 more per square foot than Asian households (EIA, 2009b).

see bills before buying a home (Nevin). Lowering energy costs by weatherizing can make housing more affordable, since the main uses of residential energy, in decreasing order of energy *cost*, are lighting and non-refrigerator appliances (36%), space heating (28%), water heating (16%), air conditioning (12.5%) and refrigeration (7.5%) (EIA, 2009b). Lower housing costs can have significant positive impacts in declining neighborhoods where foreclosures and falling population are serious issues.

By addressing physical building infrastructure to reduce home utility costs and energy burden, an urban environmental education program could inform residents of the larger impact that such environmental strategies have on improving the quality and value of their neighborhood environment. Furthermore, such a program could assist residents in implementing energy and water efficiency strategies in their homes, thereby reducing GHG emissions and water consumption as well as alleviating energy poverty.

Strategies to Address Household Resource Conservation

This section provides an overview of technical and physical strategies that address household resource conservation, federal and state programs that exist which directly support and encourage adoption of such strategies, a sample of other resource conservation programs, and the idea of a demonstration house as an educational tool for showcasing implementation of conservation strategies. There is much that can be learned about program effectiveness by assessing past and current household resource conservation initiatives. Effective programs include collaboration between multiple organizations, holistic approaches to household resource conservation, feedback, and educating residents about the environmental consequences of consumption choices.

Technical or Physical Strategies

Residential resource consumption strategies that address heating and cooling, refrigeration, air conditioning, hot water service, water use, electricity and insulation are important to reducing home energy use (Borrell, Lane, & Fraser, 2010). Improving the energy performance of residential buildings is essential in reducing home energy consumption, as is the need to provide accessible environmental education opportunities and resources to their residents (Dietz, Mulford, & Case, 2009; Kua & Lee, 2002). As Gardner and Stern (2008) point out, roughly half of all Americans believe that global climate change is caused by human energy use and that reducing human energy use can help curb climate change. Citing former US Vice President Al Gore's documentary, *An Inconvenient Truth*, Gardner and Stern emphasize that although media allows people to be well informed about climate change, such media does not provide specific guidelines to people in order for them to know what they can do to curb climate change. As a result, Gardner and Stern developed a list of specific household strategies to

reduce residential energy use, which include replacing incandescent light bulbs with compact fluorescent bulbs (4% energy saved), decreasing thermostat heating settings and increasing thermostat cooling settings (3.4%), installing more efficient heating (2.9%) and cooling (2.2%) units, and weatherization activities such as caulking and weather stripping (up to 2.5%).

Many of the strategies in Gardner and Stern's (2008) "Short List" to reduce energy use pertain to heating and cooling, such as improvements to attic insulation and ventilation (up to 5% energy saved), heating unit replacement (2.9%), and window replacement (2.8%). For example, improving heating and cooling efficiency of the building envelope by replacing single-pane windows with clear storm windows can reduce the heating load by 13% with a 10-year payback; similarly, replacing single pane windows with ultraviolet reflective windows can reduce the heating load by 21% with a five-year simple (Drumheller, 2009). The results demonstrate that there is a lot of potential for energy savings by installing better windows, especially given that an estimated 43% of homes have single-pane windows (Drumheller). Furthermore, a study on residential resource conservation measures demonstrated that window characteristics (such as single- and double-paned windows) have the largest impact on energy conservation (Clark & Berry, 1995).

Although window replacement, attic insulation, and heating unit replacement are highly effective physical approaches for increasing home energy efficiency and reducing resource consumption, these strategies require significant financial investment, and, as Gardner and Stern (2008) point out, are not practical solutions for low-income residents. An example of a practical solution is low-cost water conservation devices, which have been show to be effective in reducing water consumption (Geller, Erickson, & Buttram, 1983).[4] Yet even this technical resource conservation strategy has limitations, as less water was saved from these devices than expected. Either theoretical savings were not equal to the actual savings or, as the researchers suggest, some residents may have increased their water consumption because the low-flow devices justified the residents' decision to take longer showers or flush toilets more frequently, thereby reducing the realized savings.

To address the issue of technical feasibility and effectiveness, Gardner and Stern's (2008) "Short List" includes several practical solutions to reducing resource consumption such as changing the type of light bulbs used, altering thermostat settings, and weatherizing a home. Because low-income households bear a larger energy burden than higher income households (EIA, 2009b), it is important to

[4] The analysis compared education versus no education, daily consumption feedback versus no feedback, and low cost conservation devices versus no devices.

focus on effective and feasible strategies for low-income residents to seal up the building envelope, improve heating and cooling efficiency, and ultimately reduce the risk of living in energy poverty.

Federal, State, and Other Programs

Several federal government initiatives exist to assist low-income households in reducing their resource consumption and associated energy costs through home energy efficiency. Federal incentives are important because they help households overcome low levels of participation in home energy conservation (Maibach, 1993; Gardner & Stern, 1996).

Since 1988, the Department of Health and Human Services has funded the Low-Income Energy Home Assistance Program (LIHEAP), a grant-based program to assist people in financial need[5] with paying their energy bills (US Department of Health and Human Services, 2011). LIHEAP funds are distributed to all 50 states. In FY 2010, LIHEAP funded $4.5 billion in block grants (US Department of Health and Human Services, 2010).

The US Department of Energy's (DOE) federal Weatherization Assistance Program (WAP) targets low-income households for the purpose of reducing utility bills through improved home energy efficiency (DOE, 2010a). Similar to the LIHEAP, the WAP distributes funds to each state, which in turn distributes the funds to local governments, organizations and communities. Having reached more than 6.3 million low-income families[6] in 33 years (DOE, 2009b; DOE, 2010a), the services from WAP[7] have reduced annual utility bills by an average of $437[8]. The White House allocated $250 million to the WAP for Fiscal Year 2009 (DOE, 2010b). From 2002 to 2007, the program funded weatherization of more than 700,000 homes (DOE, 2010b).[9]

Like WAP, the Energy Efficiency and Conservation Block Grant Program (EECBG) targets energy reduction and conservation to reduce fossil fuel emissions (DOE, 2010c). Modeled after the Community Development Block Grant by the Department of Housing and Urban Development, the EECBG is a grant-based program that supports community-based energy efficiency strategies in an effort to contribute to the larger goal of reducing national green house gas emissions. The program is funded ($3.2 billion) under the American Recovery and Reinvestment Act of 2009 (DOE, 2009c).

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[5] Eligible households are those whose income is less than or equal to 150% of the poverty line or 75% of the State median income (U.S. Department of Health and Human Services, 2011).

[6] People who receive Supplemental Security Income or Aid to Families with Dependent Children are automatically eligibility for the Weatherization Assistance Program. Other eligibility determinants include: people over 60 years old, families that have at least one member with a disability, and having an income that falls below the 200% poverty line (DOE, 2010d).

[7] Services include addressing energy efficiency of the building envelope, heating and cooling systems, the electrical system and electrical appliances (DOE, 2010e).

[8] The average expenditure on a single home is $6,500 (DOE, 2010e).

[9] The website emphasizes that "number of homes weatherized" is the single most important metric (DOE, 2010b).

The American Recovery and Reinvestment Act (ARRA) of 2009, created in response to economic recession, seeks among many other goals to enhance building infrastructure and development, including home weatherization (US Government, 2011). More specifically, the ARRA provided $5 billion for low-income home weatherization, $4.3 billion for a 30% tax credit for investments in home energy efficiency, and $300 million in rebates for Energy Star appliance purchases (Alliance to Save Energy, 2009). Although the ARRA provides large financial incentives, such incentives have not been marketed well, shopping for products that qualify for those incentives becomes complex and difficult, and the process to receive tax credits requires extensive paperwork that can take up to one year for approval (Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009). Another shortcoming of the ARRA is that it was a one-time lump sum of funds, meaning that future funding for programs is not guaranteed. This shortcoming is shown in President Obama's FY2012 budget, which does not allocate any funding to the EECBG program (U.S. Conference of Mayors, 2011), a program that was previously supported under the ARRA budget (DOE, 2009c).

One of the major incentive-based federal energy efficiency initiatives is the Energy Star® program (EPA & DOE, 2011). A joint effort between the US Environmental Protection Agency (EPA) and the DOE, Energy Star® is a label for energy efficient products that meet a set of stringent efficiency standards. For example, replacing a refrigerator that dates from the year 2000 or older with a new Energy Star® unit can reduce home energy consumption by roughly 2% (Gardner & Stern, 2008).

In 2009 alone, Energy Star® products saved purchasers roughly $17 million on utility bills and avoided greenhouse gas emissions equal to nearly 30 million automobiles. On average, Energy Star® products yield 30% savings on household utility bills. In addition to savings associated with reduced energy and water use, buyers of Energy Star® products can receive tax credits that further incentivize their purchases (EPA & DOE, 2011). Over the long term, a cost-benefit comparison shows that more money is saved by energy use reduction than is spent on energy-efficient appliances and other efficiency measures (DOE, 2009a).

A number of studies have demonstrated the effectiveness of energy efficiency incentive programs in reducing energy consumption and utility costs. An evaluation of the DOE's Weatherization Assistance Program showed significant energy savings in participating households. Using regression analysis on state-level data for homes heated using natural gas, it was found that weatherization saved an average of 22.9% of gas consumed for all end uses and 32.3% of gas consumed for heating (Schweitzer, 2005). A statistical analysis of the impact of energy efficiency programs at the state level on the growth of electricity sales found that weatherization programs decrease the growth of electricity

sales (Berry, 2008). The study used price changes, state income and population changes, cooling and heating degree day data, and the American Council for an Energy-Efficient Economy's (ACEEE) 2006 scorecard for states as a measure of energy efficiency program effort. It was shown that between 2001 and 2006 as weatherization program efforts increased, the growth in electricity sales decreased by as much as 60% in states having the most program effort (the highest spending on weatherization programs) compared to states with no effort.

The Center for Energy and Environmental Policy (2006) has shown that the benefits of energy efficiency and weatherization programs are numerous and extend beyond the immediate benefits to households. Aside from reducing energy costs, individual residences are better able to afford other utilities and necessities, increase their property values, reduce instances of service stoppage, and reduce concerns for health, safety, and comfort. Furthermore, the wider environmental benefits include decreased carbon dioxide emissions by about one ton per home per year. More specifically, weatherized homes collectively save the nation about 15 million barrels of oil per year, which not only conserves energy but also promotes national energy security. Households can save an average of 15% or $237 per year on energy costs by weatherizing. In addition, weatherization programs increase awareness about home energy efficiency and stimulate the local economy by creating jobs. The DOE, for example, was supporting 8,000 jobs related to these programs in 2006. Finally, in low-income communities, the local training, investment, and job creation support economic re-growth.

By providing financial support and energy efficiency assistance to low-income homeowners and renters, federal money[10] is directed via state hands to eligible recipients. Federal energy programs such as the WAP, the EECBG program, and LIHEAP provide grants to support investment in home energy efficiency, reduction of utility bills, and, ultimately, a plethora of small efforts on a larger scale that conserve energy and reduce emissions. A comprehensive analysis of seven climate models showed that, even though climate change will naturally reduce heating load demand, US energy efficiency programs are still very effective, saving consumers approximately $45 billion annually on energy costs (Scott, Dirks, & Cort, 2007).

A paper that focused on the shortcomings of federal energy policy concluded with a call for a more ecologically focused and community-based approach to energy equity in order to create more sustainable natural and social systems (Higgins & Lutzenhiser, 1995). Specifically focused on LIHEAP, the

[10] In 2009, Michigan received $325.4 million in federal funds for general weatherization and energy efficiency initiatives with $243.4 million of that money directly allotted to Michigan's Weatherization Assistance Program (Michigan Department of Human Services, 2010a; DOE, 2010f) and $19.6 million was directed to Michigan's Energy Efficiency Conservation Block Grant program (DOE, 2010g). Sixty-nine grants were distributed via the Michigan EECBG program; Detroit received a block grant of $8.8 million (DOE, 2010h).

authors explained that LIHEAP was a price-based policy created in the 1970s in response to significant energy price hikes due to the Middle East oil embargoes. Although not its intention, LIHEAP quickly became known as a welfare program. By the 1980s, the goals of LIHEAP and the history that created it were soon forgotten as energy prices fell, which resulted in reduced program funding, uneven local adaptation and an uneven distribution of energy off-set payments. During that time, less than 20% of the 30 million eligible US households received LIHEAP assistance and about 50% of those eligible were unaware of the program, revealing a need for a more comprehensive energy policy approach that takes into account the relationship between energy, environmental equity and social welfare.

Apart from federally and state-funded programs, a number of other initiatives exist that address household resource consumption. A 2005 study reviewed 24 utility-funded low-income home energy efficiency programs from across the country (Kushler, York, & Witte, 2005). While there was no one perfect program, the most effective programs created opportunities for partnerships and collaboration between multiple organizations to increase the efficiency of implementation. Furthermore, existing community organizations interacted directly with participating households. These organizations were already connected to and trusted by communities and could provide the necessary technical expertise required for the program.

The study went on to state that viewing the house as a system and taking a “whole house” approach was characteristic of successful programs. Similarly, all types of energy were typically considered, for a more cost-effective, integrated strategy, as were a full range of housing types. A complete suite of efficiency measures was offered to participants rather than only limited services, thereby maximizing the potential for energy and cost savings. The study also highlighted the importance of not just offering services, but also educating households as an important part of a successful program. Finally, continual third-party program evaluation was also seen as an essential component.

Global Action Plan International is a non-governmental organization that developed the Household EcoTeam Program, which was designed to encourage sustainable household behavior change in order to promote environmental conservation (Global Action Plan International, 2011). Focusing on information, feedback and social interaction and having served over 20,000 households worldwide (Staats, Harland, & Wilke, 2004), the program has shown that effective leadership for as little as 5-10% of households in a community can positively change the environmental behavior of the whole neighborhood (Global Action Plan International).

Participants in a three-year EcoTeam Program usually knew each other as neighbors, friends, club or church members, or by other associations (Staats et al., 2004). The program spent four

consecutive weeks on each of six environmental topics (garbage, gas, electricity, water, transport, and consumer behavior). The program used group discussions, information in a workbook guide and periodic feedback about savings from household behavior change as the main educational approaches (Global Action Plan International, 2011). Although the EcoTeam Program serves as an effective example of a residential environmental behavior change program, the high demands placed on participants and the organization that administered and oversaw the study are not practical for many people (Staats et al.).

An environmental health program that combined nutrition education with pollution prevention education focused on critical environmental topics such as household products and lawn and garden care (Emanoil, 2000). The program resulted in many traditionally underserved families gaining a better understanding of pollution risks and how certain practices affect their health and the environment. On a more general level, if consumers are aware of the negative environmental effects of their resource consumption (believing that their energy consumption has negative environmental effects) then they are more likely to adopt resource conservation measures (Ek & Söderholm, 2010). One such example is a national study of US households, which found that participants who conveyed an understanding of landfills and the environmental impact of their waste were more than seven times more likely to recycle than participants who did not feel morally obligated to recycle (Nixon & Saphores, 2009).

Demonstration Houses

Demonstration houses exist with varying scopes of purpose and design to promote more environmentally conscious uses of a building or home. Whether to serve as a research facility (Tuohy, Johnstone, & McElroy, 2006), to showcase high-tech architecture, design and construction strategies (Burdock, Ritter, Livingston, & Carnes, 2001; Tilden, 2002; Dietz, Mulford, & Case, 2009), or to educate people about existing available home technologies to reduce resource consumption (Tilden; Dietz, Mulford et al.), demonstration houses play an important role in expanding knowledge about environmentally-conscious buildings and homes.

The Utah House in Kaysville, UT, is a demonstration house that teaches visitors about sustainability, energy efficiency, water conservation, healthy indoor air, and universal design (Dietz, Mulford et al., 2009). Although much of the Utah House building and design concept is geared towards new construction and design (showcasing techniques such as the use of Forest Stewardship Council lumber, countertops constructed from locally made and recycled glass products, and straw bale insulation), the House also incorporates simpler demonstration techniques that can be applied to most existing buildings at comparatively affordable costs, such as installing Energy Star® appliances, high

efficiency furnace filters, compact florescent lights; low-flow toilets, faucets and washing machines; landscaping with drought tolerant plants and storing roof water runoff in a large rain barrel.

A survey of Utah House visitors showed that they increased their knowledge in all five key subject areas, with energy efficiency and water conservation as the topics they learned the most about (Dietz, Mulford, et al., 2009). Sixty-three percent of respondents reported attempting to adopt one of the behaviors they learned about from their visit to the House. Convenience and affordability were two main factors that influenced their engagement with the activity or behavior.

The Utah House paints a holistic picture of energy conservation within the building sector. Although such an approach is necessary for creating idealistic vision and incorporating sustainable practices into construction and renovation, such demonstration houses do not represent typical homes.

In an effort to better define "home weatherization" to policy makers and local leaders who provide services that are funded by the federal Weatherization Assistance Program, a local demonstration home was built using a typical home (Tilden, 2002). The home was revamped and updated using an integration of significant construction and technical upgrades and then showcased to Congressional members, state representatives and other local leaders. A second demonstration house initiative was created, which not only included weatherizing a home but also incorporated a weatherization kit and a weatherization manual (Tilden, 2002). Based on these examples, Tilden (2002) expands upon the potential of the demonstration house concept by stating that a demonstration house can improve "the health, safety, comfort and energy efficiency in the homes of low-income… populations" (pp. 36).

Creating a demonstration house in a local home within a low-income community, as the Detroit SUN Project did, not only makes this educational tool more accessible to residents but also shows what those residents can realistically do in their homes – homes that are very similar to the demonstration house. The Detroit SUN Project's Demonstration House (which is discussed in detail later in this paper) created a resource that was highly representative of the target community's housing stock, financial situation, and capacity to implement technical change. It also established the home as a tool that is immediately accessible to the target community, with the purpose of serving its local residents.

Holding environmental education workshops in a demonstration house located within the target neighborhood creates a space that is both familiar and accessible to the target community, rather than using a more public or formal venue. A space that fosters comfort and familiarity outside of a traditional educational setting is an integral part of community environmental educational programs (Barton & Tan, 2010a). In the case of the Detroit SUN Project, residents were in a setting already familiar to them,

because they were in their own neighborhood. The residents may have been less likely to engage or less motivated to attend if the workshops had instead been held at a nearby church or school. This setting provides participants with a greater sense of belonging (Barton & Tan, 2010a). Furthermore, the experience provides participants with a form of subjective engagement with their surroundings to bring about change, be it social, economic, political, or environmental; this leads to a greater sense of ownership of, pride in and commitment to their community (Barton & Tan, 2010b).

Having reviewed technical and physical strategies for reducing resource consumption, existing household resource conservation programs, and the demonstration house concept, it is important to note that technical efficiency constitutes only one aspect of resource conservation. The next section discusses the role of behavior in household resource conservation.

Behavioral Strategies

The Behavior Wedge in Climate Change Strategy

A theoretical approach to curb the effect of business-as-usual carbon emissions is the concept of emissions reduction (or stabilization) wedges (Pacala & Socolow, 2004). Each wedge represents an amount of carbon emissions avoided due to implementation of certain technological innovations. Examples of wedges include avoided carbon emissions due to adoption of solar, wind, geothermal, or nuclear energy or adoption of efficient vehicles. There is also a wedge devoted to avoided carbon emissions as a result of green design, construction and retrofitting to create efficient buildings. The idea behind the stabilization wedge strategy is that each technological innovation plays a role in reducing carbon emissions such that the cumulative effects of the wedges produce an overall desired emissions reduction level. A “behavior wedge” that would complement technology-based emission reduction strategies deserves more attention in the stabilization wedge theory, because behavior change reduces carbon emissions faster (in the short-term) than high-tech solutions, which undergo inevitable implementation time lags due to financial feasibility and political complexity (Dietz, Mulford, et al., 2009). For this reason, behavior change plays an integral role in resource conservation.

Dietz, Gardner et al. (2009) showed that focusing on low-carbon technologies and climate change policies to reduce carbon emissions has overshadowed the integral role of behavior change in mitigating climate change. This study revealed that implementing five behavior change strategies throughout households nationwide could result in a 20% reduction of national residential carbon emissions. These behaviors include weatherizing the home, installing efficient upgrades, properly maintaining major equipment and systems, performing timely adjustments to equipment, and changing daily use behavior. None of these strategies require new policy, yet the study revealed that these

behavior change strategies could reduce national carbon emissions by 7.4% within a decade of implementation. Counter to complex long-term policy initiatives such as a cap-and-trade program, behavior change is low-cost and could achieve significant carbon emissions reductions in the short term (Dietz, Gardner et al.).

Both behavior change and use of a resource conservation device serve as a reminder to residents of their impact on the environment. Therefore, every effort should be made to improve environmental knowledge and behavior that yields even small reductions in water or energy use. This approach is supported by Hobson (2006) who determined that living with pro-environment objects in and around the house (e.g. compact florescent light bulbs, shower timers, and recycle bins) creates a regular reminder for residents of their impact on the environment. Although certain behavior changes may yield minimal energy and water savings, increased awareness may lead people (or cause them to influence other people) to make other environmentally-conscious choices elsewhere.

Kua and Lee (2002) stress the importance of not only incorporating smart, pro-environment, conservation-based technologies into the home but also changing household behavior through exposure to educational activities and courses. Hands-on, do-it-yourself activities or behavior changes that can be easily incorporated into existing homes are recognized as important tools in reducing household resource consumption (Dietz, Mulford, et al., 2009).

In discussing household resource consumption and energy efficiency, it is important to distinguish between efficiency and behavior change (Abrahamse, Steg, Vlek, & Rothengatter, 2005). Efficiency comes from technological innovation, while the impact of that technology depends on the number of consumers that implement it (Costanzo, Archer, Aronson, & Pettigrew, 1986). Behavior change can be divided into two categories: one-time changes and repetitive behavior (McKenzie-Mohr, 2000b). One-time changes typically entail the installation of an efficient technology, whereas repetitive behavior requires a commitment to curtailing habits or forming new habits. Behavior change that involves repetitive actions typically requires relinquishing a sense of comfort and trusting a new approach and is, therefore, more challenging to sustain over time than one-time changes.

In their analysis of energy conservation behavior, Costanzo et al. (1986) focus on device-oriented behaviors such as installing energy efficient technologies, because such technologies are typically a one-time investment and effort. The general idea behind device-oriented behavior change is that once people purchase and install the device, they perceive instant payoffs from their investment, become more confident about the device, and are more likely to research other conservation devices

and inform others about the devices. It has also been shown that device-oriented behaviors are more likely than non-device oriented behaviors to result in higher energy savings (Stern & Gardner, 1981).

An example of the difference in savings between implementing new technology and behavior change can be seen in an analysis of two workshop programs to reduce residential water consumption. The analysis (Lawrence & McManus, 2008) revealed that simple behavior change (such as turning off the faucet while brushing one's teeth) does not necessarily yield significant savings. Although savings from simple behavior change may be less than savings from highly efficient technologies, participants in the workshops were responsive to behavior change. In fact, more participants than non-participants in the workshops adopted five of the six possible behavior changes. Lawrence and McManus (2008) suggested that successful behavior change from the workshops was as result of having positively influenced participants' underlying environmental values, situational circumstances and psychological factors, all of which play a role in motivation to change behavior.

In sum, resource conservation strategies include technical and behavioral approaches that incorporate educational opportunities for residents, yet household situational and psychological factors create an added complexity that affects willingness and motivation to change behavior.

Obstacles to Behavior Change

Perception, motivation, knowledge, and control are several obstacles to behavior change. Understanding the community in which resource conservation is being addressed is a key factor in overcoming these obstacles.

Knowledge about environmental issues and ways to conserve energy, motivation to change, and the ability to undergo the required change, all influence household energy consumption (McKenzie-Mohr, 2000a; Steg, 2008). Moreover, perception can be a major barrier to implementing energy efficient strategies (Costanzo, et al., 1986; Maibach, 1993; McKenzie-Mohr, 2000a; Mlecnik, 2010). One study found that a lack of control by community residents was the underlying commonality among barriers to changing behavior (Dillahunt et al., 2009). Such control-based barriers to engaging in environmentally positive behavior change include: inefficiencies in the building structures of homes, unavailability of services (such as recycling), lack of support from landlords because of rental status, inability to implement improvements (such as weatherstripping) on one's own, safety (such as clothes being stolen that are put outside on a line to dry), and actions of other community members (such as littering). As Costanzo et al. (1986) noted, these barriers are also highlighted in several other papers, which include other barriers to behavior change such as inaccessible information, insufficient access to technology or expertise, cost in relation to low-income households, and low levels of motivation (Miko, 2005; Spoehr,

Davidson, & Wilson, 2006; Garnaut, 2008). In another study, saving money was the main motivation for only one third of the participants (Dillahunt et al.). Lack of information about local environmental resource experts can also be an obstacle to behavior change (Junk, Junk & Jones, 1987).

A study on barriers to implementing home weatherization showed that motivation and perception play a larger role than energy savings in affecting people's willingness to weatherize their homes (Wilk & Wilhite, 1985). Weatherization does not produce very visible improvements to a home, so people may be less likely to value the associated benefits. Perceived benefits of weatherizing a home may not seem important enough for some people to spend the time to do it. Furthermore, information about potential monetary savings is not a driver of behavior change (Ek & Söderholm, 2010). In other words, consumers are not necessarily willing to change their behavior when presented with potential energy savings. Unwillingness to change behavior could be due to consumers' perception of the value of the savings or due to their trust (or lack thereof) in the source of information. Additionally, it is difficult to define home weatherization as a single action or home improvement. People tend not to prioritize it because it generally requires several types of improvements.

The literature discussed here shows that perception, motivation, and knowledge can limit behavior change because of incomplete knowledge or misunderstanding of the benefits associated with resource conservation. It is important to look at existing strategies to overcome these obstacles and provide a more effective educational experience.

Educational Approaches

Vivid Information, Local Experts and Workshops

Several studies on behavior change focus on the way information is conveyed and by whom, as well as the role of workshops in educating residents about resource conservation.

"Vivid information" is an important strategy to influencing behavior change (Costanzo, et al., 1986). Vivid information is knowledge that is conveyed through face-to-face interaction (or a personal letter or e-mail). Vivid information is more effective than impersonal information conveyed in a generic sense to a broader audience because the specific personalized experience helps sustain the new knowledge. Moreover, specific information about ways to change energy behavior or ways to compare appliances, such as comparing payback periods, is more likely to be remembered than vague information about conserving energy.

A specific example of the effectiveness of vivid information is a national study of US households that showed that face-to-face interaction with direct associates (such family or friends, or sharing a community, like a workplace, school or neighborhood) is an effective strategy to get people to recycle

(Nixon & Saphores, 2009). The study also concluded that providing people with an assortment of printed informational resources, such as mailings or posters, as well as media sources is also an effective strategy to get people to recycle, yet they are more effective when combined with face-to-face interaction.

The importance of vivid information supports the notion of conveying resource conservation information by way of local environmental extension agents, skilled craftspeople, and short courses or workshops, all of which have been shown to be effective in promoting behavior change (Junk et al., 1987; Abrahamse et al., 2005). These information sources provide learning opportunities and access to expertise. Furthermore, environmental experts play an important role in motivating high-impact behaviors that reduce energy use in households (Abrahamse et al.). It has been shown that households that received personalized information from a home energy expert consumed one-fifth less electricity than a control group (Winett, Love, & Kidd, 1982-1983). Another study revealed that households that interacted with agents who personalize information were more likely than a control group to not only be eligible for but to also apply for the associated financial rebates (Gonzales, Aronson, & Costanzo, 1988).

Energy agent specialists can empower residents to better understand the financial impacts of their energy use by explaining how utility bills are calculated, and how it relates reducing energy waste (Borrell et al., 2010). Therefore, connecting residents to professionals who are trained in household resource conservation is an important strategy for fostering effective behavior change.

Informants of energy conservation practices can use vivid information to personalize information for households, such as providing examples of people in similar situations who have saved energy and money by adopting energy conservation strategies (Costanzo et al., 1986). Furthermore, households that have positive experiences with trained professionals feel a sense of authority in their home and become empowered to implement changes when they understand how their actions, habits, systems, and appliances in their home affect the cost of energy (Borrell et al., 2010). They are also more inclined to share with other people the information they learned about their energy bills and ways to save energy (Dillahunt et al., 2009).

Energy use has been found to decrease with increasing level of education (Junk et al., 1987). Thus, educating low-income residents about resource conservation is an important strategy for decreasing resource use. Furthermore, having local environmental experts lead workshops on resource conservation topics combines the educational opportunity with vivid information from experts.

A Multidisciplinary Approach

Motivations to change behavior stem from a complex system of factors including demographics and goals (Dietz, Mulford et al., 2009), as well as personal and cultural values, and situational circumstances (Lawrence & McManus, 2008; Dietz, Mulford et al.). Ek and Söderholm (2010) emphasize that individual approaches to energy consumption, such as behavior change, are effective yet limited. It takes a wide range of initiatives, from the individual to the federal (such as tax incentives) to create a holistic approach to energy conservation.

Energy savings are highest when a holistic approach to home energy efficiency is used (Kushler, York, & Witte, 2005; DOE, 2009a). Seeing the home as an interconnected system helps to correctly identify needed improvements. A holistic approach also increases the overall energy savings by not overlooking problems that could decrease the effectiveness of the measures installed. In the words of Geller et al. (1983, pp. 110):

> Large-scale conservation programs should not focus on one approach or strategy; they must instead consider input from a variety of disciplines (including architecture, engineering, economics, and the behavioral sciences) in the development of practical and effective interventions. Systematic assessment of attitude change, behavior change, and consumptions change should be an integral part of each conservation program.

In other words, energy conservation strategies must not overlook the multifaceted nature of what affects human behavior (Costanzo et al., 1986).

An extensive literature review focused on household energy conservation conducted by Abrahamse et al. (2005) concludes that it is essential to consider macro factors, such as technological capabilities, demographics and socioeconomic conditions, as well as micro factors, such as knowledge and behavior, to create an effective multidisciplinary approach that promotes household energy conservation. Furthermore, they concluded that implementing a variety of energy saving strategies is more effective than focusing on a single strategy.

Describing energy conservation as part technical and part human, Costanzo et al. (1986) distinguish between two main theories (the rational-economic model and the attitude-change model) that aim to increase adoption of energy conservation technologies. They conclude, however, that such theories overlook the complex nature of human behavior, because studies have shown that even highly cost-effective technologies are not always adopted (Ross & Williams, 1981; Solar Energy Research Institute, 1981; Office of Technology Assessment, 1982) and that there is a weak relationship between attitude and behavior (Olsen, 1981; Archer, Pettigrew, Costanzo, Iritani, Walker, & White, 1985). The belief that energy conservation is important does not necessarily lead people to change their behavior in order to conserve energy.

Costanzo et al. (1986) focus on a social-psychology energy conservation model. They explain that every human is a dynamic being who lives as a consumer with individual situational circumstances that may affect his/her entry into the market. A psychology-based approach looks at how people process information as decision-makers and consumers, and a sociology-based approach takes into account the characteristics of the particular situations or "positional factors" (pp. 522) in which people live that either drive or hinder certain behavior. Key psychological variables that inform behavior include perception, positive evaluation, understanding and remembering. Key positional variables that inform behavior include financial capital, home ownership, home repair skills, and ownership of home technologies. As a result, the social-psychological model accounts for influential factors not necessarily taken into consideration under the rational-economic or attitude-change models.

Social marketing takes a different approach to behavior change. Instead of focusing on knowledge and attitudes, social marketing is a consumer-oriented campaign that starts with an audience rather than a product or a message and focuses on the roles of perception, incentives and social status in relation to behavior change (Maibach, 1993). The perceived benefits of a social marketing campaign must outweigh the costs by enhancing positive value and incentives while reducing costs and barriers. Perception of risk can inhibit adoption of new principles and behaviors, yet perception, as a barrier, can be overcome by emphasizing controllability (such as ease of use or ease of repair). Furthermore, an understanding that there are no severe negative consequences associated with adopting a new behavior or technology also helps to overcome the perception barrier. Social status also plays a role in social marketing as people may compare themselves to their peers. Social status also promotes the achievement of personal behavior-oriented goals. On a macro level, larger social change requires communication that targets government officials, organizational and corporate officials, as well as the general public, for organizing and mobilizing popular support (Maibach).

A more recent scientific approach to behavior change is community-based social marketing (CBSM) (McKenzie-Mohr, 2000a). CBSM attempts to overcome obstacles often found in behavior change program planning by literally focusing on barriers. CBSM is based on several steps: identifying barriers to behavior change, selecting which behaviors to focus on based on the existing barriers, designing a program for how to overcome the barriers to the selected behavior, testing the program, and then evaluating the program based on direct measurement instead of self-reported information in order to more accurately gauge program effectiveness.

Understanding barriers is a central theme to CBSM. Determining which barriers and behaviors to focus on depends on the outcome of three assessments: the level of impact a behavior has, the barriers

that exist which prevent that behavior, and the availability and access to resources to overcome the existing barriers. Along with better understanding existing barriers, targeting specific populations and incorporating strategic program delivery are also integral to the success of community-based social marketing. For instance, low-income communities usually lack direct access to traditional resource networks, such as experts or materials (Capetola, 2008). However, when low-income communities do have access, they are often seen only as recipients of available expertise rather than as active participants in, and even conduits of, such expertise (Capetola). In other words, it is important to recognize the extent to which legitimate community participation enhances learning (Barton & Tan, 2010a). Low-income residents should be seen as an integrated part of this learning experience, playing an integral role society in the face of climate change (Capetola). Agency, through community participation, is socially transformative. It allows residents to develop a sense of ownership, pride and environmental activism within their own community and can lead to more sustained, widely shared learning experiences (Barton & Tan, 2010a).

A study focused on transformative sustainability learning (TSL) concludes that the "head, hands and heart" (Sipos, Battisti, & Grimm, 2008, pp. 69) each play a necessary role in sustainable development education. Sipos et al. explain that this approach focuses on the dynamic relationships among knowledge, physical capability and motivation as part of sustainable development education. Having grown from community-based experiential learning research, this approach specifically incorporates innovation, implementation and reflection as essential parts of the educational experience. The mental study, physical skill, and personal values that affect behavior all work in unison as a part of a larger human system upon which organizational strategy and successful educational development can be based (Sipos et al.). The more connected an environmental education program is with the keystones of knowledge (head), physical capacity to implement (hands), and motivation to implement (heart), the more effective that program will be in fostering a more sustainable community development education experience.

In conclusion, providing opportunities for direct information sharing through a multidisciplinary approach will enhance the effectiveness of a resource conservation education program.

The Detroit SUN Project's Educational Model

The Detroit SUN Project served as a place-based environmental education program in a low-income community. As the literature shows, it is easy to overlook or underestimate the influence of behavior change barriers on household resource conservation (Costanzo et al., 1986). There is a need for greater consideration of social and psychological factors to uncover those barriers (Geller, 1989).

Community-based social marketing is one approach to delving deeper into the cultural reality of a target community by focusing on the barriers to behavior change (McKenzie-Mhor, 2000a). Such barriers include lack of control, lack of access, and lack of information and resources about environmental conservation. By partnering with local organizations, this project created a unique opportunity for an underserved, low-income community to actively engage with and participate in an urban environmental education workshop series within their own neighborhood. Additionally, the use of a demonstration house located within the community and similar to residents' own homes provided a unique, accessible educational opportunity for the target area. This project adds to the literature of research focused on low-income environmental education in an urban context while fostering a more sustainable and healthier community.

Target Area

Introduction

Low-income areas in Detroit face significant economic challenges and barriers to education. Many government programs target these populations, but their success in Detroit is unclear. There are specific issues the project team identified as central to Detroit today. These include increasing blight, aging housing stock, and increasing amounts of vacant land. Declining population is another challenge the city is experiencing; the recently-released 2010 census results show a 20% decrease in Detroit population in the last 10 years (U.S. Census Bureau, 2011). Although population decline in Detroit may be a complex issue, its impact in neighborhoods is clear. It is reflected in plummeting home values, blight, vacant fields, and illegal dump sites. This in turn leads to continued neighborhood destabilization. Within the city, the project team's focus was on an edge community – a transition zone between stable and destabilized communities. Edge communities show a decrease in population density, vacancy rates, and destabilizing economic conditions along a gradient, and separate a stable community from a blighted and destabilized area. This concept is reflected in the map as the area between the high vacancy and lower vacancy areas (See Figure 1). The hypothesis was that such communities would benefit through decreased utility costs, greater control of resource consumption, and a better understanding of available municipal services.

The Detroit SUN Project target area was located in the Morningside community on the east side of Detroit. The project team identified several blocks within the Morningside community that exemplify the concept of an edge community. The team also chose to focus its efforts in a small geographic area with the goal of having a significant impact in a single defined neighborhood rather than targeting a

broader area and offering a possibly diluted impact. The team thought the project's educational approach, being a unique effort, would be best tested in a defined, manageable setting. The team wanted to personally involve as many residents as possible in order to build a sense of community among neighbors.

Geographic Characteristics

Our target area encompasses a three-square-block area located on the east side of Detroit, in the Morningside community (see Figure 1). The target area is bordered by Nottingham Road to the east, Balfour Road to the west, Bremen Street to the north, and Mack Avenue to the south. The target area consists of a diverse mix of renter- and owner-occupied single- and multi-family homes, punctuated by vacant/abandoned homes or vacant property. The western boundary of the study area maintains the highest percentage of vacant/abandoned homes and vacant property; this percentage decreases dramatically moving from west to east across the study area. An initial team-conducted field survey resulted in the identification of the target area as a typical edge community in Detroit. Somerset Avenue, running in a north-south direction, bisects the study area; this road essentially forms a visual buffer between distressed and stable properties located within the study area. Additionally, the study area is located just north of the affluent suburb of Grosse Pointe.

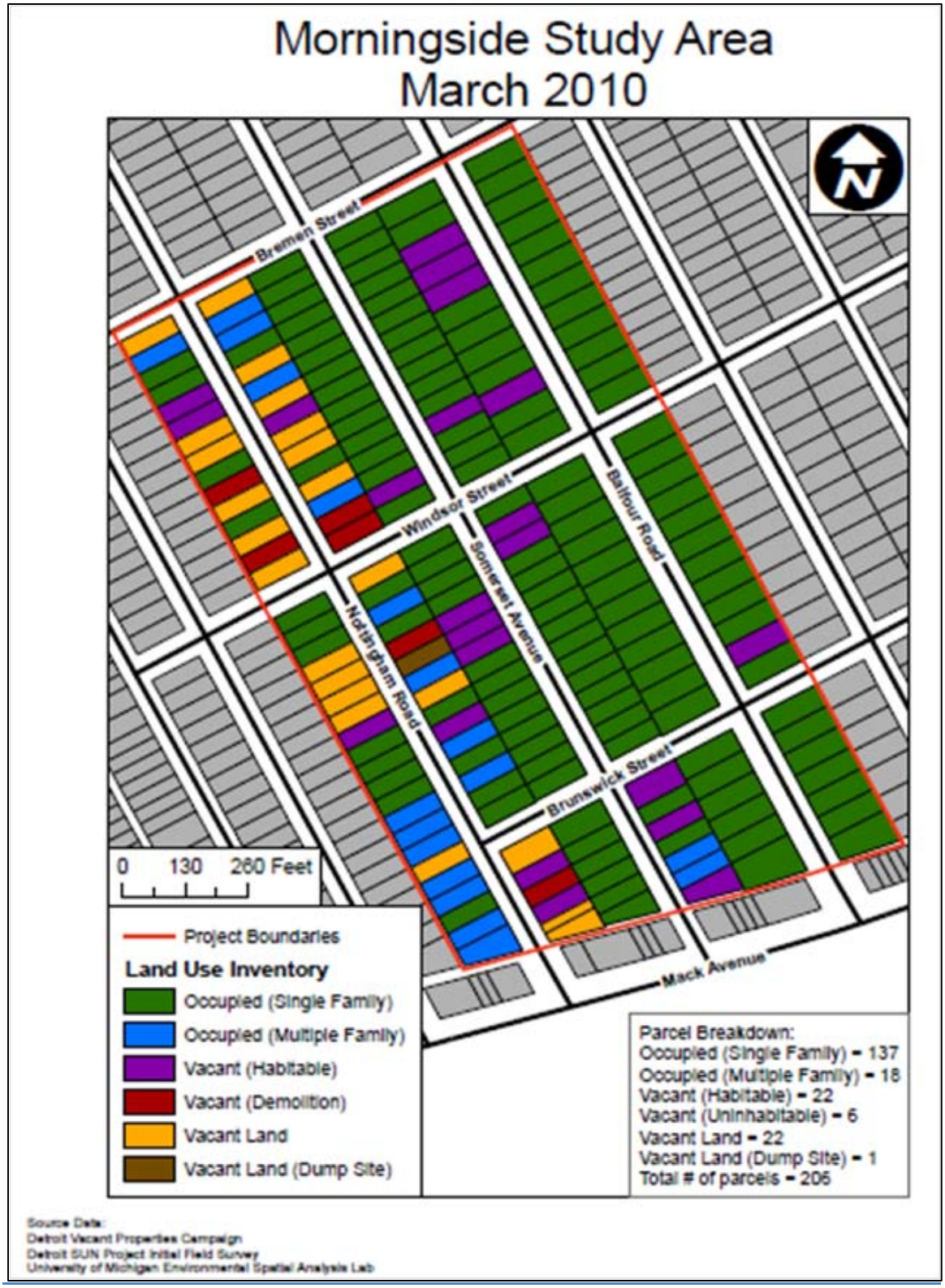


Figure 1. Detroit SUN Project target area, March 2010. Base map created using parcel data from the Detroit Vacant Properties Campaign, 2009.

Climate

The Detroit area experiences a humid continental climate with cold winters and warm to hot summers. Heating Degree Days (HDD) and Cooling Degree Days (CDD) are used to express amount of the energy needed for heating or cooling a home or business; the number of days is determined by measurements of outside air temperature. The lowest average temperatures typically occur during the month of January (see Figure 2). Consequently, the average number of Heating Degree Days (HDD) is highest during this month, averaging 1,199 days (see Figure 3). The highest average temperatures typically occur in the month of July. While the average number of HDDs during this month is one day, the average number of Cooling Degree Days (CDD) is at its highest with 311 days (see Figure 3). Precipitation in the area averages between 2.5-3.5 inches/month. On average, the City receives approximately 34 inches of precipitation/year (see Figure 4).

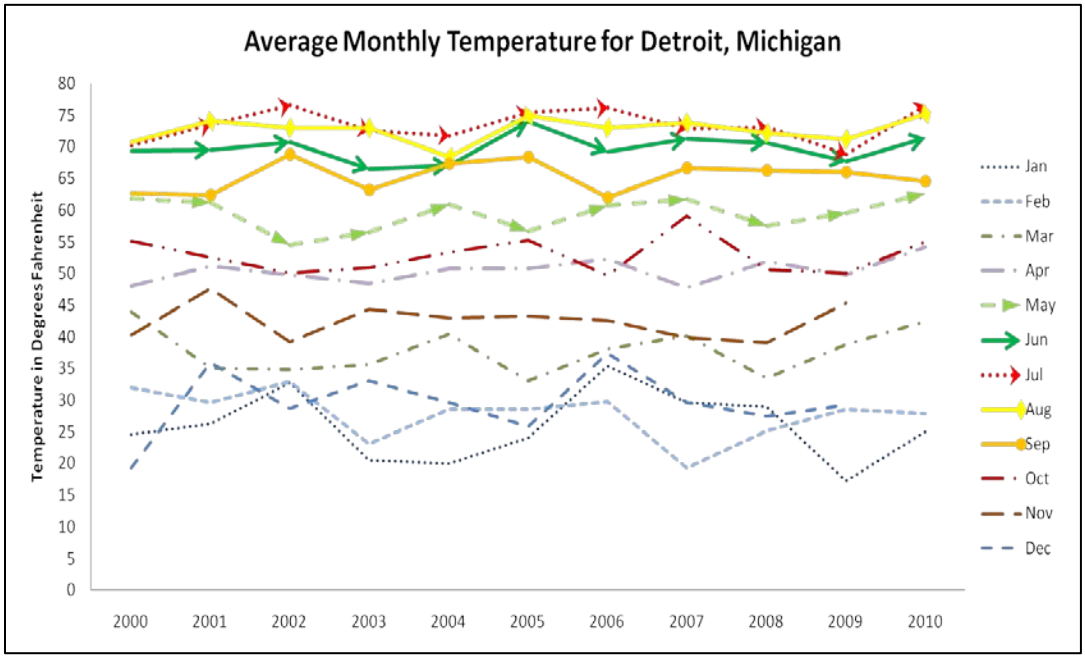


Figure 2. Average Monthly Temperature for Detroit, Michigan. Source data from the Yearly Climate Summaries, (Detroit/Pontiac Weather Forecast Office, 2006).

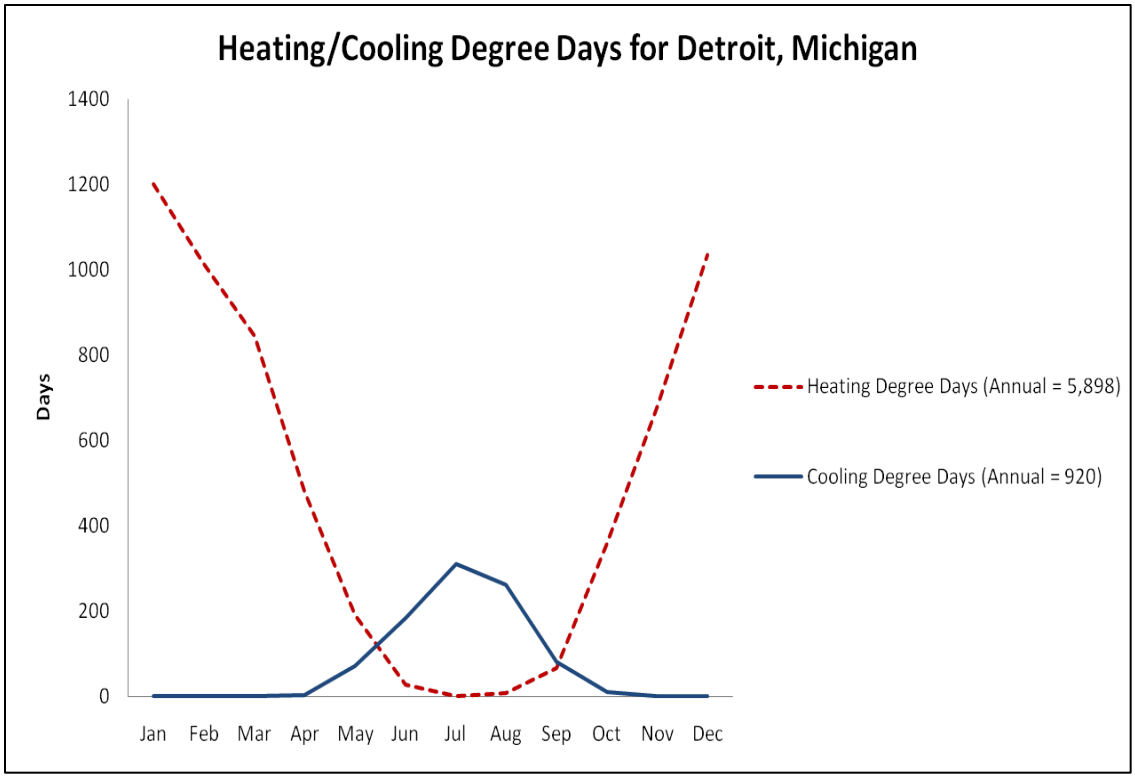


Figure 3. Heating/Cooling Degree Days for Detroit, MI. Source data: HUD-Heating Degree Database, (US Department of Housing and Urban Development, 2007).

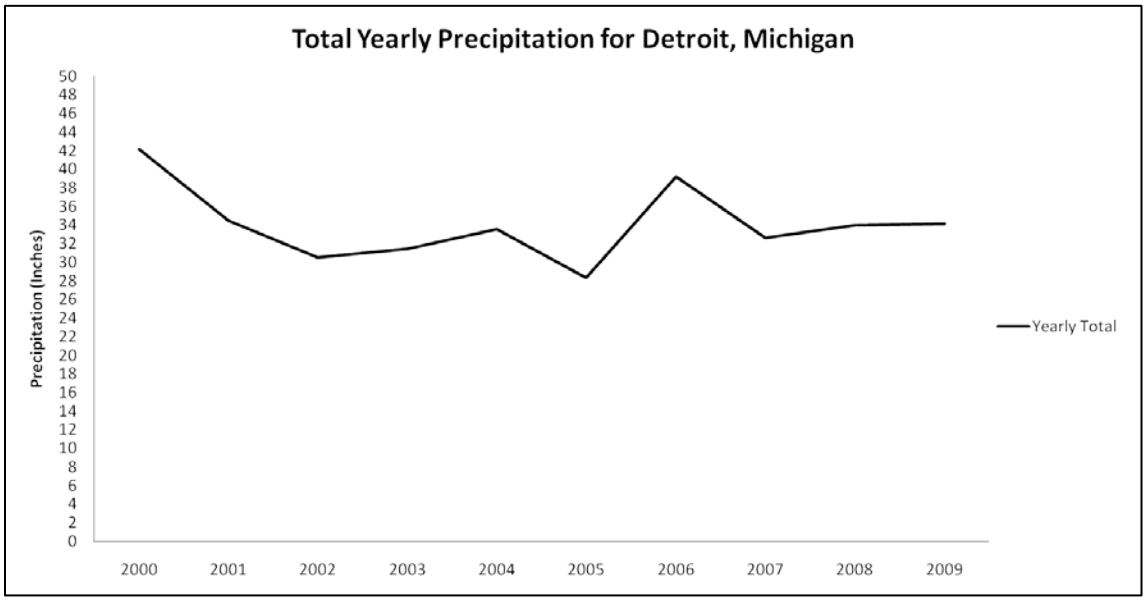


Figure 4. Total Monthly Precipitation for Detroit, MI. Source data: Yearly Climate Summaries, (Detroit/Pontiac Weather Forecast Office, 2006).

Demographic Information

According to demographic data published by Data Driven Detroit in 2008, there are approximately 203 households located in the target area (see Figure 5). Of these households, 50-75% are categorized as family households (see Figure 6, Appendix A). Data collected during the 2000 Census indicates a population range of 740-920 people living within the study area (see Figure 7, Appendix A). The project team conducted a foot survey of the target area in March 2010 during which 155 occupied homes, 28 vacant homes, and 23 vacant parcels (see Figure 1) were identified. However, population estimates compiled by Data Driven Detroit indicate a 3.5-9% decrease in population within the study between the years 2000 and 2008 (see Figure 8). These estimates are consistent with the previously-noted housing field survey conducted by the group. Additional Census data indicates that 94.5-100% of the study area population identified themselves as black, African-American, or non-white (see Figure 9, Appendix A).

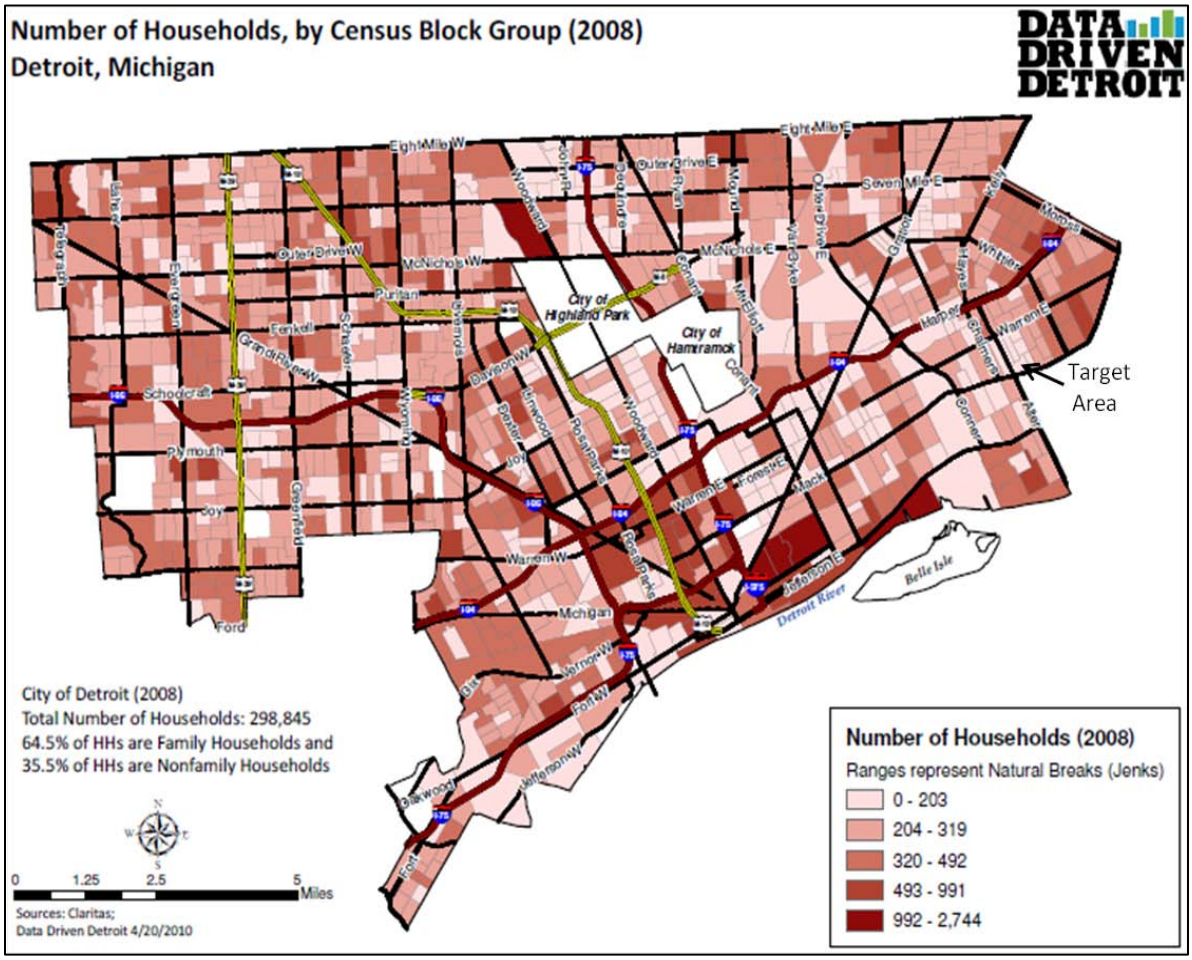


Figure 5. Number of Households, by Census Block Group (2008) Detroit, MI. Source: (Data Driven Detroit, 2010).

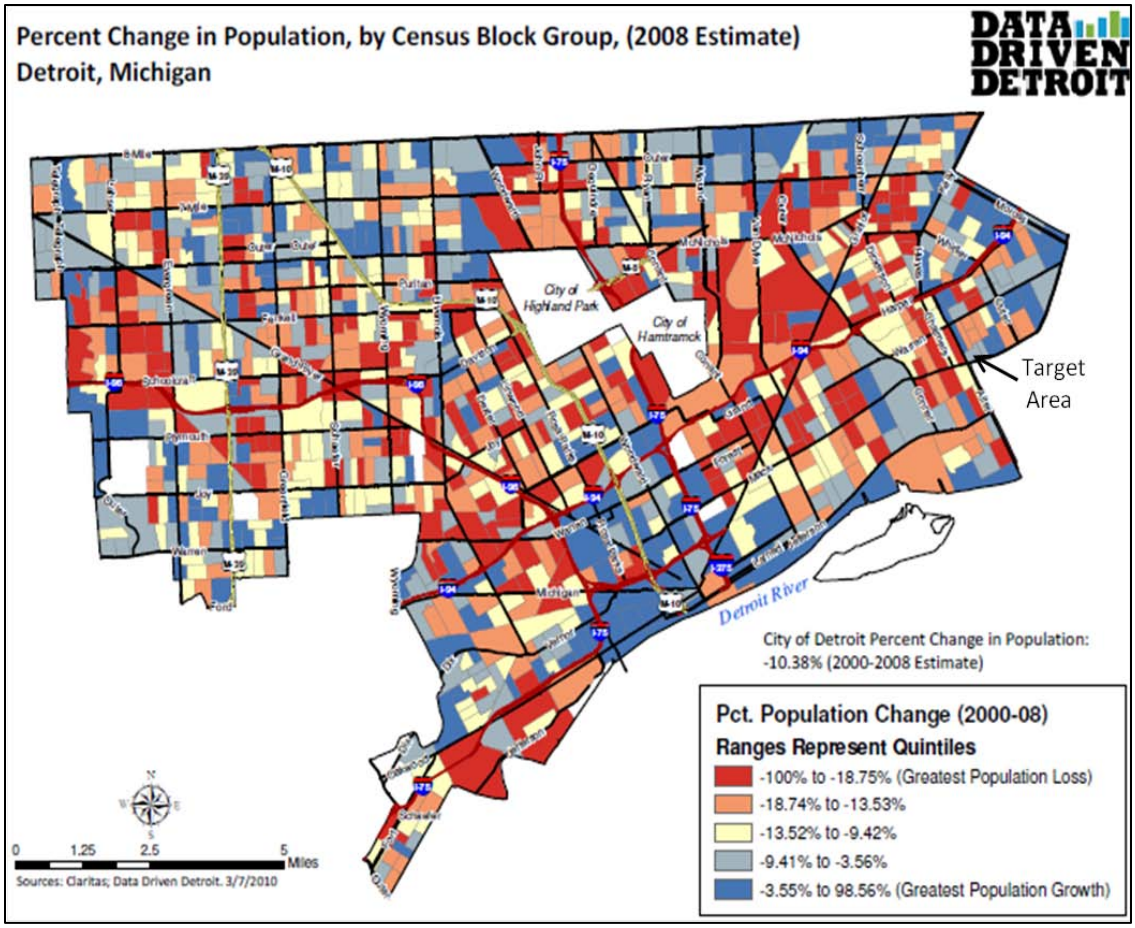


Figure 8. Percent Population Change, by Census Block Group, (2008 Estimate), Detroit, MI. Source: (Data Driven Detroit, 2010).

In terms of education level, approximately 35% of persons 25 years of age or older within the study area have obtained a Bachelor's degree or higher level of education (see Figure 10, Appendix A). Of the remaining two-thirds of the population, approximately 25% have no high school diploma or GED (see Figure 11, Appendix A). According to white-collar and blue-collar occupations maps created by Data Driven Detroit, between 20-30% of the population 16 years of age and older are employed in blue-collar occupations, while 30-50% are employed in white-collar occupations (see Figure 12 and Figure 13, Appendix A). Although the data suggests a significant number of persons employed in white-collar occupations, the median household income is $22,213.11[11] (see Figure 14).

[11] According to the U.S. Census Bureau, for a family of four that includes two children, this value is just above the 2008 poverty threshold. http://www.census.gov/hhes/www/poverty/data/threshld/thresh08.html).

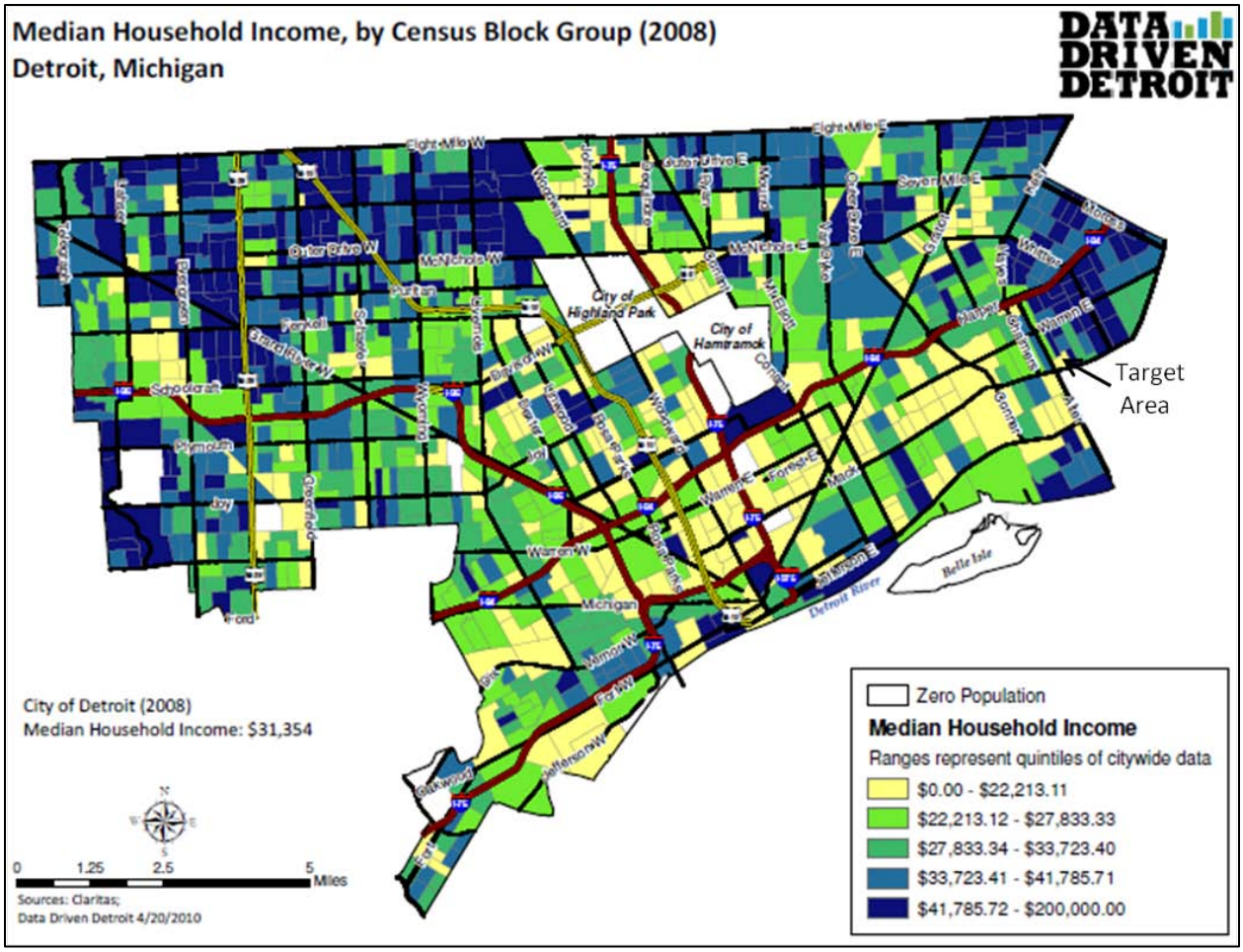


Figure 14. Median Household Income, by Census Block Group (2008), Detroit, MI. Source: (Data Driven Detroit, 2010).

Area Utility Services

Electricity and natural gas are supplied to the target area by DTE Energy. Water and sewer service are supplied by the City of Detroit. Although the project team was unable to obtain statistics on electricity, natural gas, and water use in the target area, residents who filled out the surveys self-reported monthly expenditures on gas ranging from less than $100/month to $600/month in winter and electricity bills ranging from $25/month to $289/month.

Waste Disposal and Recycling Services

The City of Detroit Department of Public Works (DPW) is responsible for waste disposal and recycling services and represents the core of city services through which residents interact with the environment. This is through water use and disposal as well as material disposal through waste, recycling, bulk waste, and hazardous material. DPW offers weekly curbside household waste removal for this area. All household waste in Detroit is processed in the waste to energy incinerator, operated by the

Greater Detroit Resource Recovery Authority (GDRRA) (City of Detroit Department of Public Works [DPW], 2010). The target area falls partially within the City of Detroit curbside recycling pilot program, which the City began in July 2009 (DPW, 2010). It is the first time that the city has operated a curbside recycling program.

Figure 15. City of Detroit 2009 recycling program. Source: (DPW, 2010).

Residents located outside of the pilot program wishing to participate in recycling must bring recyclables to a drop off location. See Figure 15 for the DPW Drop-Off locations throughout the City of Detroit. These sites accept the same recyclable materials that are allowed in the curbside program as well as bulk materials. The nearest location to the residents in the target zone is the Heilmann Center site, which is located approximately four miles away or a 10 minute car drive from the target area. Throughout the year, DPW orchestrates four bulk curbside pickup dates for this area. The size of materials collected is limited to one cubic yard or 1000 lbs (DPW, 2010).

Finally, the City of Detroit operates a hazardous waste facility which is located approximately eight miles, or a 15-minute drive, from the target area. This site accepts a variety of materials including hazardous liquids, medications, paints, and unknown substances (DPW, 2010). This site operates six days a week and is free for Detroit residents. DPW posts information about its services via the Internet at the

City of Detroit website. Information is also distributed through the mail (in water bills), through flyers, and through other communication channels such as community meetings and public announcements.

Site Selection

The site was seleceted because of its dynamic nature and the specific challenges that the target community faces. Declining population, increasing blight, aging housing stock, and increasing amounts of vacant land are common throughout Detroit. However, the target area is also representative of an edge community. After an initial investigation of several Detroit neighborhoods, the project team selected the site because it fell between a densely populated, well-kept area with most of the houses occupied and a completely blighted area with few homes still standing (see Figure 1).

Further considerations included the neighborhood's proximity to city services, the median average income level of the residents, and the percentage of home ownership versus renters, which may affect levels of interest in sustainability applications (such as home weatherization). Additionally, one team member was familiar with the location through family and through professional experiences. Finally, the broader neighborhood has a community organization, the Morningside Community Organization, which the project team identified early on as a potential partner. President Kelley Marks had been recently voted in as chair of the organization and was gaining some publicity for the current environmental efforts in the Morningside community (Monts, 2010). Because of this, the project team thought that Morningside would be receptive to its efforts.

Introduction to the Morningside Community and Initial Survey

The team attended two Morningside Community Organizations meetings during the planning stages of the project in the spring of 2010. The purpose of this was foremost to meet members of the Morningside community and to hear what issues they were most concerned with in their community. The project team wanted to identify resident's concerns and knowledge gaps in addition to disjunctions between community needs and available services, and how people perceived the conditions of their own community. By attending these meetings, the team succeeded in identifying topics for the workshops and in introducing the project to the broader community.

A written survey was conducted on April 13, 2010 at the Morningside community meeting. This survey was designed to understand more generally community concerns and interests as the team planned the project and also to provide the community with a few hints about possible project themes, including energy efficiency, recycling, food sources, and sustainability. The number of respondents was too small to make any quantifiable conclusions. However, presented here is a qualitative summary of

what the project team learned from these surveys. A copy of the survey forms can be found in Appendix B.

Out of 13 respondents, seven reported that they thought their utility bills were too high. The other six responded that they thought their bills were too high only in winter. Nine responded that their homes were cold and drafty in the winter. Almost all responded that they currently try to reduce energy use and that they have tried to learn more about increasing energy efficiency (only one, in fact, reported no interest in doing so). One possible from conclusion from these results is that this group both needs and has interest in reducing energy consumption and decreasing utility bills among this group. Only one respondent reported specifically having used insulation to increase energy efficiency, which may make home weatherization opportunities important to this group.

Other questions regarded regarding recycling, all but one responded that they do recycle; the one respondent who did not recycle reported "procrastination" as the reason for not recycling. This may indicate that residents are interested in recycling, and that the convenience of recycling programs may help widen recycling efforts. A last question asked where survey takers usually bought food, with the aim of gauging relative access to fresh foods. There were several options, but all respondents reported that they usually bought food from a supermarket with a produce section, indicating that access to fresh food may not be an issue for this group.

Interestingly, a question asking respondents to tell us what sustainability meant to them yielded a wide range of responses. Of the eight responses that question received, none were the same or used similar language. One, in fact, was a question mark. Such a response is interesting, because it points not only to the difficulty in defining the term but to the potential difficulty in introducing or emphasizing sustainability as the guiding principle in community building or rebuilding. Some phrases included the words "replacing the resources you use," "being able to maintain," "not wasting," "mindful," "not to do something," "afford to stay in home." That people use such disparate vocabulary when describing sustainability shows that sustainability encompasses many meanings and that making a community "sustainable" means addressing all of those meanings. This includes addressing issues like those alluded to by respondents, such as resource use and economic viability. Overall, these survey results and the project team's observations of the discussions during the meetings familiarized the team with the concerns and knowledge level of the community and ultimately influenced the project design.

Partnerships

Introduction

The Detroit SUN Project relied on a range of partner organizations and key staff within the organizations in planning and executing the scope of the project, sharing expertise and resources, and providing content for the workshop series. These organizations included municipal bodies, local NGOs, businesses and corporations. Leveraging existing relationships in Detroit, one team member was assigned to be the advocate for partnership building and encouraged collaboration with a wide range of actors. The project team identified partners by the following criteria:

- Actively involved in the Detroit community
- Focused on work that addressed environmental issues
- Offered resources that the project team perceived to be of interest to community members in the target area, including dedicated staff time
- Could address limited access to relevant information by participating
- Willing to donate time and/or resources
- Enthusiasm for the project

Partners that assisted in the workshops and events include the City of Detroit Department of Public Works (DPW), Recycle Here!, Wayne County Department of Environment, WARM Training Center, Earthworks Urban Farm's Garden Resource Program, and Sierra Club Chapter of Southeast Michigan. This section details the SUN Project's relationships with its partner organizations, as well as with the Morningside Community Organization and with A & J Yummies, a local eatery that catered the Community-Q. Information about how these relationships contributed to the project is presented below.

City of Detroit, Department of Public Works (DPW)

The Department of Public Works is a municipal agency that is currently overburdened by the economic struggles in Detroit. With an annual operating budget of $135 million, the DPW provides services to approximately 800,000 residents (Jordan, 2010). They also operate within one of the largest municipal districts in the United States, approximately 133 square miles (Jordan). While the City struggles to maintain the same square mileage of aging infrastructure, a decreasing population has eroded the tax base that supports DPW's activities. For example, an annual waste fee of $300 per household covers weekly curbside service, four annual bulk pickup days, and lawn debris removal (Jordan). However, increased numbers of foreclosures and people leaving the city have greatly decreased the revenue stream for these services (Data Driven Detroit, 2010).

Leveraging an existing relationship between one of the team members and the DPW, the SUN Project team was able to arrange for the DPW Director Alfred Jordan to speak at the Recycling, Illegal Dumping, and City Services workshop. Residents' concerns about city services were the initial motivator for this collaboration, and, ultimately, the DPW had interests in communicating with the residents of the target area. By participating in the project, the DPW could directly address some of its constituents' biggest concerns, especially with regards to vacant or abandoned property and illegal dumping. The workshop also provided a forum for residents to discuss the curbside recycling pilot program, which covers part of the target area. The DPW was able to talk directly with residents and to distribute information and brochures about city services in regards to waste management, recycling, and physical environmental hazards.

This successful partnership with the Detroit SUN Project addressed only a portion of DPW's work. While services provided by DPW can assist residents in reducing their environmental impact, the scope of work performed by this department extends well beyond the range of topics included in this project's programming. For example, DPW also focuses on street maintenance, traffic control, and engineering projects. The role of this department has shifted as the population continues to decrease and the department struggles to address growing problems, such as illegal dumping, on a shrinking budget. Because of the limitations of the department and frustration of residents dealing with a range of serious urban issues, the project team observed a heightened level of tension during the discussion portion of the workshop.

Recycle Here!

Recycle Here! provides neighborhood-oriented recycling services in Detroit and has a background in grassroots, community-based education. A portion of its operating budget is slated specifically for educational purposes. Recycle Here! operates recycling drop-off locations throughout the Detroit area; they provide disposal opportunities for items not collected in Detroit's curbside recycling pilot program, including batteries, electronics, Styrofoam, and light bulbs.

Lauren Cooper, Recycle Here! Education Director (and SUN Project team member), spoke at the Recycling, Illegal Dumping, and City Services workshop, provided and informational flyer about recycling drop-offs and answered questions about recycling and material disposal options in Detroit. Recycle Here! also set up a recycling station in the Demonstration House which workshop participants used to dispose of beverage containers and other items during workshops. This installation allowed residents to actively participate in recycling immediately and throughout the entire program. Recycled materials were taken back to Recycle Here! periodically by the SUN Project team.

Our recycling workshop provided an excellent opportunity for Recycle Here! to reach new individuals, particularly those expressing an interest in increasing their knowledge of sustainability principles, as well as individuals who are involved in the City's pilot project in curbside recycling. Cooper has experience educating in community meetings across the city and found this workshop to be particularly helpful. The residents were engaged and asked questions in regards to the recycling in Detroit in both Recycle Here! and in the curbside program. Overall, this partnership allowed for an in-depth discussion on material disposal options available to Detroit residents.

Wayne County Department of Environment

The Wayne County Department of Environment (DOE) provides environmental protection and regulations through three departments: Land Resource Management, Facilities Management, and Water Quality Management. Wayne County is the eleventh most populous county in the United Sates and serves over 2.1 million people (Wayne County, 2010).

The Wayne County DOE participated in two workshops (Recycling, Illegal Dumping, and City Services and Water Use Efficiency and Responsibility) and contributed expertise and resources for the community cleanup. Patrick Cullen, C.L.E.A.N. (County Lending Environmental Assistance to Neighbors) Program Manager, spoke during both workshops and acted as the main point of contact with the organization. At the workshops, Cullen informed attendees about his work on various environmental issues in Detroit as well as available resources and programs. Most notable was the C.L.E.A.N. program for cleaning up illegal dump sites. Cullen distributed a variety of useful informational pamphlets describing programs and resources for residents.

The SUN Project team found Wayne County DOE to be a rich source of knowledge and was helpful in promoting the project. They added an important regional perspective to the environmental issues that the project team discussed. Furthermore, this was an important partner in terms of influence on the project planning process. Because of DOE priorities in both water and solid waste issues, the project team looked to the department for guidance in defining key water and sewer issues to discuss in the workshop. One example of this influence is the Water Use Efficiency and Responsibility Workshop; it was expanded to include discussion of toxic and medical prescription waste that the County is currently addressing in their own educational programming.

Wayne County DOE further supported the project through the C.L.E.A.N. program, providing us with a large truck bed waste hauler for the community cleanup. The waste hauler was delivered to the site and picked up following the cleanup. Without this tool it would have been impossible to remove

large items. This served as a direct demonstration to residents of how the C.L.E.A.N. program can enhance a community cleanup effort.

Sierra Club (Southeast Michigan Chapter)

The Sierra Club is a national organization with chapters in each state that focus on local environmental issues. The Sierra Club's Southeast Michigan chapter has its offices in Detroit and works on environmental issues specific to Detroit, including water issues, environmental justice concerns, and education disparities.

Melissa Damaschke, Great Lakes Regional Representative, served as the connection to the organization. She led two of the workshops: Water Use Efficiency and Responsibility and Rain Gardens, and Rain Barrels and Storm water Management. Damaschke provided information about household water efficiency and runoff mitigation, gave out informational pamphlets, and provided hardware, tools, and instruction for rain barrel construction. She also successfully incorporated the Demonstration House as an instructional tool for both workshops. After the completion of the SUN Project workshop series, Damaschke requested to host another water efficiency workshop at the Demonstration House. The project team gladly allowed her to use the House, although the workshop was not officially part of the project.

The SUN Project's partnership with the Sierra Club was one of the strongest partnerships and was highly beneficial to both parties. The project presented the Sierra Club with an opportunity to deliver information directly to the community. Furthermore, the Sierra Club's expertise helped the SUN Project identify additional environmental topics to address through the workshops. Overall, the Sierra Club was able to meet their goals of educating additional residents, increasing water use efficiency, and decreasing storm water runoff, while the SUN Project was able to offer additional programming beyond the expertise of the team members.

One shortfall in this partnership occurred when the Sierra Club was unable to fulfill a promise to provide materials for the rain barrel workshop. Although the project team was able to source these materials ourselves at the last minute, this is an example of the limitations of nonprofits working with very limited budgets.

WARM Training Center

The WARM Training Center is a Detroit-based non-profit organization that promotes energy efficiency in homes and communities through education and training. WARM's energy analyst Shane Robinette provided the SUN Project with invaluable information about home energy efficiency and

weatherization materials during the planning stages of the project. Later, Andrea Fleming led the Home Weatherization Workshop and provided the weatherization kits that the project team distributed.

Our Home Weatherization workshop was an excellent opportunity for the WARM Training Center to share its educational resources and to distribute its weatherization kits. The kits, valued at over $50 each, were assembled by the WARM Training Center and were tailored for the homes in the target area. As grant recipients, the WARM Training Center is obligated to distribute annually a certain number of weatherization kits. Their participation in the program resulted in the distribution of 22 weatherization kits with an educational demonstration of how to install the items in the kit.

The WARM Training Center was an ideal partner for the Detroit SUN Project. Their efforts to provide grassroots energy conservation education throughout the Detroit area coincided perfectly with the SUN Project's goals, and the weatherization materials and information were central to the project's objectives. Furthermore, the Demonstration House was a particularly successful venue for the mandatory educational component WARM is required to provide before distributing weatherization kits. The workshop also allowed for direct demonstrations and a very engaged audience, which lead to optimal results and impact for the presenter, organization, and community residents.

Earthworks Urban Farm

Capuchin Soup Kitchen's Earthworks Urban Farm is a community-based organization focused on increasing access to fresh foods, urban agriculture, and community-based growth in Detroit. Their Garden Resource Program provides gardening education and materials to thousands of Detroit residents each year. The Garden Resource Program was willing to participate in the project workshop due to their commitment to encouraging a sustainable and community-based food system in Detroit.

Lisa Richter, Earthworks' Outreach Coordinator, spoke at the Health & Environment Workshop, sharing information about eating healthy food, buying locally, and gardening and growing one's own food. The workshop was reflective in nature and did not provide facts, figures, and tips; instead it served to foster improved communication between community residents.

This partnership succeeded because of the grassroots similarities in Earthworks mission and the SUN Project's educational approach. Lisa Richter is a passionate Detroit resident who was eager to talk about health, food, and sustainable communities. However, this partnership could have been improved by more clearly establishing expectations for workshop content in advance. For example, deeper discussion of the steps to create a garden as well as the associated economic, environmental, and social benefits of growing a portion of one's own food would have fit more closely with SUN Project goals for

the workshop. Although Richter was a willing participant and generous with providing information and her time, the project team could have provided greater clarity on workshop and partnership goals.

Morningside Community Organization

The Morningside Community organization holds meetings and other community events in the Morningside neighborhood of Detroit, of which the target area is part. The project team hoped to establish a relationship with the Morningside community organization's president and board. A partnership with this organization had the potential to improve the access to community members as well as the base knowledge of the community. Although the project team made every effort to include this organization throughout the course of the project, the team was not able to establish a successful partnership with this organization. Several members of the board attended project events, but this was the extent of the relationship established between the SUN Project and the organization.

Our attendance at two Morningside community meetings helped us to develop the project. The Morningside Community Organization holds monthly community meetings on Tuesday evenings at the Peace Lutheran Church at 15700 East Warren Avenue. Here, the organization's president, Kelley Marks, presides over the meetings while community members announce events and voice concerns. Guest speakers, such as members of local government or other organizations, frequently attend these meetings to present events or programs or to discuss an issue of interest to the community.

A & J Yummies

A & J Yummies is a local eatery located adjacent to the target area at 15645 Mack Avenue, Detroit, MI. A & J Yummies donated a substantial amount of food to the Community-Q event in order to support the local community. Food consisted of fried chicken wings, green beans, and pasta salad. In return for the owner's support, the SUN Project team publicly thanked the owner during the Community-Q and posted A & J Yummies flyers at each project event. This partnership was ideal for both parties because it allowed a local business to contribute to the local community and to market its products to that community, and it provided a source of food for the SUN Project's Community-Q event.

Demonstration House

Introduction

A key component of the Detroit SUN Project was the temporary acquisition of a Demonstration House in the target area. The Demonstration House, located at 3975 Nottingham Road, served as a location for the workshops, a demonstration tool for weatherization and water conservation techniques, and as a way to establish a presence in and build familiarity with the community. This section explains

how the project team acquired the house, the house's physical characteristics, the improvements to the house, and how the use of the house contributed to the success of the project.

House Acquisition

During a foot survey of the target area in March 2010, the project team found a vacant home that would serve as the future location of the Demonstration House (see Figure 16). The team met the property manager by chance and learned of the property's availability. Although the property was in the process of being rehabbed for rental purposes, the neighborhood characteristics and lack of desirability (including a number of adjacent vacant homes and lots) would make it difficult for the property owners to secure tenants. The manager was enthusiastic about the project and the possibility of us temporarily renting the property. The original asking price was negotiated to about half, and the project team rented the property on a month-by-month basis in July and August 2010.

House Characteristics

Figure 16. Demonstration House, 3975 Nottingham Road, Detroit, MI, 48224

The house that served as the Demonstration House for the project is located a few blocks north of Mack Avenue, within the target area boundaries. The house is situated on a 0.11-acre lot in the Morningside neighborhood and is adjacent to two vacant lots on one side and an abandoned house on the other. The nearby area consists of a mixture of occupied houses, abandoned houses, and vacant lots. Built in 1941, the single-family bungalow-style house is fairly representative of the age and construction style of the housing stock located in the target area. The home consists of 912 square feet of living area and an 873 square foot unfinished basement. The living area is further subdivided into three bedrooms, one bathroom, a living room, a small dining room, and the kitchen.

Construction materials consist of brick, concrete, wood, sheetrock, plaster, single-pane wood-framed windows, and asphalt shingles. Upon initial inspection, the team noted the absence of any form of insulation in both the areas where the floorboards rest on the foundation and where the ceiling is adjacent to the roof. Although generally in good condition and initially well-constructed, the house is in need of some maintenance and renovations. Some work has recently been done to the house, especially in the single upstairs attic room, but it seemed to be of substandard quality and failed to address some of the more fundamental insulation needs.

The home's utility services are provided by a mix of both public and private entities. The City of Detroit provides water and sewer services for the home while DTE Energy supplies both natural gas and electricity. Natural gas is used in the home's forced air furnace, water heater, and gas range. The home does not have a washer, dryer, dishwasher, or microwave. The furnace is between 35 and 48 years old; the water heater was manufactured in 1992. The kitchen appliances are estimated to be well over 10 years of age and non-Energy Star compliant. During the project team's occupancy in the house, the toilet was replaced with a model that uses 1.6 gallons per flush.

Demonstration House Weatherization and Improvements

The Demonstration House's primary purpose was to serve as a teaching tool to support the content of the project workshops. With this in mind, the SUN Project team installed simple weatherization and water-efficiency materials throughout the house accompanied by signage to emphasize these improvements and demonstrate how they were installed. The project team installed CFL light bulbs, weather stripping, face plate insulation, hot water heater pipe wrap, sink faucet aerators, and a plastic window covering. Photos of the accompanying displays and signage can be found in Appendix C, Figure 17 through Figure 23.

In addition to the small and largely instructional improvements completed by the SUN Project team, the Demonstration House received an energy audit and initial weatherization from DTE. During the course of the project's summer workshop series, DTE offered free home energy consultations in and around the target area as part of their Neighborhood Energy Savings Outreach Program. The program offered a free, baseline energy audit to identify areas of low energy efficiency and free installation of energy-saving products to reduce energy consumption.

DTE completed a baseline assessment of the Demonstration House on August 18, 2010. Initial findings of the assessment indicated that the home's single-pane windows and interior insulation were the areas of highest concern. Several suggestions were listed for improving the energy efficiency of the windows. These included: 1) replacement of storm windows, 2) addition of indoor plastic window

coverings to reduce heat losses during winter months, and 3) replacement of basement windows with higher efficiency glass-block windows. Additional recommendations to reduce heat losses included the addition of insulation materials with an R-value of 49 or higher in attic spaces and an R-value between 13 and 19 in basement areas.

Energy-efficient products installed by DTE personnel during the baseline assessment included: five CFL light bulbs, one low-flow showerhead, two low-flow sink aerators, and six feet of foam pipe wrap insulation extending from the home's water heater. A copy of the complete baseline assessment can be found in Appendix D, Figure 24 and Figure 25.

Results and Evaluations

The Demonstration House was paramount to the success of the project and a critical component in reaching the target community. The Demonstration House provided us with not only a very accessible and convenient venue for the workshops but also served as a powerful teaching tool for the workshop participants, a valuable learning experience for the SUN Project team, and a means by which to integrate the SUN Project team into the community. The Demonstration House concept could be very useful for other community education and development projects. The uses and successes of the Demonstration House are elaborated in the following paragraphs.

The Demonstration House as a Convenient, Safe, and Inviting Venue for Workshops and Events

The Demonstration House was located in the heart of the target community. It was a permanent, designated fixture in the neighborhood for the duration of the summer that could serve as a reminder of the lessons provided at each workshop, even at times when workshops were not occurring. One of the speakers pointed out that having the workshop right in the neighborhood served to put him on their turf, and this was very helpful in building confidence and trust. The team also thought that because the Demonstration House was located in residents' own neighborhood, people would feel safe and at home when attending the workshops.

Additionally, the canopy tent and outdoor tables and chairs combined with pleasant weather made sitting out in the yard very inviting and welcoming. Workshop participants and presenters alike seemed to enjoy the outdoor environment. The yard was also a safe place for children to play; their parents could keep an eye on them while simultaneously attending the workshop.

The Demonstration House as a Teaching Tool for the Community

Because the 1940s Demonstration House was fairly representative of the housing stock in the target area, it was a powerful tool for demonstrating energy and water efficiency techniques to workshop participants in an environment similar to their own homes. The Water Use Efficiency and

Responsibility and Home Weatherization workshops included inside tours during which the workshop presenters showed how and where weatherization and water efficiency materials and techniques could be employed. Speakers discussing storm water management could point to gutter downspouts, show participants where to put a rain barrel, or demonstrate an appropriate location for a rain garden.

The SUN Project team installed weatherization and water efficiency materials throughout the house, accompanied by signage drawing attention to it and explaining how it was installed. Furthermore, recycling bins, environmentally safe cleaning products, and biodegradable kitchenware were available for use and examination inside. During all of the workshops, participants entered the house to get dinner, to use the bathroom, or simply to look around, and this increased their exposure to energy- and water-efficient demonstration materials. Because the Demonstration House was similar to the homes of the workshop participants, they could more easily see how these techniques and materials could be applied in their own homes.

In addition to the usefulness of the house itself, its location on Nottingham adjacent to a vacant lot proved helpful as well. One speaker from the Recycling, Illegal Dumping, and City Services workshop commented that it was very helpful to be able to point out a nearby dumpsite. The vacant lot in which the speakers gave their presentations was also very pertinent to the discussions of abandoned properties and personal and community gardens.

The Demonstration House as a Learning Tool for the SUN Project Team

The Demonstration House aided the SUN Project team in understanding the needs of the target community. During the time spent at the Demonstration House, the project team experienced life in the Morningside neighborhood. The team watched what went on in the street, kept its eyes on local dump sites and abandoned homes, and talked to curious neighbors. The team received hands-on experience with the type of housing stock within the community, which increased the team's understanding of the types of construction materials used in the neighborhood houses, as well as specific problems and weatherization needs associated with those materials. Furthermore, having a house available to use allowed the team to actually experiment with installing weatherization materials; this was advantageous when the project team sought to explain these items to the workshop participants. By working with a landlord, the team experienced what it is like to be a renter in Detroit; the frustrations with various contractors who were called on by the landlord to fix some significant problems in the house gave the team a taste of the challenges faced by Detroit residents. Trying to maintain the property's yard and the adjacent vacant lots allowed the team to experience one of the most common issues faced by area

residents. Overall, the experiences that the Demonstration House afforded the SUN Project team greatly increased the team's effectiveness as educators.

The Demonstration House as a Means through Which to Become Part of the Community

Having the Demonstration House for the duration of the summer allowed the SUN Project team to easily integrate itself into the community, rather than using a shared venue at which the Project would not have a sustained presence. The team members became neighbors and community members, building trust with residents and increasing the effectiveness of the workshops. As the summer progressed, the team began to see signs of their acceptance into the community. A few anecdotes will serve to demonstrate this sense of acceptance: a neighbor put away the garbage can after trash collection day because the project team could not be there to move the trash can from the curb to the rear of the Demonstration House; at this point, the team realized that the neighbors were watching the property in between the team's visits to the neighborhood. Later, an unprecedented number of people came to the Home Weatherization Workshop and there were not enough chairs for all guests. The next door neighbor noticed this before the team did, and brought some of her own chairs for workshop participants to use. During the last workshop, one man donated his caulking gun when he saw that the team was in need of one for finishing the rain barrels. Finally, in preparation for a workshop, a neighbor helped us mow the grass in the vacant lot next to the Demonstration House.

Overall, these supportive actions from community members increased the team's comfort and confidence in the project programming. Further, these actions highlight a sense of trust in the team, which bolstered the project message and the information that the project team provided. Without this growing level of trust, the team members thought it unlikely that the message would provide a significant positive impact in the target area.

The Demonstration House Concept as a Useful Tool for Other Projects

For the reasons listed above, the Demonstration House was critical to the success of the project and increased the effectiveness in achieving the project goals. Feedback from the workshop leaders regarding the Demonstration House as a venue was overwhelmingly positive. The workshop leader for the two water-focused workshops from the Sierra Club has told us that because she found the Demonstration House to be so useful in teaching her workshops, she will actively try to hold workshops in homes in the future. The SUN Project team highly recommends the Demonstration House concept to other educational and community development organizations seeking to develop ties with a community, particularly organizations trying to promote home energy and water efficiency. In a city like Detroit, where rents are low and property is readily available, this is a particularly viable option.

Because of the necessarily temporary nature of this project, the SUN Project team moved out of the Demonstration House at the end of the summer, and the House was no longer used for community education. When the team conducted a foot survey on February 28, 2011, the Demonstration House appeared to be occupied by new residents.

Project Events and Activities

Introduction

The Detroit SUN Project's central education activities consisted of a series of five workshops addressing urban environmental concerns held at the Demonstration House in the target area between July 20, 2010 and August 17, 2010. Workshops covered the following topics:

- Recycling, Illegal Dumping, and City Services
- Water Use Efficiency and Responsibility
- Home Weatherization
- Health and Environment
- Rain Gardens, Rain Barrels and Storm water Management

These themes were chosen through interactions with partner organizations who were researching similar programs and outreach objectives and from major resident concerns that the team observed during community meetings in the Morningside neighborhood.

In addition to the workshops, the project team also held an open community event at the Demonstration House (the Community-Q) to kick off the workshop series. The purpose of this event was to introduce the team members, explain the scope of project, and to encourage participation in the following workshop series.

Surveys were distributed to participants at the Community-Q and at each of the workshops. They were designed to:

- Gauge general areas of concern within the community
- Gauge participants' knowledge level of each workshop topic
- Identify knowledge gaps regarding workshop topics
- Identify gaps between residents' concerns and available services
- Determine level of interest and/or concern regarding resource use reduction

Following the completion of the workshop series, a survey was also mailed to participants of the home weatherization workshop to determine which materials they successfully installed.

To encourage increased participation in the workshops and sustainable behavior at home, giveaways were provided to all attendees. The items were used to supplement educational information provided at each workshop and to provide a tangible, hands-on example representing various principles of environmental stewardship. Careful consideration was given to choose items that would best represent the sustainability principles represented by each workshop. All items provided to workshop participants were either sourced from local vendors or from participating non-profit organizations.

To further incentivize participation in workshops and create a sense of community, dinner was provided at all SUN Project workshops. When possible, the team utilized local vendors in order to contribute to the local economy of the Morningside community, as well as provide an outlet for local businesses to market their services to the community. Local eatery A & J Yummies catered the Community-Q event. Food for all other workshops was purchased from Mama Rosa's Pizzeria nearby on the commercial corridor of Mack Avenue. Food was served with biodegradable plates, cups, and utensils from Green Safe Products, a Detroit-based business. Green Safe flyers explaining these products were available to workshop participants, and they drew significant interest from guests. Guests were also requested to dispose of pop cans and water bottles in the recycling bins in the Demonstration House kitchen, which further reinforced some of the lessons from the workshops.

A final event, a community cleanup, was held on October 30, 2010, in conjunction with the Wayne County Department of Environment C.L.E.A.N. Program. This date was purposely aligned with the Morningside Community organized cleanup day as well. Organization members, the project team members, and volunteers picked up litter and several illegal dump sites in and near the target neighborhood. The team was able to produce a visible change in the neighborhood as well as demonstrate how a particular community assistance program, Wayne County C.L.E.A.N., works to assist residents.

In this section, the workshop series and additional events are discussed as well as the evaluation of each workshop. The project team also evaluated the effectiveness of the overall approach to implementing the workshop series. For each workshop, the team offered five primary parts: 1) a general description of the event, 2) a description of the giveaways participants received at the event, 3) a statement of how many people participated, 4) an overall evaluation of the success of each workshop, and 5) a summary of the results of the surveys taken at each workshop and a discussion of how they can inform future urban environmental education programs. The teams also described and evaluated the Community-Q event and the community cleanup. Transcribed notes of the presentations and discussion

from each workshop can be found in Appendix E, and survey forms can be found in Appendix B. Table 1 summarizes the workshop topics, speakers, and giveaways, which are described more fully in the text.

Table 1. Summary of the summer 2010 workshop series held at the Demonstration House**.**

Detroit SUN Project Workshop Summary			
Event Title	Date	Presenter	Giveaways
Recycling, Illegal Dumping, and City Services	20-Jul-10	Patrick Cullen (*Wayne County*); Al Jordan (*City of Detroit Department of Public Works*); Lauren Cooper (*Recycle Here!*)	Reusable bags
Water Use Efficiency and Responsibility	27-Jul-10	Patrick Cullen (*Wayne County*); Melissa Damaschke (*Sierra Club*)	Faucet aerators, metal water bottles
Home Weatherization	3-Aug-10	Andrea Fleming (*WARM Training Center*), Tiffany Curry and Greg Garland (*DTE*)	Weatherization kits
Health and Environment	10-Aug-10	Lisa Richter (*Earthworks Urban Farm*); Lara Zador and Emily Kreger (*Wayne State Medical School*)	Surplus items from previous workshops
Rain Gardens, Rain Barrels, and Storm water Management	17-Aug- 10	Melissa Damaschke (*Sierra Club*)	Rain barrels

Description and Evaluation of Each Event

Community-Q

General description

The Community-Q gathering served as a kick-off event for the summer workshop series and as a way of introducing the team, the project, and the Demonstration House to community members. Participants were invited to the Demonstration House to share a meal, meet the team members, voice their concerns, and learn about the project's upcoming events. Prior to this event, the team attempted to personally contact each resident of the target area by knocking on doors. The team also distributed

brochures outlining the project and invited them to the Community-Q event. Many people who attended the Community-Q also attended subsequent workshops.

Giveaways

No giveaways were distributed at the Community-Q. However, participants were invited to take project brochures describing upcoming events. A meal was also provided.

Participation

Because of the casual nature of this event, it was difficult to determine exact number of participants. However, the team estimated there to be about 30 adults. Thirteen people filled out surveys, and about 26 signed the guest book. There were many children playing in the yard throughout the event.

Overall evaluation

The project team considers the event a success, because it attracted approximately 30 community members. The team discussed with the attendees the opportunities that the workshop series would afford them and general community issues. The team also involved local businesses in the event. One of the eventual workshop presenters also attended and was able to interact with residents even before the workshop series began. The team was quite satisfied with the attendance, and team members were able to speak personally with every attendee. Along with the familiar setting of the demonstration house, this helped create a friendly, personal environment in which to communicate about the project and get to know residents.

Survey results

The aim of the Community-Q survey was to gather some basic information about the target community and begin identifying its concerns and interests regarding the project's themes. Several questions asked basic demographic data (street of residence, number of household members, employment level, whether homes were owned or rented). Others focused on what respondents perceived as the most important issues their community faced.

Blight was a major concern among those completing surveys at the Community-Q. When residents were asked what they thought was the biggest problem facing their neighborhood, five of 12 responses were related to blight and/or vacant property. When asked what they would like to see changed in their neighborhood, six of 12 responses were related to blight and/or vacant property. A more focused question listed items that residents might like to see in their neighborhood. The three items relating to urban blight were checked by 8-11 of the 12 people who responded to those questions. Vacant lots and homes that are not cared for become unsightly with time, and are easy targets for

vandalism, theft, and illegal dumping. The survey results surrounding this issue are perhaps not surprising, given that the team identified 28 of the 155 houses in the neighborhood as being vacant, six of which looked uninhabitable, and that 23 of the 206 lots were vacant.

Recycling, Illegal Dumping, and City Services Workshop

General description

The goal of this workshop was to connect participants with existing city services regarding recycling, illegal dumping, and waste disposal. Information about city waste services was provided to participants by Alfred Jordan, Director of the City of Detroit Department of Public Works, and Patrick Cullen from the Wayne County Department of Environment. Recycling information was provided by Lauren Cooper of Recycle Here!, a Detroit organization that provides recycling drop-off services and related education programs. These presenters brought large-scale perspective to the waste disposal issues in Detroit, while hearing the concerns of residents. They discussed proper waste disposal, which materials can be recycled where, and the current capabilities of the City and County's waste disposal mechanisms. They also talked about ways to discourage illegal dumping in neighborhoods.

Giveaways

To discourage the use of plastic bags and to promote the use of recycled materials, reusable tote bags made of recycled materials were provided to attendees. Annually, Americans dispose of approximately 100 billion polyethylene plastic bags (World Watch Institute, 2010). Plastic bags discarded in the local environment can end up clogging sewers or becoming entangled in trees or fences. Sewers clogged by plastic bags prevent storm water runoff and raw sewage from entering proper sanitary treatment pathways, resulting in unhealthy conditions and increased maintenance costs. Further, bags that become entangled in trees and fences can pose an additional threat to the health of pets and wildlife. Using reusable bags can also act a daily reminder to encourage people to think about the materials they use and what they can reuse or recycle.

Participation

Six people attended the Recycling, Illegal Dumping, and City Services Workshop. Although the number was small, the team was pleased with the turnout for this first workshop and with the level of engagement of the participants. They eagerly asked questions of the speakers and discussed ideas and issues with each other.

Overall evaluation

The presentation at the workshop by Department of Public Works (DPW) director Alfred Jordan was a significant and particularly successful aspect of this workshop. This allowed for genuine

interaction between residents and DPW. It represented a rare opportunity for community members to express frustrations and limitations of the city department to provide continued service while operating on a decreasing budget, as well as issues such as illegal dumping. Because only part of the target area is in the City of Detroit's curbside recycling pilot project, this workshop was also an excellent venue for neighbors to share knowledge and experience with each other and the guest speakers about recycling.

Survey results

We collected six surveys at the Recycling, Illegal Dumping, and City Services workshop. All respondents said they were concerned about litter and illegal dump sites in their neighborhood, but only one responded explicitly that they were aware of services to help clean up illegal dump sites. Four reported that they engage in picking up litter and/or cleaning up dump sites. Four of six respondents reported that at the end of the workshop they knew how to get dump sites in their neighborhood cleaned up. Though the number of surveys was small, this may indicate a knowledge gap among residents regarding how to deal with illegal dumping in their neighborhoods, and that the simple provision of information can help address it. It seems that residents are concerned about this issue, and some are trying to address it themselves, but they need information to connect to existing services to assist them in their efforts.

Half of respondents reported that they recycle; two participated in curbside recycling and one at drop-off locations. The half that did not recycle said they do not recycle because they do not know how or where to do it. After the hearing from presenters, four felt that they had learned more about recycling opportunities and four planned to recycle more in the future. Similar to illegal dumping, it seems a lack of information limits recycling among this group.

Water Use Efficiency and Responsibility Workshop

General description

The goal of this workshop was to provide hands-on instruction to workshop participants to reduce residential water consumption. A secondary goal of this workshop was to provide an opportunity to encourage dialogue between local residents and the Sierra Club, a national non-profit organization dedicated to grassroots environmental action with a Michigan branch. The presenters were Melissa Damaschke of the Sierra Club and Patrick Cullen of the Wayne County Department of Environment. Cullen discussed water treatment and how to properly dispose of household pollutants to reduce downstream water pollution. Damaschke then led the group through the demonstration house to show simple ways to conserve water in the home.

Giveaways

To promote the principles of efficient water use and waste reduction, one low-flow water faucet aerator (1.5 gal/min) and one reusable aluminum water bottle was provided to each workshop participant. According to the American Water Works Association, the average residential customer uses approximately 69.3 gallons/day (Detroit Water and Sewerage Department, 2009). By installing just one low-flow aerator in each of the project area's homes, the team estimated that water consumption could be significantly reduced, resulting in low to moderate savings on water bills. Additionally, based on the EPA's estimates, approximately 100 million kWh/yr of electricity would be saved if one out of every 100 American homes were retrofitted with water-efficient fixtures (Natural Resources Defense Council, 2009).

In 2005, approximately two million tons of plastic water bottles ended up in landfills instead of being recycled (Natural Resources Defense Council, 2005). By distributing reusable aluminum water bottles to the workshop participants, the team aimed to promote the principle of waste reduction by discouraging the purchase of bottled water. Bottled water is problematic on two levels: the plastic containers contribute considerably to waste production, and the production and transportation of bottled water create significant amounts of greenhouse gases (GHGs). By promoting behavior changes that lead to the reduced consumption of bottled water, the team further aimed to reduce GHG emissions into the atmosphere.

Participation

Although only five people attended this workshop, those that attended seemed particularly engaged with the topic, asking questions and discussing previous and future efforts to conserve water at home.

Overall evaluation

This workshop made very successful use of the Demonstration House, as participants were able to see where and how to implement water conservation strategies in their homes. Also, this was a particularly important environmental discussion because of Detroit's location, situated in the Great Lakes region and on a waterway connected to two of those lakes. Though the group was small, the advantage of a low number of participants is personal attention on the part of the presenter. This group in particular asked many questions, and the workshop took the form of a friendly conversation rather than a presentation. Participants seemed to appreciate the interactive and hands-on style of this workshop.

Survey results

Four surveys were collected at the Water Use Efficiency and Responsibility workshop. Interestingly, three of the four respondents reported that they had bought a more water-efficient appliance or toilet in order to save water or money in the past. At least for these participants, saving money on water bills by reducing water consumption was important enough to buy a new appliance. In fact, all participants responded that they were interested in buying additional water-efficient appliances (only two had heard of the ENERGY-STAR label), but two said they did not have enough money and one did not know how to purchase one.

Regarding water quality, two respondents replied that they did not know how to dispose of toxic chemicals, such as motor oil, paint, and paint thinner. When asked if they knew how to properly dispose of unused medicine, only one person responded "Yes." Though four surveys cannot be extended to a whole neighborhood, there may be some knowledge gaps concerning choosing water-efficient appliances and how to properly dispose of hazardous materials.

Home Weatherization Workshop

General description

The goals of this workshop were to provide participants with a basic weatherization kit and to facilitate a demonstration of the proper installation techniques for each item in the kit, as well as to share ideas about other energy-saving measures at home. The WARM Training Center was the partner organization and provided the necessary materials. Prior to receiving a kit, participants heard a home energy efficiency presentation from Andrea Fleming of the WARM Training Center. She offered many ways to save energy (both electricity and gas) and lower energy bills. Two representatives from Detroit Edison (DTE), Greg Garland and Tiffany Curry, also spoke briefly about the free home weatherization program currently available from DTE. Following the presentations, participants were able to walk through the Demonstration House to see several weatherization materials installed and to receive their kits.

Giveaways

To promote energy efficiency and reduce the economic burden of increasing energy rates, participants were provided with home weatherization kits donated by the WARM Training Center. The kit consisted of a door sweep, two compact fluorescent bulbs (14 and 19 watts), rope caulking, weather stripping for doors, two plastic window kits (50 by 80 inches, clear plastic), tape for window cracks, and socket sealers for electrical outlets. In total, 22 weatherization kits were distributed to workshop participants.

Participation

Twenty-two people attended the Home Weatherization Workshop. Attendance at this workshop was quite high, largely because, unlike the previous workshops, it had been advertised through the Morningside Community Organization's e-blast. Many organization members from outside the target area attended the workshop.

Overall evaluation

The Demonstration House was especially important to the success of this workshop. The materials that the project team installed in the house and the displays that the team constructed showed how the weatherization materials functioned and how they should be installed. The team believed that the hands-on and practical nature of this workshop, in addition to the presenter's lively and interactive style, made this workshop very successful.

Workshop survey results

Sixteen surveys were collected at the Home Weatherization Workshop. Nine participants expressed that their electricity bills were too high, and 10 participants said they felt their gas bills were too high during winter. In fact, reported monthly expenditures on gas ranged from less than $100/month to $600/month in winter. The range for electricity bills was reported as $25/month to $289/month. Ten reported their homes feeling cold and drafty in the winter. Even with a small number of surveys, this shows there is a clear need for improving home energy efficiency in this neighborhood. However, a gap may exist between people that need such services and those that provide them. For example, DTE provides free weatherization kits to customers who fill out a questionnaire online, but 14 of 16 participants did not know about the program.

Actions already taken by a majority of participants may indicate true interest in improving home energy efficiency. Eight respondents said they had done quick, inexpensive things to weatherize their homes, and three had invested more substantial time and money in home weatherization. Only one respondent said his home did not need to be weatherized.

Follow-up survey results

In October 2010, the SUN Project team mailed a follow-up survey to the participants that attended the Home Weatherization Workshop who also reside within the original target area. The intent was to learn whether the weatherization kits distributed at the workshop had been installed, and specifically which items had been installed. Only five of over twenty surveys sent were returned.

Everyone who returned a survey reported having installed the CFL bulbs. Each kit contained only two bulbs, but respondents reported that they had installed from two to 16 bulbs, indicating the

purchase of extra bulbs. Three of the five respondents installed items other than CFLs, although one of these installed only light switch insulators beyond the new bulbs. Four of the five respondents reported that after the workshop they are more aware of their energy and resource use. Three reported that they now feel more in control of their resource use, though two people qualified their answer as "somewhat" and "just a little bit…" This might indicate that even with new information and weatherization materials, people feel they can only control so much, or that having new information does not necessarily mean actions can/will be taken with that information.

A question at the end of the survey asked participants what else they needed to continue to improve their energy efficiency. The most common answers circled were "money" (four of five people) and "information" (three of five people). Only one person circled "incentives" and one "time"; two circled "expertise". While this information comes from only five surveys, it points to the largest barriers people in such communities have in taking control of their resource use. Similar gathering of information on a wider scale could help inform the creation of programs/policies intended to reduce resource use.

Another question, perhaps the most important question on the survey, asked if participants had changed any behaviors because of something they learned at a workshop. Three of five respondents circled "yes," and described briefly the change they made, including simple behaviors such as remembering to turn off lights when leaving a room. As one of the goals of the project was to increase awareness about resource use, and recognizing the challenges in achieving behavior change, that even a small number of people have implemented a change in their lives makes this workshop successful.

Health and Environment Workshop

General Description

The goals of this workshop were to provide free health information to workshop participants and to provide an opportunity for participants to learn about local urban farming practices in the city of Detroit. Lisa Richter from the Capuchin Soup Kitchen Earthworks Urban Farm explored the link between the urban environment, food availability, and human health. Several medical students from Wayne State University were also present to discuss related health issues.

Giveaways

Due to a surplus of giveaways from previous workshops, the project team chose to provide attendees of this workshop with items leftover from the previous workshops. Items provided for this event included the reusable tote bags and aluminum water bottles.

Participation

Four people attended the Health and Environment Workshop. The low attendance can be partially attributed to a time conflict with the Morningside Community Organization's monthly meeting that evening. Many potential participants (i.e. those from the week before) chose to attend the community meeting instead of the workshop.

Overall evaluation

The team does not consider this workshop to be as successful as the others in the series. In addition to the relatively low attendance, the presenters' content did not fully match what the team had intended for the workshop. This may have been prevented by increased communication between the team and presenters before the workshop. In spite of this, participants did learn about several resources available for getting involved in community gardens and urban agriculture, such as the Garden Resource Program offered by Earthworks Urban Farm, and they seemed inspired to further explore gardening.

Survey results

Four surveys were collected from this workshop. When asked where participants bought groceries, all responded that they shopped at stores with produce sections. This may indicate that access to fresh food is not as much a concern in the target area as in other areas of the city. However, one participant responded that "I go to suburbs because of better/healthier food sold." It's important to note that this could be referring to a nearby grocery store because proximity to a suburban community only just across the nearest avenue. Also, none of the participants reported having gardens.

Two survey questions inquired about participants' purchasing of organic and locally grown food. Two responses pointed to the lack of availability of such foods, and one mentioned higher cost. With such a small number of responses and no specific store locations, it is impossible to tell if the access to local and organic foods is lower in this neighborhood relative to others. One person reported that they never thought to buy local food, and another that they buy organic food because "it's supposed to be healthier," and yet another said they do not buy organic food because they "… don't really know if it is organic!!" Although small in number, the varied responses points to the confusion people have surrounding the food they eat. It may indicate that this community could benefit from information about these topics in order to make more informed food choices.

Two other questions focused on vacant land. Only one person indicated that vacant properties were bad for their health, saying "mental health – it's depressing and ugly," highlighting an important component of environmental health that the workshop did not touch on. All four participants reported they would like to see vacant lots used as community gardens, among other varied responses.

Rain Gardens, Rain Barrels, and Storm Water Management Workshop

General description

The goal of this workshop was to educate participants on the economic and environmental benefits of rain barrels and their positive impacts on the local combined sewer system. The Sierra Club's Melissa Damaschke returned to discuss the function of rain barrels, rain gardens, and to help participants build their own rain barrels to take home.

Giveaways

To promote the principles of water conservation, storm water management, and energy efficiency, the project team provided the materials for each participant to build a rain barrel. Twenty-five 55-gallon plastic drums were sourced from two private vendors found on Craigslist, and 22 were given away at the workshop. The Southeast Michigan Chapter of the Sierra Club provided additional hardware including debris screens, brass faucet outlets, Teflon plumber's tape, and waterproof caulk.

According to the EPA, approximately 40% of total household water use during the summer months comes from watering a lawn and/or garden (EPA, 2009). Each barrel, if properly installed could divert over 600 gallons of water from a 1000 ft^2 roof with one inch of rain. Southeast Michigan averaged 34.12 inches of precipitation in 2009 (Deedler, 2009). It is estimated by the Environmental Protection Agency that rain barrels will save homeowners at least 1300 gallons of water during peak summer months (EPA, 2010).

Participation

The Rain Gardens, Rain Barrels, and Storm Water Management Workshop attracted 21 people. Attendance at this workshop was quite high, again resulting from an advertisement through the Morningside Community Organization's e-blast and significant local interest in gardening.

Overall evaluation

This workshop was also considered very successful by the team. Not only was attendance relatively high, but it was an exciting hands-on learning experience for participants. Participants made the barrels together in a group, and were able to see exactly how and where to install them on their own properties using the Demonstration House as an example. The Demonstration House proved very useful also for this workshop, since it was a great visual aid in discussing the placement and functioning of rain barrels and rain gardens, and in discussing residential runoff. From talking with participants at the workshop and hearing immediate positive feedback, the team feels they provided a very practical and rewarding learning experience for participants.

Survey results

Sixteen surveys were returned at this workshop. Respondents reported that their water bills ranged from $21/month to $119/month. Nine people thought their bills were too high, yet only four had done something to conserve water in their homes or yards. The project team could only speculate on the reasons for this, and with such small numbers it is difficult to make generalizations about the gap between perceived high bills and taking action. Two people said they had previously used a rain barrel in their yards and none had ever made a rain garden (but 10 people knew of them). Six of the 16 respondents said they had heard of Combined Sewage Overflow in Detroit. It is possible that practical, implementable information could help turn this group's desire to lower water bills into actions to conserve water.

Morningside Clean-up

General description

On October 30, 2010, the team held a community cleanup in conjunction with the Wayne County Department of Environment C.L.E.A.N. Program and a cleanup event organized by the Morningside Community Organization. Organization members, the SUN Project team, and other volunteers picked up litter and removed several illegal dump sites in and near the target neighborhood. The SUN Project team provided coffee, apple cider, and donuts as well as a pickup truck rented from the University of Michigan. The Morningside Community Organization provided bags and gloves, and participants shared tools, vehicles, and other equipment. The C.L.E.A.N. program provided a large dumpster and disposal service.

Giveaways

No giveaways were provided at the community cleanup event.

Participation

Approximately 10 people (not counting SUN Project team members) helped with the community cleanup. Some of these volunteered because of the SUN Project's invitation, and others responded to advertisements from the Morningside Community Organization. Various volunteers contributed tools, gloves, and bags, and one person brought a truck.

Overall evaluation

The cleanup was successful in the sense that it produced a visible change in the community's landscape. Because of limited time, volunteers, and dumpster space, the project team was only able to fully eliminate two dump sites in Morningside, and made progress on part of a mostly vacant street just outside the project area. With about 10 people and three hours, a total of 5,420 lbs of waste was

removed from the community. This figure was calculated by Wayne County after removing and weighing the filled waste hauler from site. Most importantly, the event demonstrated that community cleanups are very doable through the Wayne County C.L.E.A.N. program, and given enough volunteers.

Overall Evaluation of Project Events

The purpose of holding this workshop series in the target area was to fill knowledge gaps regarding urban environmental issues. The project goal was to provide resources and knowledge in order for people to meet their own environmental needs, to increase awareness about resource use, to conserve resources and reduce utility expenditures, and to put people in contact with services and programs that can help meet environmental needs. In total, approximately 54 people attended at least one SUN Project event at the Demonstration House during the summer. This is from approximately 157 households within the project target area, and includes at least 25 participants from outside the target area. Eight speakers from seven organizations shared their knowledge with participants, and numerous giveaways facilitated participants' adoption of sustainable behavior and home energy-efficiency.

Overall, the team considered the Detroit SUN Project events a success at meeting the project's primary objectives as an urban environmental education program:

1. Identify environmental needs and knowledge gaps in a low-income area of Detroit. Though not statistically significant, survey results collected from individual project events generally were able to identify knowledge gaps (or potential knowledge gaps) in terms of basic terminology, environmental best practices in the urban residential context, sustainability principles, and access to local financial and informational resources. Survey results also provided an instant feedback mechanism for improving the quality and presentation of information at future workshop events.

2. Give people resources and knowledge in order to meet their own environmental needs. Participants heard presentations from local organizations and city representatives about several important urban environmental issues, and were able to interact extensively with presenters directly to ask questions and further clarify new information. They were also given free materials (e.g. weatherization kits, rain barrels) to begin implementing new knowledge immediately in their own homes. Lastly, showing participants how to implement strategies for resource conservation with the Demonstration House made transferring new knowledge to participants' own homes easier.

3. Increase awareness about resource use to conserve resources and cut utility costs. Learning new information regarding workshop topics and interacting with presenters showed participants how they could take better control of their resource use in simple ways, which could benefit them economically as well as decrease their impact on the local environment.

4. Put people in contact with services and programs that can help meet environmental needs. Residents who participated in project events were able to interact directly with representatives from local organizations and city officials who informed them of available services and programs related to each of the workshop topics.

Communication with Target Area Residents

Introduction

Communication with residents of the target area was an essential part of this project. It was essential to not only inform the target audience about the project, but to use the appropriate means and language to pique interest and encourage participation. During the planning phase, the project team discussed the best avenues for communicating with community leaders and partner organizations. The team determined that using multiple approaches would best ensure effective communication with the target area.

Introducing the project personally was agreed upon as the best method to attract high participation levels. The team needed ways to inform residents about the project that would provide opportunities for this. The team also did not know how prevalent Internet access and usage was in households within the target area, and so could not rely too heavily on online modes of communication. Ultimately, the following modes of communication were used to inform people about the project and to provide reminders of project events: distributing informational flyers and brochures door-to-door, signage on the demonstration house, verbal reiteration at every event or workshop, phone calls, e-mails, a project website, and announcements via Facebook. Below is a discussion of the usefulness and challenges of each approach in the context of this project.

Distribution of Flyers and Brochures

The SUN Project team's primary method of contacting target area residents about the project and events was by leaving flyers at their houses. Distributing flyers to each home individually was determined to be the simplest and most direct way to ensure that each household was informed about project events and how to contact the team for further information. It also provided the opportunity to meet residents and introduce the project to them personally. The project team thought this essential to building community support and interest in the project.

Flyers were distributed several days to a week before the subsequent event to all the occupied houses in the target area. In preparation for the Community-Q, the team distributed flyers a few days in advance to all the occupied houses in the target area. This first round of canvassing prior to the

Community-Q included the distribution of an introductory brochure along with the flyer announcing the event (see Appendix F, Figure 26 and Figure 27). This brochure explained the message and purpose of the SUN Project, described the events and workshops, provided a calendar of events, identified partner organizations, and provided contact and website information. On this first day of canvassing in the target area, the team attempted to personally make contact with each household in order to introduce the project and extend a personal invitation. Most people were friendly, if a bit wary, but many expressed genuine interest. Having learned fairly quickly that the most effective way to start conversation about the project was not by mentioning energy efficiency or saving money on utility bills, the team decided to launch a more effective introduction to the project by inviting the residents to a barbeque. While the team distributed flyers at each occupied house prior to all other events, they did not pursue conversation with residents at their homes after the initial canvassing.

This mode of communication presented a few challenges. First, significant manpower was required to place a flyer at each house in the target area. Secondly, and more importantly, houses in the target area had with flyers and advertisements from various sources, many still on the exterior of the property. Several houses had signs saying “Post no bills” and others had large piles of flyers that had never been picked up. Clearly this method of communication is already very common and could be viewed negatively or ignored by residents in this area.

As the summer progressed and the team spent more time at the Demonstration House and noticed several groups of people going door-to-door and leaving flyers. While posting flyers for one of the workshop events, a team member was approached by an individual claiming to represent a local green energy company. He told her that signing up for the company’s bill-paying service would significantly reduce energy costs. Skeptical of the representative’s motives, she questioned the man about the details of the service he was offering. When questioned, the man could not provide details about the service and proceeded to end the conversation. Events such as these highlight the importance of offering educational opportunities to increase awareness and prevent fraudulent organizations from taking advantage of residents. Because of the number and dubious quality of some door-to-door initiatives, the team understandably found some residents wary of canvassers. This problem indicates a communication challenge that must be overcome by any legitimate project in a neighborhood like this.

Phone Calls

The SUN Project team found that personal phone calls were helpful in reminding residents to attend the workshops. With each visit to the Demonstration House, visitors were reminded of upcoming events and encouraged to sign up with their email addresses and phone numbers. The phone number

provided proved to be a useful way to contact residents. Phone calls reminding them of the events that they had signed up to participate in were placed either the day before or the day of the event. Reminders were simple, friendly, and brief. A verbal mention of the topic, any giveaways, and that refreshments would be provided was included.

The SUN Project also received multiple phone calls from community members. Some residents called to ask about workshops, for other information about the project or resources, and to register for additional workshops.

Internet and E-mail

Information about the Detroit SUN Project was compiled on the website, www.detroitsunproject.org. The site contains basic information about the workshop topics, a calendar of events, a blog detailing the highlights of each event, photo albums, links to useful resources and partner organizations, team contact information, and team member information. In addition to the website, the team created a Facebook group through which events, photos, and updates could be posted. Prior to the Home Weatherization workshop, the Health and Environment Workshop, and the Rain Gardens, Rain Barrels and Storm water Management Workshop, an e-mailed announcement was sent over the Morningside Community Organization's e-mail list inviting the wider Morningside community to attend.

Most of the participants did not list e-mail addresses when giving us their contact information. Thus, the team did not pursue e-mail as a primary way of advertising workshops and other events. E-mail reminders were sent out for each event to those who did provide e-mail addresses, however. The Morningside Community Organization's e-blast announcements did succeed in bringing in additional participants to the later workshops. However, none of these residents lived in the target area and may represent a subsection of Morningside that uses e-mail for communication more frequently.

No direct inquires to participants about their Internet access or computer skill levels were made, so it is unclear if the project website was useful to participants. However, the team did notice a substantial increase in the number of hits the site received the day after flyers were first distributed in the neighborhood and brochures were handed out in person. This suggests that a significant number of households in the target neighborhood do have Internet access and were able to look up the website to read more about the project. Regardless of the use within the specific target area, the content on the website was intended to provide useful information for all Detroit residents and other organizations with similar goals.

The SUN project's Facebook group attracted 246 members (as of March 20, 2011). However, the majority of those appeared to be friends, family members, and colleagues of the SUN Project team members and people active in Detroit area non-profits. Very few of those participating in the workshops or other events joined the Facebook group.

Communication among participants

While originally intending to focus the project on the narrowly-defined target area, the project team discovered throughout the course of the project that this was not always practical. Although the workshop location was centered in the target neighborhood and the project team only distributed flyers to the target neighborhood, the project attracted a number of participants from other parts of Morningside and some from elsewhere in the city. Even though the target area did not always produce a lot of participants, some target area residents were enthusiastic about the workshop series, and they brought friends and family who were often from other parts of the city. When the team realized that the participants' social networks did not seem to correspond much with their neighborhood the team encouraged communication of the project's themes through these social networks.

Because supplies and funding were limited, and because the team did not know what participation level to expect at the outset of the programming, the team was unsure if it was possible to extend the invitation to the entire Morningside community. However, after completing the first few workshops, it was determined that the resources would in fact allow us to invite the broader community (through the Morningside Community Organization's e-blast newsletter) due to relatively low participation numbers within the target area. Although expanding this invitation to participate to the broader community was a deviation from original plans to serve the targeted area, the team decided that expanding the educational impact of the program superseded the concept of concentrating efforts on a small target area. The team did not have trouble accommodating the additional workshop attendees. In fact, this allowed for maximum distribution of educational materials (i.e. weatherization kits, rain barrels, etc.). Additionally, the Morningside community uses a bulk e-mail system which allows for rapid and widespread communication among participating residents. Following the announcement of the Detroit SUN project through this e-mail system, the last workshop quickly filled up via phone and e-mail communication. This allowed the team to discuss the message of the project with a larger audience, even if they did not participate in the entire program.

Booklet Publication

The results from the workshop surveys indicated a need for increased access to educational opportunities involving resource conservation and other environmental topics. Understanding the

limitations of providing information in a Web-based format, as well as the short-term nature of the workshop series, the team chose to create an educational booklet to compile the findings, resources, and educational elements for distribution to interested community groups and individuals.[12] The booklet is essentially a synthesis of information learned in the workshops, put into an easily readable format. It also includes contact information for local services and organizations that can help residents meet their resource conservation needs. While the resource conservation tips are applicable to any city, the resources and contact information are Detroit-specific. It is meant to help people continue to implement what was learned in the workshops, and to serve as a template that any organization could make specific to their location.

The booklet consists of eight different sections. Section 1 contains the Introduction which provides a brief explanation of the expression "sustainable urban neighborhoods" and uses a Venn-diagram to represent visually the intersection of the three principles that define sustainability (Economics, the Environment, and Social Equality). Section 2 gives a brief explanation of the purpose of the information presented in the booklet and provides a list of symbols used throughout the booklet. Sections 3 through 7 are broken down further by the topics that were presented in the workshops. These include: Recycling-Illegal Dumping-City Services, Home Energy Efficiency and Weatherization, Water Conservation in the Home, Water Resource Management, and Human Health and the Environment. Every section contains a brief introduction with resource conservation facts, which is followed by a list of tips for conserving resources. Each section also includes a list of local services and organizations with associated contact information. Local organizations listed in these sections include those that participated in the workshops and other organizations identified through additional research efforts. The final section of the booklet contains a list of additional local resources for topics that are connected to, but that were not overtly discussed, in the workshops. These topics include: environmental justice, environmental enforcement, and resource recovery.

[12] An example of the difficulty with existing online resources via Michigan state websites: both the Department of Human Services (DHS) and the Department of Energy, Labor and Economic Growth (DELEG) contain information in on their websites about Michigan's energy assistance programs, yet the DHS website (Michigan Department of Human Services, 2011b) seems visually outdated and difficult to navigate. Finding general information about eligibility and how to apply to the programs is not intuitive and requires a concentrated effort to navigate the websites. The DELEG website (Michigan Department of Energy, Labor & Economic Growth, 2011) contains much more information yet is still a bit overwhelming visually. In comparison to informative, user-friendly federal energy assistance program websites, the Michigan websites seem sub-par, adding to the difficulty of accessing and understanding information about residential energy assistance programs.

Demonstration House Energy Analysis

Introduction

As an additional component of the project, the team performed an energy consumption analysis on the Demonstration House. The goal of this analysis was to calculate the economic and environmental benefits of various levels of appliance upgrades and weatherization techniques to reduce resource consumption. This included weatherization materials similar to the types distributed at the Weatherization workshop, and more efficient weatherization materials and appliances. In order to calculate these benefits the team contacted the local utility company, DTE Energy, and requested historical energy use data for the Demonstration House and for the target area. However, as attempts to gather this data from DTE and other sources proved unsuccessful, the team instead opted to utilize an existing Web-based program to calculate hypothetical energy use outcomes.

Home Energy Saver Program

Using Lawrence Berkeley National Laboratory's (LBNL) Web-based Home Energy Saver (HES) program, the team calculated the economic and environmental benefits of installing selected weatherization upgrades and energy-efficient appliances in the Demonstration House. This program was created by the LBNL for the US Department of Energy to serve as an educational tool for homeowners and renters to reduce energy use in residential homes. The program calculates estimated energy consumption and dollar savings from installing selected home weatherization and energy-efficient appliance upgrades. Benefits are calculated in terms of avoided CO_2 emissions (lbs) and savings of electricity (kWh), natural gas (therms), and money (dollars).

The HES program was chosen because its objectives aligned well with the project goals. The HES program's objectives are as follows: 1) "Cost-Effective National Energy Policy," 2) "Maximal Consumer Benefits", 3) "Widespread Applicability", 4) "Objectivity & State-of-the-Art Energy Modeling," 5) "Transparency of Assumptions," 6) "Use of Latest Internet Technology," and 7) "Ease of Use" (DOE, 1999). The program also averages nearly 900,000-hits per year, and has received numerous awards and extensive national media coverage. Additional information pertaining to the models used in the HES program can be found in "Home Energy Saver: Documentation of Calculation Methodology, Input Data, and Infrastructure" (Mills et al., 2007).

Demonstration House Energy Analysis

The HES program offers two levels of analysis, a basic level and a more-detailed level. The team chose the basic level for the home energy analysis since the more detailed level required professional knowledge outside the scope of the expertise regarding the specific building materials used in the

construction of the home. Demonstration House characteristics used in the model can be found in Appendix G. The team entered the Demonstration House's characteristics into the program and ran several analyses to test the program's sensitivity to changes in age and number of home occupants. For each test analysis, parameters were changed to reflect different configurations of individuals living in the Demonstration House. Test results indicated that the models were not overly sensitive to minor changes in the number or age of people living in the home, so the team decided to model the analysis on the energy consumption patterns of a family of four people (one child (0-5 years), one child (6-13 years), and two adults (14-64 years)).

In order to compare the costs and benefits of the program's home weatherization and energy-efficient appliance upgrades, weatherization and appliance upgrades were selected based on three different payback periods (5-, 10-, and 20-years). The selection of three different payback periods allowed for increased flexibility in using the results from the analysis for developing future policy recommendations. Policies targeting renters may incentivize upgrades in the 5-year category while policies targeting homeowners may incentivize upgrades in the 10- or 20-year category. Figure 28 identifies the upgrades included in each of the three payback periods.

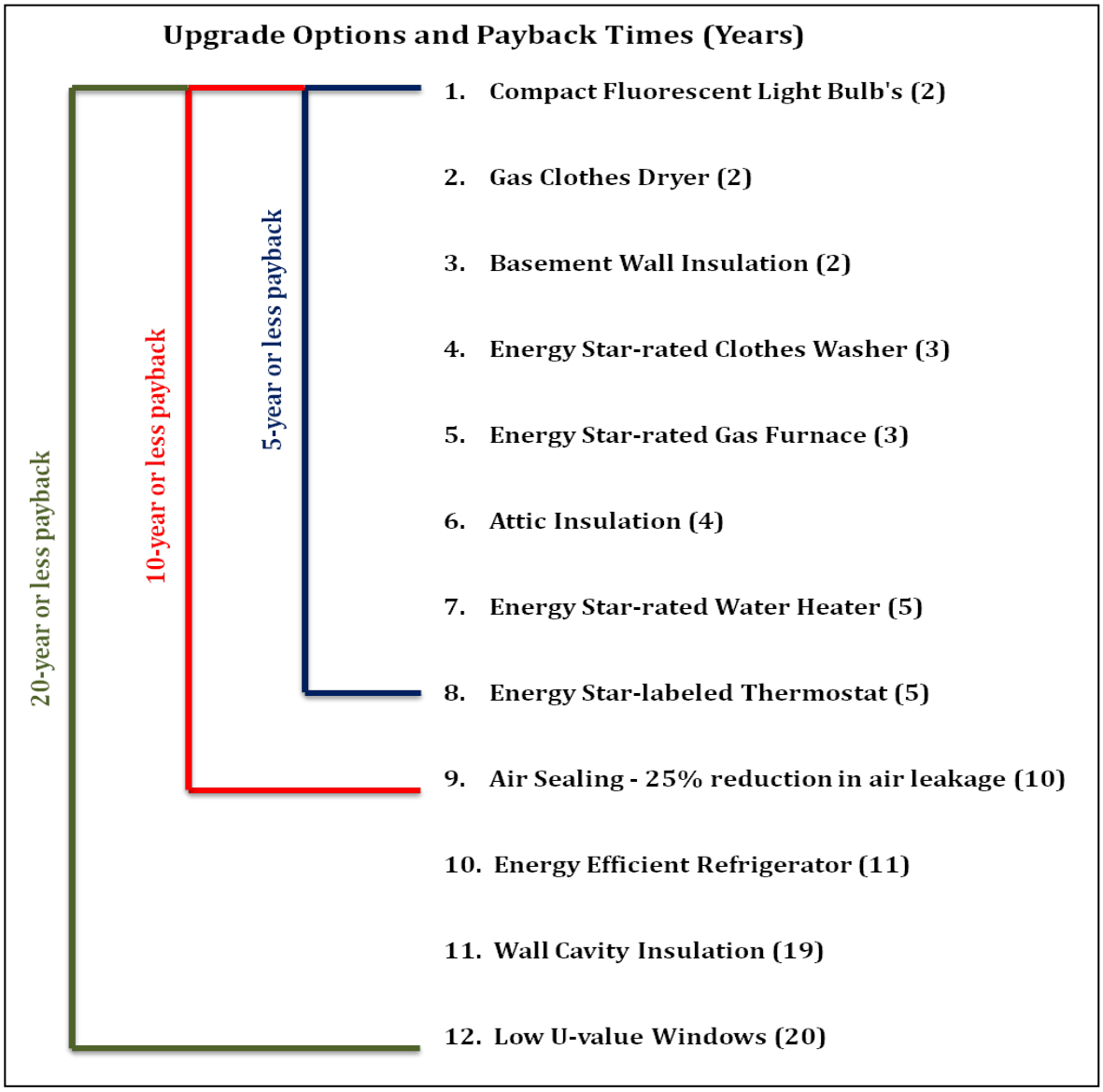


Figure 28. Home energy efficiency upgrades for payback periods of 5-, 10-, and 20-years.

Results

Estimated savings in terms of electricity (kWh), natural gas (therms), money (dollars), and avoided CO_2 emissions (lbs) are summarized in Table 2, Appendix H. Overall, results from the HES analysis indicated a range of annual dollar savings from $945 to $1,218. Electricity savings ranged from 2,583 kWh to 3,224 kWh and natural gas savings ranged from 729 therms to 953 therms. In terms of CO_2 emissions, the installation of selected weatherization and appliance upgrades indicated a range of annual reductions from 12,552 lbs to 16,172 lbs of CO_2. This is equivalent to between 6.28 and 8.09 tons of CO_2 emissions.

The results from the 5-, 10-, and 20-year energy analysis on the Demonstration House were used to estimate the benefits for all 137 occupied, single-family homes in the project area. Results for this analysis were calculated by multiplying the 5-, 10-, and 20-year totals for the Demonstration House by 137 homes. The estimated annual dollar savings for the project area ranged from $129,465 to $166,866. Electricity savings ranged from 353,871 kWh to 441,688 kWh while natural gas savings ranged from 99,873 therms to 130,561 therms. Annual reductions in CO_2 emissions ranged from 1,719,624 lbs. to 2,215,564 lbs. of CO_2. This is equivalent to between 860 and 1,108 tons of CO_2 emissions. Full HES output for the 5-, 10-, and 20-year analyses can be found in Appendix I.

Discussion

Trends in Energy Consumption and Pricing

As shown by the graph in Figure 29, Michigan's residential electricity consumption has steadily increased at a rate of 2% since the 1970s.

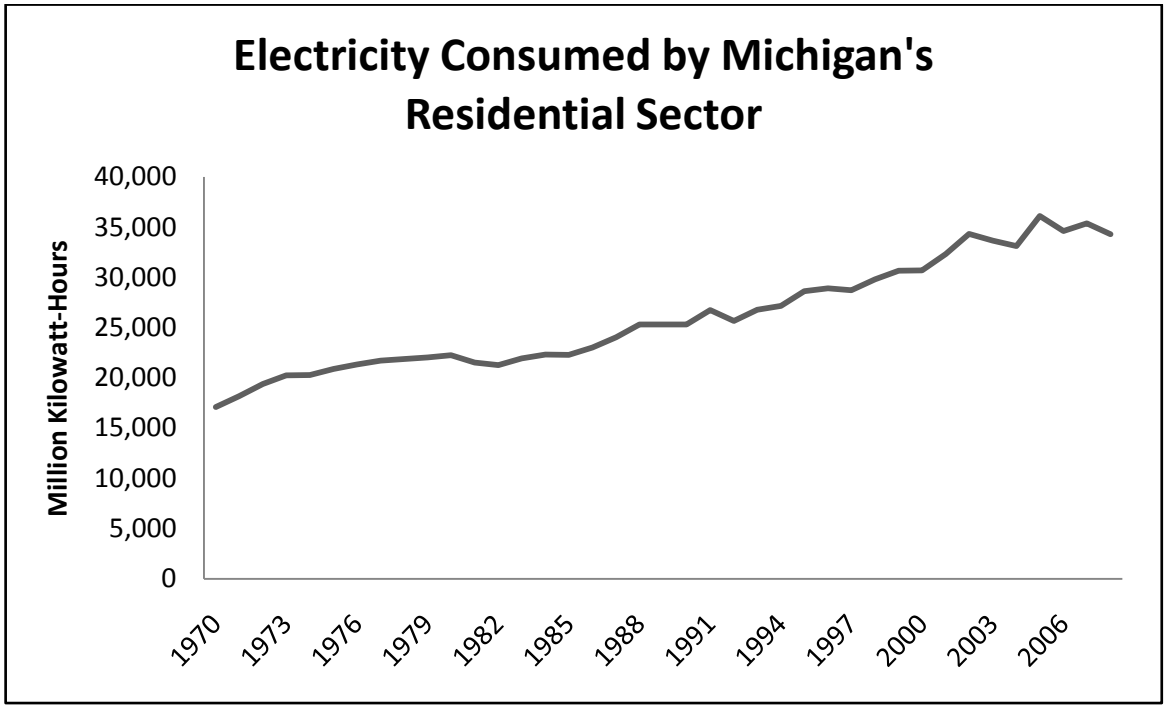


Figure 29. Electricity Consumed by Michigan's Residential Sector. Source Data from State Energy Data System (SEDS)-Michigan. (2010). http://www.eia.doe.gov/emeu/states/state.html?q_state_a=mi&q_state=MICHIGAN

This rate of increase is consistent with the 65% increase in US residential housing size (from 1,500 to 2,479 ft^2) from 1970 to 2007 (Center for Sustainable Systems, 2009). The increase in housing size from 1970 to 2007 resulted in increased energy requirements for home heating and cooling, water heating,

and lighting. This increase in demand for electricity is one of the driving forces behind the significant increase in the average price of electricity (see Figure 30).

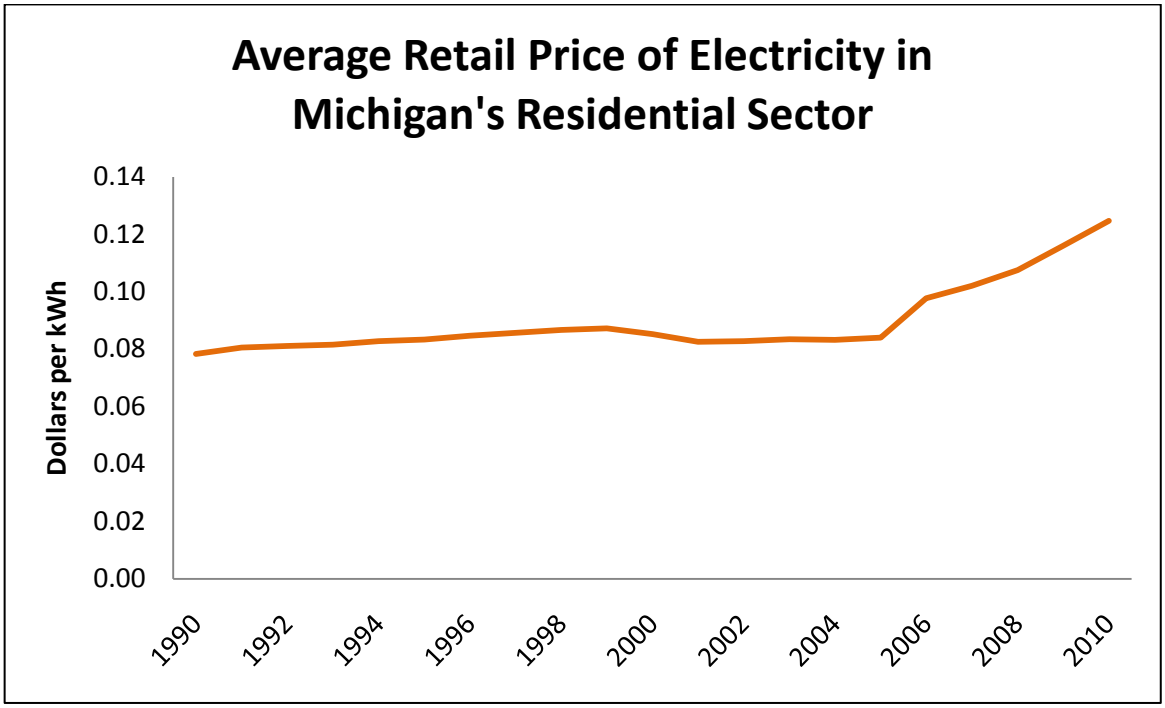


Figure 30. Average Retail Price of Electricity in Michigan's Residential Sector. Source Data from State Energy Data System (SEDS)-Michigan. (2010). (U.S. Energy Information Agency, 2010).

Before 2004, electricity prices averaged an annual increase of 0.5%. Between 2004 and 2005, the average price of electricity increased by 16%. Since 2005, the average price has increased annually by approximately 8%. This marked increase in the price of electricity poses a significant threat to the financial stability of residents in the project area.

The average size of the homes the project area is about one-third the size of the average new construction and therefore has less square footage requiring energy for heating and cooling (Center for Sustainable Systems, 2009). However, older homes are generally less efficient per square foot because newer buildings have been built with today's improved efficiency standards; consequently, these older homes have more gains available to them through simple weatherization for this reason. Further, increasing energy prices continue to threaten the financial stability of this low-income community. This is a prime example of the need for incentivizing home weatherization and energy-efficient appliance upgrades in the project area, as well as improving access to educational materials with clear and relevant information.

Policy Implications

The energy analysis conducted on the Demonstration House provided us with valuable data pertaining to the economic and environmental benefits of installing home weatherization and energy efficient appliances in the target area. The results from the analysis indicated an estimated annual savings of between $129,465 and $166,866 for the entire project area. In theory, the money saved from installing the home weatherization and energy-efficient appliance upgrades could be reinvested into the community. This would result in increased financial stability and security for residents located in the target area.

Understanding the implications of the analyses and the potential for weatherization and appliance upgrades to improve the stability and security of low-income communities, local policymakers could use this information to create policies that incentivize the purchase and installation of home weatherization and energy-efficient appliance upgrades in low-income communities. A list of locally available home weatherization incentives can be found in Appendix J, Table 3. However, it is often unclear which weatherization upgrades best balance economic and environmental benefits. That said, the project team analyzed the options and organized them in such a way to increase understanding of costs and benefits in returned value (see Figure 31).

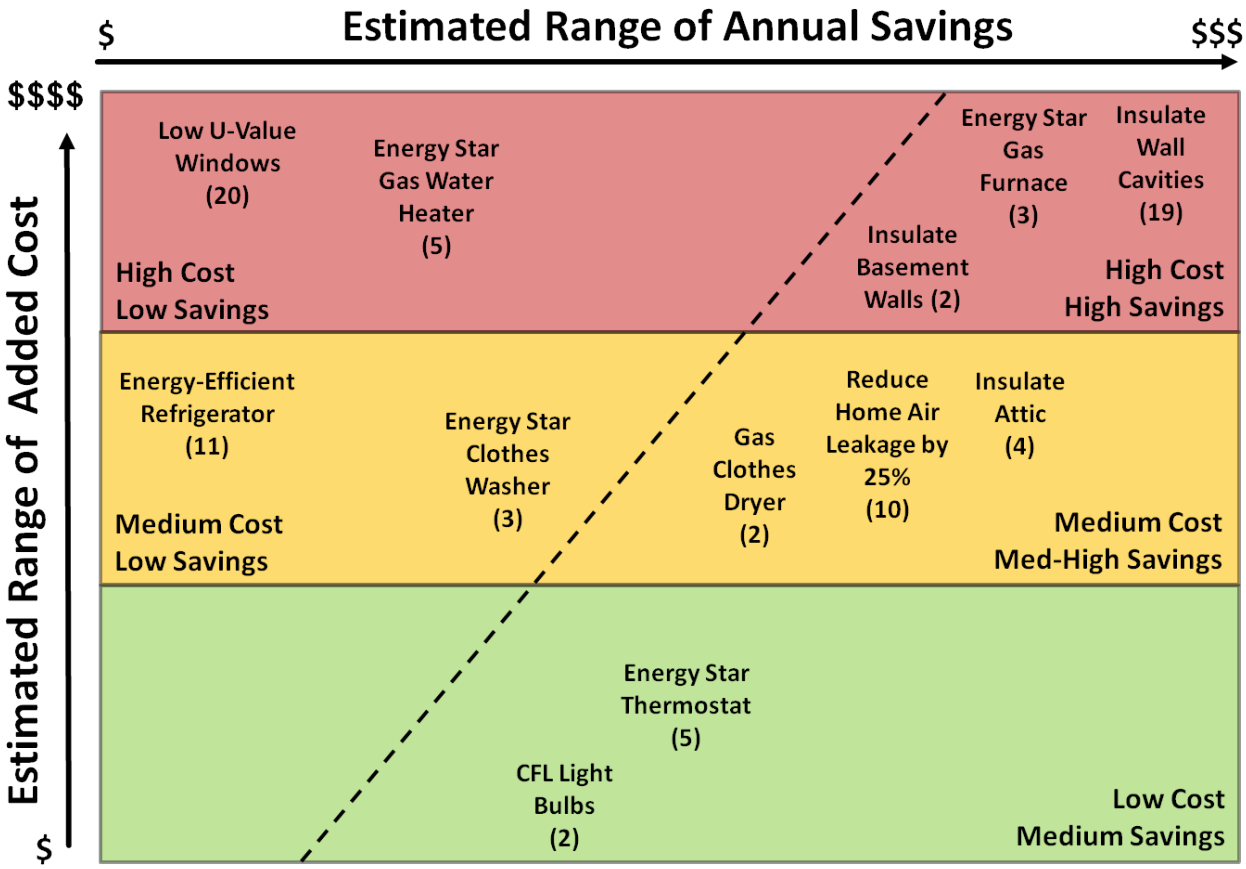


Figure 31. Estimated range of added cost and benefit for each upgrade modeled in the HES analysis. Numbers in parenthesis are the payback periods for each upgrade.

The upgrades located to the right of the dotted line offer the best economic opportunity for local policymakers to incentivize the purchase and installation of home weatherization and energy-efficient appliances in residential homes located in the project area. These upgrades typically have a lower cost of investment, a lower payback period, and higher annual benefits. The upgrades located to the right of the dotted line and inside the lower two boxes offer medium-to-high annual savings with a low-to-medium initial cost of investment and short payback time. The team therefore recommends policies to incentivize the purchase and installation these items since they maximize economic benefits for homeowners and renters in the project area. Upgrades located to the right of the dotted line and inside the upper right corner of the diagram offer a significant amount of annual savings; however, the initial cost of investment is very high. The high cost of investment for these items may prevent many of the low-income residents in the neighborhood from purchasing these types of upgrades. This is another example of an opportunity for local policymakers to offer financial incentives to low-income residents to assist in reducing the economic burden of increasing energy prices. The upgrades located to the left of

the dotted line have a medium-to-high cost of investment and do not offer a significant amount of annual savings. The team suggests that local policymakers avoid creating incentives for upgrades such as these due to the limited amount of financial savings provided to the homeowner or renter.

Overall, the team found that while a mix of incentives and efficiency options exist for residents, they are often not the most cost-effective solutions for the target population, are difficult to implement (i.e. many steps and/prolonged waiting periods for incentive fulfillment), and do not take advantage of the highest return on investment. These issues can be overcome by increased education and communication, targeted programming (specifically towards the most beneficial efficiency upgrades), and efficient incentive programs.

Conclusion: Project Successes, Challenges, and Recommendations for Future Work

In teaching strategies for resource use reduction and cost savings, addressing community and environmental issues, and building community among residents, the Detroit SUN Project offers an approach to sustainability education and urban revitalization in low-income urban edge communities. The approach is unique in that it not only provided useful information relevant to their community's environment, but connected residents directly with local resources and organizations to help meet environmental needs. The Demonstration House was an important element and was critical to the success of the project as an educational tool and event venue. Ultimately, promoting sustainability involves addressing simultaneously the economic, social, and environmental issues confronting such communities. In conclusion, the project team offers the overall successes of the project, as well as the challenges that the project team faced, so that others might learn from this work. Finally, the team makes several recommendations based on the project's findings for future programming in similar communities.

Project Successes

The overall success of the workshops is difficult to measure, especially since the project team did not have the resources to follow up with participants to see if they have implemented the knowledge they gained through the workshops. Furthermore, given the low number of respondents to the surveys, the team was unable to make any statistically significant statements about the knowledge level and interests of the target community. However, as previously described, the survey results still prove qualitatively interesting and informative. They are able to indicate potential knowledge gaps

regarding workshop topics, and gaps between community needs and available services. This kind of information is useful to others planning education programs or offering services in these communities.

The team thinks that the workshops were able to meet the above-stated goals by providing a direct communication link between city officials and helpful organizations and members of the community. For example, residents were able to talk directly with the Director of the Public Works Department about waste management issues and illegal dumping, and representatives from DTE offered a free in-home consultation to determine weatherization needs for residents. The team was also able to provide physical materials in addition to information, such as weatherization kits and rain barrels, to ease implementation of knowledge learned at the workshops. Thus, the team considers the project events to be successful overall.

This success is further supported by feedback from the workshop presenters. Following the conclusion of the workshop series, a follow-up survey was sent to the workshop presenters. The purpose of this survey was to get feedback from the presenters on the workshop series and its venue, the Demonstration House. Five surveys were returned. They are discussed here to give the presenters' perspectives on the effectiveness of the workshop series. In general the responses indicated that the presenters had positive experiences with the workshops. The scores given (from one to 10) for the success of each workshop ranged from seven to nine.

The Demonstration House was viewed very positively as a workshop venue by all respondents. They used language such as "Showing folks how to use the weatherization kits on site is a powerful thing," "this was my favorite venue ever," " [the house] allowed for practical application of the workshop goals at a location easily accessible to the audience," "the Demonstration House allowed me to 'demonstrate,'" and other similar language. Comments generally fell into two types: those commending the demonstration house for its convenience and familiarity to workshop participants, and those commending it for its usefulness in showing participants exactly how techniques discussed during workshops could be implemented in and around their homes.

From these surveys, the project team also learned that three of the five presenters who responded were contacted by one or more participants following the workshops for additional information or assistance. These were for home weatherization, recycling, storm water regulations/volunteering with water quality, and rain barrels.

Project Challenges

We also experienced a number of challenges in fulfilling the purpose of the workshop series. The presenters all came from outside the community, as the team members lacked the time to seek out

individuals from the community with knowledge of the workshop topics. The team's initial research showed that communication can be more effective between members of the same community. Especially since the project addressed behavior changes, this may have helped the information presented in workshops better reach participants. One presenter highlighted the lack of local resident knowledge in the implementation in the workshops, that residents speaking alongside organizational representatives would be more effective.

In addition, the scale of the project was both an advantage and disadvantage. The small setting was friendly and familiar, and participants were able to interact directly with presenters. This was of utmost importance in addressing knowledge gaps and answering individual questions. The team intended the project to be carried out in a small area, believing that concentrating the focus of multiple resources and organizations on one area could produce marked change in that specific area (rather than scattered efforts over larger areas). However, the number of people that the team could potentially have involved was limited, and many of them were not actually residents of the target area.

The short temporal scale of the project also impacted its effectiveness. Due to time and budget constraints, as well as other unforeseen obstacles, the team was limited to working in the project area for two months. Residents had the opportunity to participate only once in each workshop. The effectiveness of the project as a whole might have been increased had the project been able to offer weekly workshops for a longer period of time. The team members are concerned that the transient nature of the project may also have been viewed negatively by some, a view shared by at least one of the workshop speakers in the follow-up presenter survey.

Recommendations for Future Work

In closing, the Detroit SUN Project team would like to make several recommendations for other initiatives involving environmental education and resource conservation in low-income urban communities. These recommendations arise from reviewing background research, the project planning and implementation process, the team's observations from interacting with residents and working in the target community, and finally interacting with partner organizations. Ultimately, the Detroit SUN Project served as a pilot project for a new approach to environmental education in urban edge communities. The team hopes that the experience can inform similar projects in the future.

Scale up the approach

While the project focused on a small target neighborhood, the project team thinks an organization with more resources would offer a greater impact by providing similar educational programming on a larger scale. Scaling up the approach would involve establishing a network of

demonstration houses, so that educational programs could be held in multiple convenient locations for residents. The demonstration houses could serve not only as education centers and demonstration tools, but maintaining multiple sites would be constant reminders in the city's landscape of the principles espoused in these programs. Furthermore, the current housing market in Detroit is such that properties could be acquired at a low cost for this purpose.

Additionally, many of the participants actually came from outside the target area. The project team found that residents' social networks did not correspond closely with their immediate geographic neighborhood, and that they were inviting friends and family from other communities to attend project events with them. While the team members originally intended to concentrate their efforts in a small, manageable target area, they now recognized that an organization with greater resources could have a city-wide impact by scaling up the program's educational approach.

A network of demonstration houses where similar events are held could help link different parts of Detroit's large communities, since creating and maintaining a sense of community and residents' involvement over an extensive area may be difficult. For example, while canvassing the area a week prior to the Community-Q, one of the residents the team talked to was surprised to learn that he lived in Morningside. This could be symptomatic of the lack of community in Morningside, and similarly large city quarters. It struck us that residents might not be as likely to participate in community education and improvement programs if they were unaware that they resided in that community. Moreover, people may not be as likely to participate if they do not personally identify themselves with that community. Thus, this educational approach, if employed on a greater scale, can provide opportunities for people to connect not only with the new information presented, but with each other.

Include broader range of resource conservation (or other) topics

Our workshops focused on five different environmental themes important for an urban community; however, there are myriad topics that could be addressed in workshop form. Some of the messages touched on during the workshops could make entire workshops themselves, such as home gardening, uses for vacant lots, and others. For example, vacant lots offer a great opportunity for planting a native plant garden (see Appendix K). Another topic that the team thinks would be useful involves education about existing incentives for home weatherization. The team envisions an entire workshop devoted to teaching residents about all free weatherization programs and available incentives for purchasing energy-efficient appliances. Assistance would also be provided for filling out forms and signing up for such incentives.

Establish a strong connection with community leaders

One reason this community was selected as a target site was the presence of a central community organization. While the partnership with the Morningside Community Organization did not prove as fruitful as the project team would have liked, getting to know members and leaders of the organizations was a way to gain access to, and acceptance from, the target community. The project team were also able to learn about the target community though interacting with residents at community organization meetings and through conversations with the organizations leadership. Establishing such a relationship also gives credibility to an outside group such as ours.

Maintain a sustained presence in the community

One of the presenters' surveys contained a comment about the short-term nature of the project. It said that the project has left no legacy in the community, and that this sends a message to the community as much as having done the project there at all. While the project team did not have the resources to maintain an ongoing program in the target area, it is a valid criticism. While the project team was able to quickly establish a relationship with some residents, the impact of this project would have been greater, and the team may have been able to reach many more people had it been able to maintain a presence in the community for a longer period of time. Given a longer presence in the community, the project may have been able to address more substantial issues such as vacant land and blight given more time and resources. Additionally, a short-lived program may not live long in people's memories. Communities like the target area need significant economic support in moving toward sustainability. Future projects that use sustainability as a guiding principle will need to consider the relationship between depth of impact and duration of the project. The team thinks that the approach has enormous potential to positively impact communities, and cannot fully be realized in a two-month program.

Create policies that subsidize the purchase of costly home upgrades

Many low-income communities reside in aging housing stock that could benefit greatly from home efficiency improvements. Programs do exist for free home weatherization along with rebate incentives for appliance upgrades. According to Figure 5 such a program could be aimed at strategies like home insulation and purchasing an ENERGYSTAR-rated furnace. These are medium to high cost efficiency upgrades that save significant energy in comparison to their costs. Subsidizing such upgrades could significantly reduce resource consumption and utility costs for these communities.

As part of this project, the team created a sample Appliance Mini-Grant Program targeted at the needs of residents located in the target area (see Appendix L). This is a program that the team designed

originally for appliance upgrades, in which residents would be provided with a significant portion of the up-front cost of an energy-efficient appliance in the form of a small grant, and would have to supplement the remaining amount by applying for rebates and other incentives. While this could not be implemented during the course of the project because of resource and time limitations, the team instead offered it as an example of the kind of policy or program that could be implemented to reduce resource consumption and costs.

Use multiple media routes for promoting resources

To encourage participation in a program like ours, an organization must use multiple routes of communication to reach residents. Websites cannot be relied on as the sole source, or even the primary source, of information about such a project. It was noted, for example, that many of the participants did not list e-mail addresses on the sign-up sheets. Canvassing and interacting directly with residents may be a better approach to reach residents without Internet access, or those who do not use it as a primary mode of communication. While each mode of communication has its benefits and drawbacks, as previously outlined in this paper, a greater number of residents can be reached if they can connect with the information in different ways.

"Workshop in a Box"

Lastly, the team envisions a resource that could be given to community leaders (perhaps to organizations like the Morningside Community Organization) to develop their own workshops on themes covered in the Detroit SUN Project and beyond. This resource would be a toolkit, or a "workshop in a box," that would provide curriculum and materials akin to the giveaways. The toolkit would also contain contact information for relevant, local organizations and services that might assist with workshop events, or provide further information and resources. With this toolkit, workshops could be held at any community location on any schedule. The project team would like to encourage organizations, such as the partner organizations, to collaborate and create these "workshops in a box" specific to the issues they deal with so that community leaders could request them on an as-needed basis directly from the most knowledgeable sources. This final recommendation would allow people to develop educational programming similar to this one that is geared independently for their home communities, specific to their communities' needs.

Appendix A. Maps of Target Area

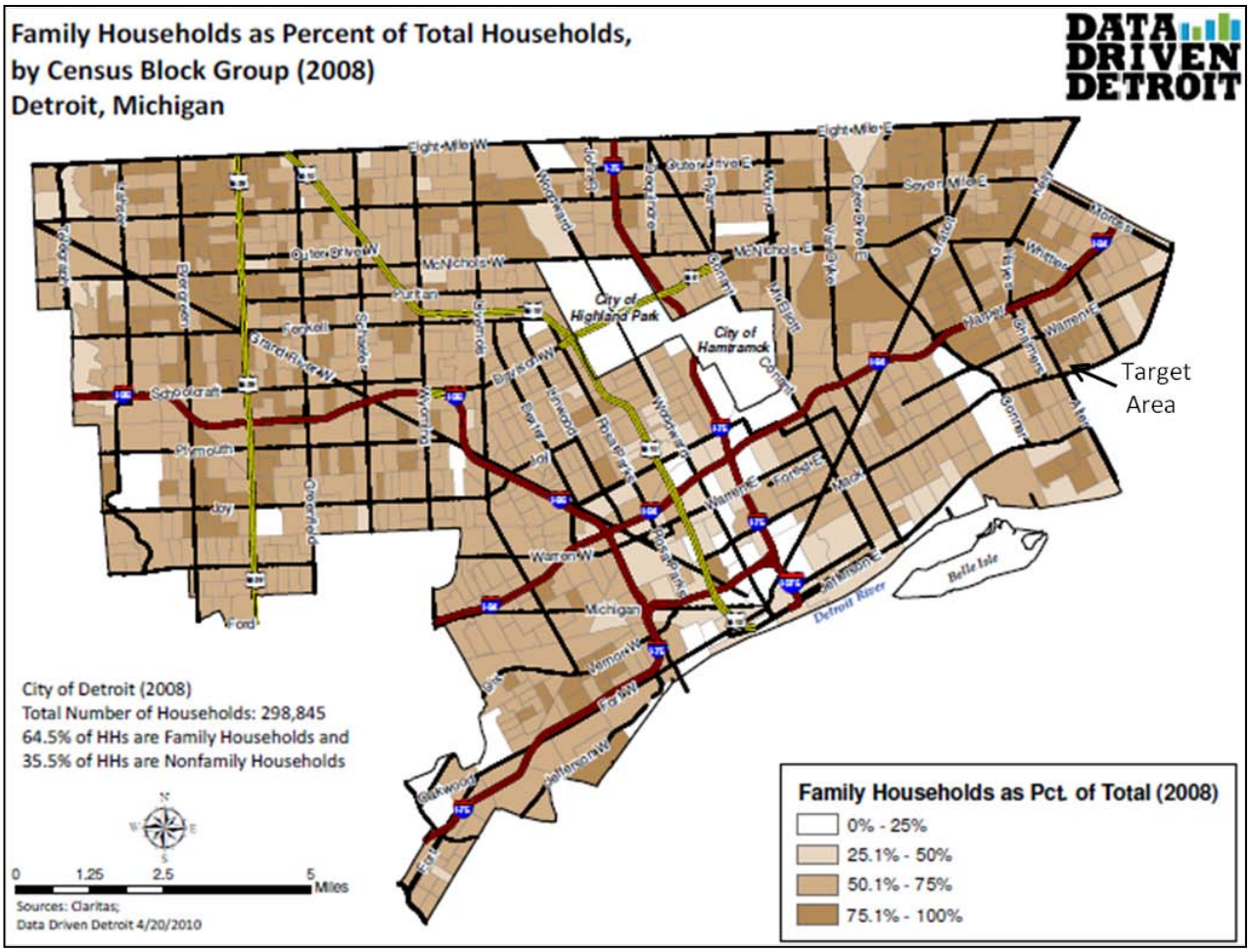


Figure 6. Family Households as Percent of Total Households, by Census Block Group (2008) Detroit, MI. http://datadrivendetroit.org/wp-content/uploads/2010/04/PctFamHH08BGMajRoads.pdf

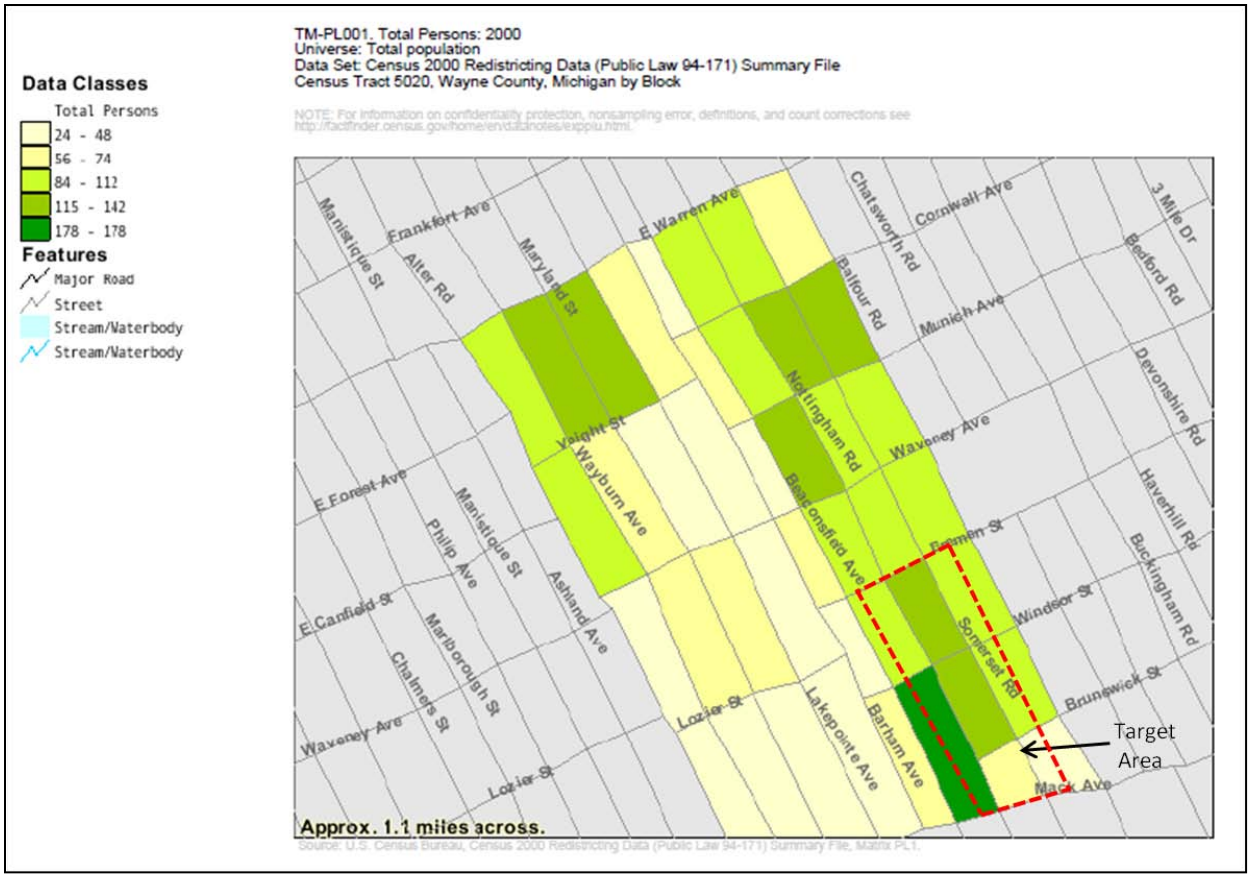


Figure 6. Total Population (2000 Census) http://factfinder.census.gov/servlet/DatasetMainPageServlet

Figure 9. Percent Persons Who Are Black or African American Alone (2000 Census). http://factfinder.census.gov/servlet/DatasetMainPageServlet

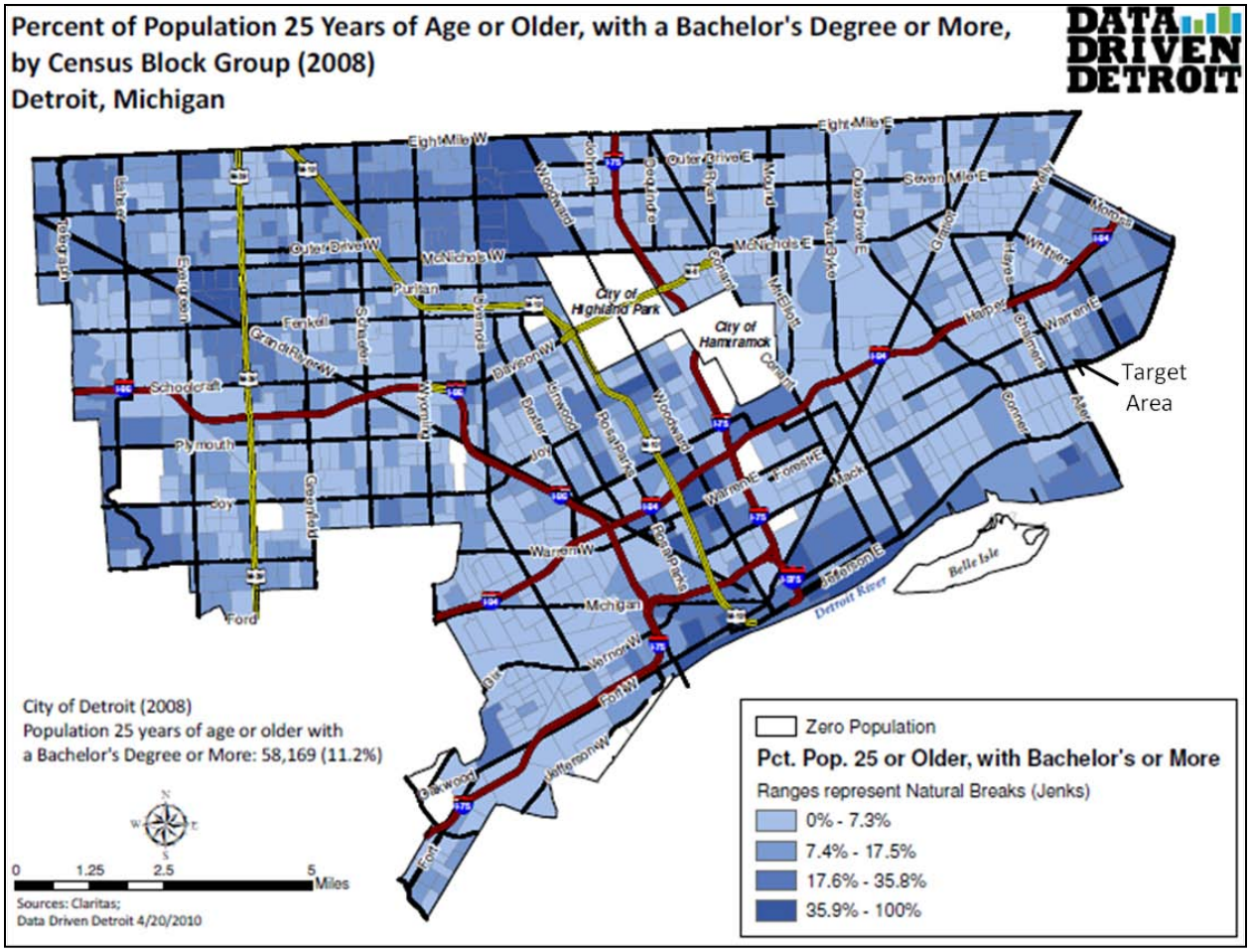


Figure 10. Percent Population 25 Years of Age or Older, with a Bachelor's Degree or More, by Census Block Group (2008) Detroit, MI. (http://datadrivendetroit.org/wp-content/uploads/2010/04/PctPop25PlusBachOrMore08BGMajRoads.pdf).

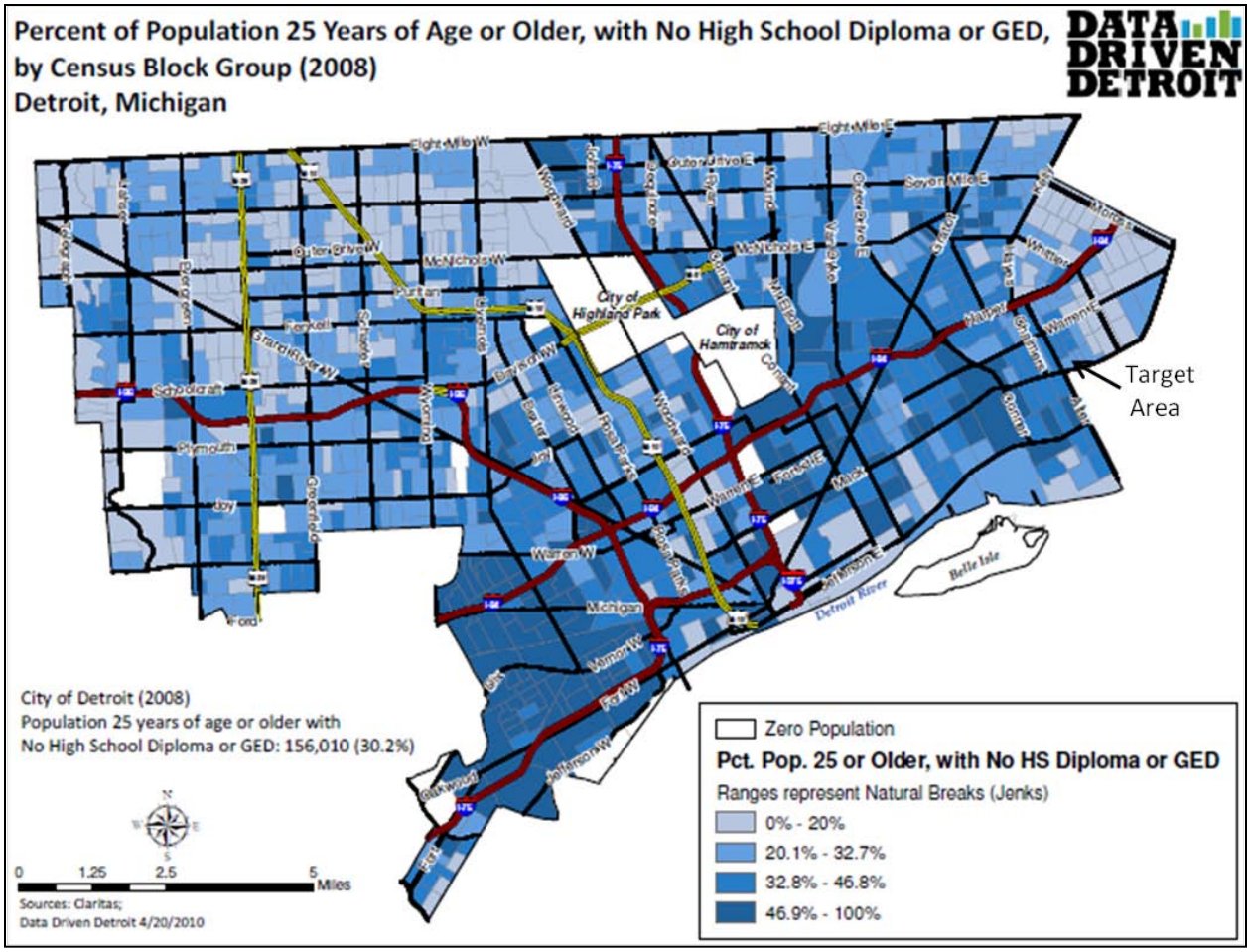


Figure 11. Percent of Population 25 Years of Age or Older, with No High School Diploma or GED, by Census Block Group (2008), Detroit, MI. http://datadrivendetroit.org/wp-content/uploads/2010/04/PctPop25PlusNoHSDip08BGMajRoads.pdf

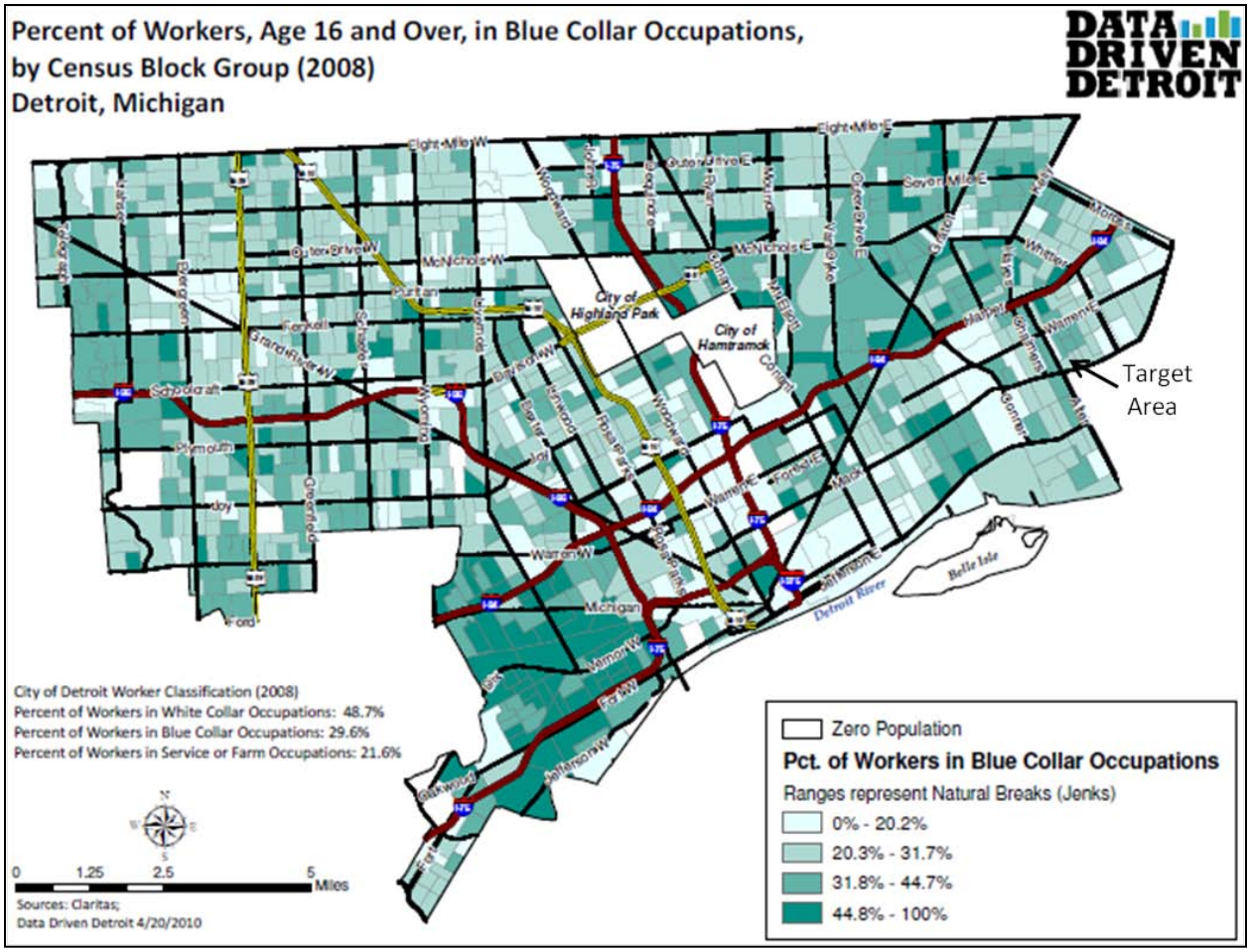


Figure 12. Percent of Workers, Age 16 and Over, in Blue Collar Occupations, by Census Block Group (2008), Detroit, MI. http://datadrivendetroit.org/wp-content/uploads/2010/04/PctBlueCollar08BGMajRoads.pdf.

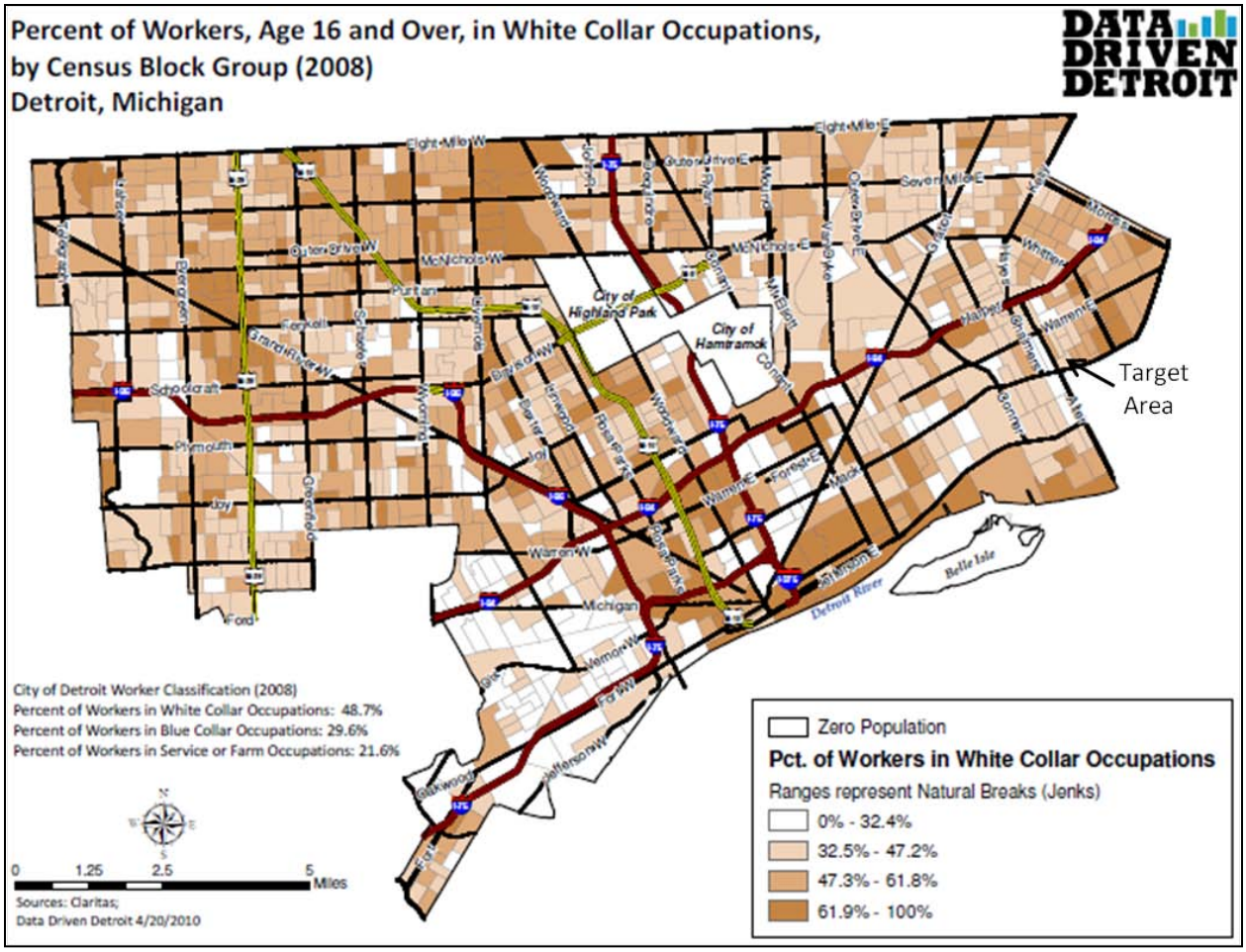


Figure 13. Percent of Workers, Age 16 and Over, in White Collar Occupations, by Census Block Group (2008), Detroit, MI. http://datadrivendetroit.org/wp-content/uploads/2010/04/PctWhCollar08BGMajRoads.pdf

Appendix B. Copies of Survey Forms

Detroit S.U.N. Project
Sustainable Urban Neighborhood
Community-Q Survey

What is your name (optional)? _____

What is your address? _____

Do you rent or own the house you live in?
- o Rent
- o Own

Including you, how many people live in your home? (1, 2, 3, etc.) _____

How many people that live at your home are *employed*? (0, 1, 2, 3, etc) _____

If employed, what are their occupations?

What is the biggest problem facing your neighborhood today?

What kinds of things would you like to see changed or fixed in your neighborhood?

Which of the following would you like to happen in your *home* (check all that apply)?
- o Lower your utility bills
- o Make your house less cold and drafty in the winter
- o Get newer, more efficient appliances
- o Have more recycling opportunities
- o Start a garden

Which of the following would you like to happen in your *neighborhood* (check all that apply)?
- o Clean up trash and dump sites
- o Tear down abandoned and burned-out houses
- o Prevent crime and vandalism
- o Start a community garden
- o Have better access to fresh food
- o Get to know your neighbors

Can we contact you in the future about our project? If so, please provide contact information (phone number, e-mail):

Detroit S.U.N. Project
Sustainable Urban Neighborhood
Recycling, Illegal Dumping, and City Services Survey

What is your name (optional)? _____

What is your address? _____

Are you concerned about litter and illegal dump sites in your neighborhood?

Do you pick up litter or clean up dump sites in your neighborhood?

Are you aware of any city or other services to help you clean up dump sites in your neighborhood?

Have you ever called the police to report illegal dumping?

Do you recycle?

If you do not recycle . . .
- Why not? (Don't know how, don't know where, don't have time, don't want to, etc)

If you do recycle . . .
- Why do you do it?

- What do you recycle? (paper, plastic, metal, glass, etc)

- Where do you recycle? (curbside, drop-off location, re-use at home, etc)

Do you wish you had more recycling opportunities?

After attending this workshop, do you feel you know how to get dump sites in your neighborhood cleaned up?

Do you plan to report any dump sites to get them cleaned up?

From attending this workshop, do you feel you have learned more about recycling opportunities?

Do you plan to recycle more in the future?

Detroit S.U.N. Project
Sustainable Urban Neighborhood
Water Use Efficiency and Responsibility

What is your name (optional)? _____

What is your address? _____

Do you pay your own water bill?
If so, about how much is your water bill each month?
Do you feel that this is too much or about right?

Do you own a dishwasher (yes / no)? About how old is it?

Do you own a washing machine (yes / no)? About how old is it?

How many toilets are in your home?
Are they very old (from before 1950, or original to the house), old (1950 – 1990), or new (1990 or newer)?

Have you ever bought a more water efficient appliance or toilet in order to save water or money?

Are you interested in getting a new dishwasher, washing machine, or toilet that is more water efficient?

- o No, I don't really care.
- o No, the ones I have are fine.
- o No, mine are already water efficient.
- o Yes, but I don't know how.
- o Yes, but I don't have the money.
- o Yes, I am planning to.

Before this workshop, had you ever heard of the ENERGY STAR, CEE, or EPA WaterSense labels?

Would you be willing to share your water bills with us to analyze for our project?

Have you ever thrown unused medicine down the sink or toilet?

Do you know how to properly dispose of unused medicine?

Have you ever dumped toxic chemicals (motor oil, paint, paint thinner, etc) into a sink or storm drain?

Do you know how to properly dispose of toxic chemicals?

Detroit S.U.N. Project
Sustainable Urban Neighborhood
Weatherization

What is your name (optional)? _____

What is your address (optional)? _____

About how much do you pay for electricity each month? _____
Do you feel that this is too much? (yes / no)

About how much do you pay for gas each month? _____
Summer: _____
Winter: _____
Do you feel that this is too much? (yes / no)

Is your house cold and drafty in the winter? (yes / no)

Did you know that DTE will send you a free weatherization kit if you sign up on their website? (yes / no)
If so, have you signed up for yours? (yes / no)
Did you install it? (yes / no)

Did somebody from DTE stop by your house a few weeks ago to sign you up for home weatherization? (yes / no)
If so, did you sign up? (yes / no)
If so, did they come and weatherize your home? (yes / no)

Have you ever tried to weatherize your home?

- o No, my home doesn't need it.
- o No, I don't have the money.
- o No, I don't have the time.
- o No, I don't know how.
- o Yes, I've done a few quick and inexpensive things.
- o Yes, I've invested time and money.

Where do you usually buy hardware and home improvement items?
_____

Would you be willing to allow the S.U.N. Team to monitor your electric and gas bills so we can see exactly how much energy and money you save? (yes / no)

Detroit S.U.N. Project
Sustainable Urban Neighborhood
Health & Environment Workshop

What is your name (optional)? _____

What is your address (optional)? _____

Where do you usually buy food (check all that apply)?

- o Grocery store *with* a full produce section
- o Grocery store *without* a full produce section
- o Convenience store
- o Fast food/restaurants
- o Farmer's market (Eastern Market, E. Warren Market, etc.)
- o Other_____

Are you happy with your access to grocery stores? (yes / no)

Which of the following do you usually eat (check all that apply)?

- o Fresh foods (fresh fruits, vegetables, meats, etc.)
- o Packaged foods (chips, boxed foods, canned goods)
- o Frozen dinners
- o Fast food

Do you grow food in your garden? (yes / no)

Do you try to buy food that is certified organic (grown without pesticides or other chemicals)? (yes / no)
Why or why not?

Do you try to buy food that is grown locally? (yes / no)
Why or why not?

Do the vacant lots or abandoned houses in your neighborhood affect your health? (yes / no)
If so, how?

What would you like to see done with vacant lots in your area (feel free to add your own ideas)?

- o Nothing. Just leave them.
- o Just keep them mowed.
- o Community garden
- o Playground
- o Neighborhood park
- o Build new houses
- o Build stores or restaurants
- o Other:_____

Detroit S.U.N. Project
Sustainable Urban Neighborhood
Rain Barrel Workshop

What is your name (optional)? _____

What is your address (optional)? _____

Do you pay your own water bill? (yes / no)
If so, about how much is your water bill each month?_____
Do you feel that this is too much or about right?

Have you ever had trouble with flooding in your yard or basement? (yes / no)

Have you ever heard of the Combined Sewage Overflow in Detroit? (yes / no)

Have you ever done anything in your home/garden to save water? (yes / no)
If so, what have you done?

Do you know what a rain garden is? (yes / no)
If so, have you ever made a rain garden? (yes / no)

Have you ever used a rain barrel in your garden? (yes / no)

Does your house have gutters? (yes / no)
If so, do they a) attach directly to the sewer, or b) flow out into the yard? (circle one)

Are there any vacant lots next to your house? (yes / no)
If so, would you be interested in turning a vacant lot into a wildflower garden? (yes / no)
If so, please leave us your contact info. We might have an opportunity for you.

Detroit S.U.N. Project
(313) 806-3311
detroitsunproject@gmail.com

Dear XXX,

The members of the Detroit SUN Project team are master's degree students in the University of Michigan's School of Natural Resources and Environment. The Detroit SUN Project itself is our master's project, and we would appreciate your feedback in order to help us with our project reporting and in making recommendations for future projects with a similar focus. Please answer the following questions and return this form to detroitsunproject@gmail.com or any member of the Detroit SUN Project team.

Name:
Organization:
Workshop:
Workshop date:

General workshop feedback

On a scale of 1 to 10 (10 being the best), how successful was your workshop? Please feel free to elaborate.

Has anyone who participated in your workshop contacted you for more information or to follow up?

Did anything surprise you about the workshop (questions you received, participant response, participant knowledge level, etc)?

The Demonstration House

The Demonstration House at 3975 Nottingham, where we held all our workshops, was a key component ofour the project. Please answer the following questions about the Demonstration House:

Did you like the Demonstration House as a venue for your workshop? Why or why not?

Did the Demonstration House help you present your workshop content? If so, how? If not, why not?

How did the Demonstration House compare with other venues in which you have held workshops, in terms of participant response?

Do you think having Demonstration Houses of a similar type in other communities in the city would be useful for educating citizens about your area of interest?

Additional comments

Please feel free to share any additional thoughts or comments here:

Appendix C. Photos and Signage From the Demonstration House

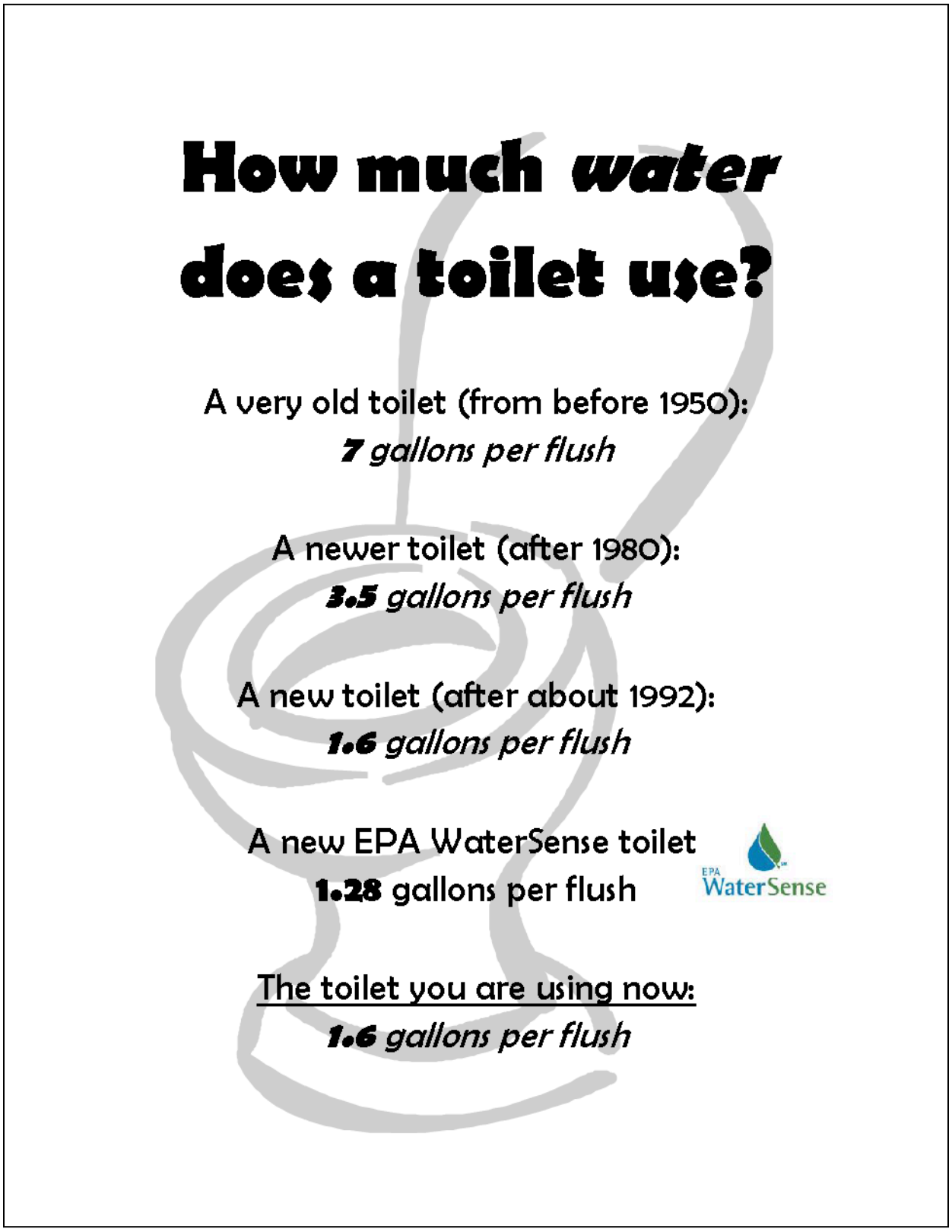


Figure 17. Toilet water use sign.

How to install

a Door Sweep

Door without door sweep:

Step 1: Make sure your door sweep is the right size. Cut it to length if it isn't.

Step 2: Clean the area.

Step 3: Screw in the door sweep with a drill.

Door with new door sweep:

Figure 18. How to install a door sweep.

How to install

Socket Insulators

Step 1: Remove the outlet or light switch cover.

Step 2: Put the foam insulation on the outlet or light switch.

Step 3: Replace the outlet or light switch cover.

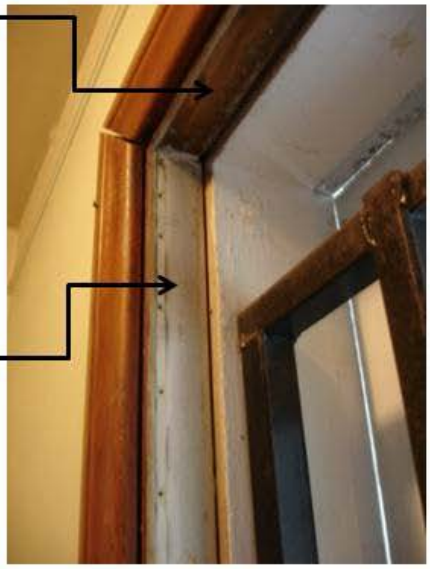
Figure 19. How to install socket insulators.

How to install

Weather Stripping

Has weather stripping

Needs weather stripping



Step 1: Check to see if your door or window needs weather stripping.

Step 2: Clean the area

Step 3: Peel and stick the weather stripping in place.

Figure 20. How to install weather stripping.

How to install

a Window Cover

Step 1: Clean the surface.

Step 2: Cut the strips to length according to the instructions

Step 3: Stick the strips in place. This is permanent!

Step 4: Stretch the clear sheet over the window.

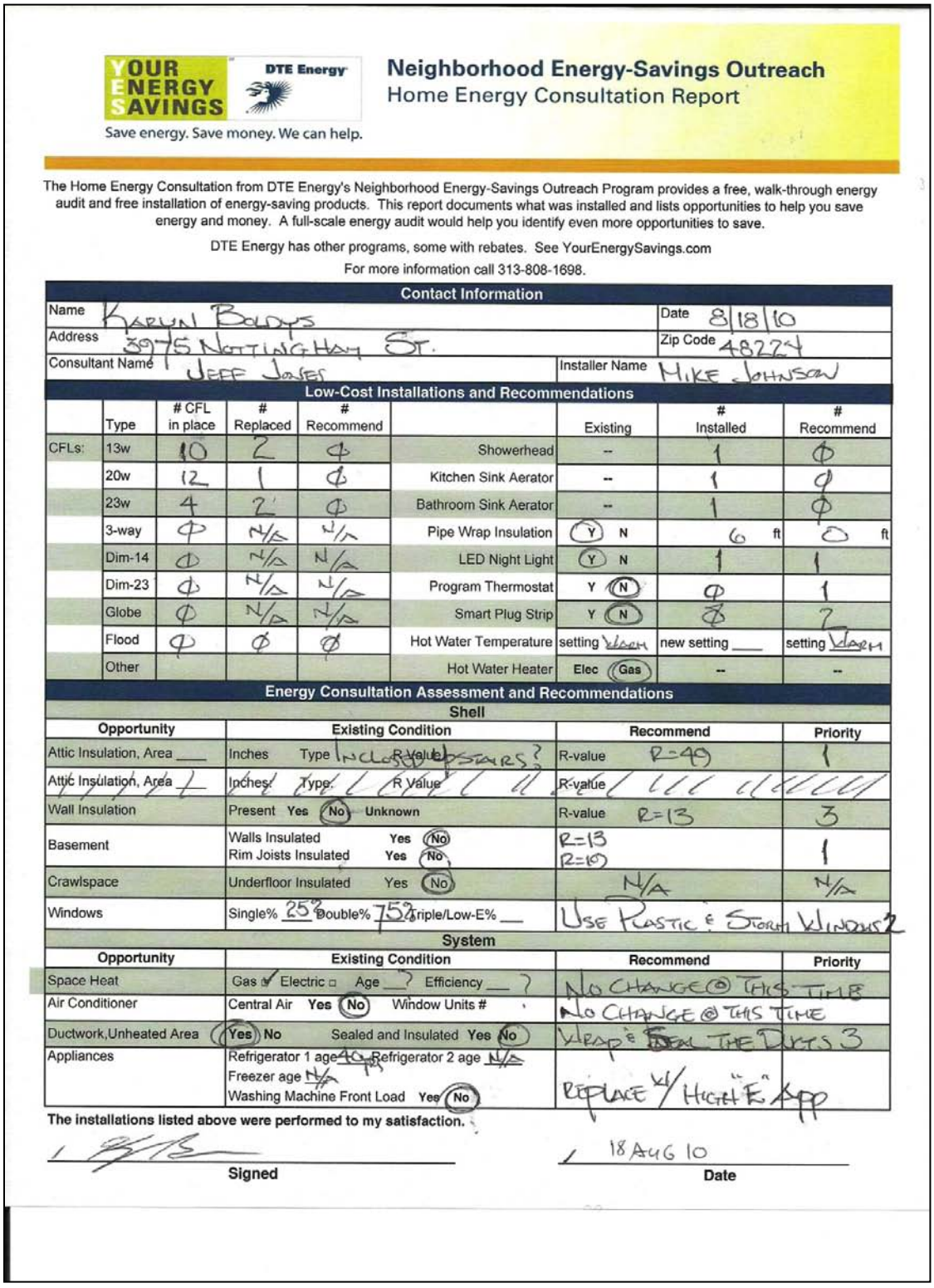
Step 5: Carefully tap the locking strip into place with a hammer.

Figure 21. How to install a window cover.

Figure 22. Signage near the kitchen sink in the Demonstration House pointing out the faucet aerator.

Figure 23. Display of weatherization materials in the Demonstration House.

Appendix D. DTE Energy Home Energy Consultation Report



YOUR ENERGY SAVINGS — DTE Energy

Save energy. Save money. We can help.

Neighborhood Energy-Savings Outreach
Home Energy Consultation Report

The Home Energy Consultation from DTE Energy's Neighborhood Energy-Savings Outreach Program provides a free, walk-through energy audit and free installation of energy-saving products. This report documents what was installed and lists opportunities to help you save energy and money. A full-scale energy audit would help you identify even more opportunities to save.

DTE Energy has other programs, some with rebates. See YourEnergySavings.com

For more information call 313-808-1698.

Contact Information

Name	KARYN BOLDYS	Date	8/18/10
Address	3975 NOTTINGHAM ST.	Zip Code	48224
Consultant Name	JEFF JONES	Installer Name	MIKE JOHNSON

Low-Cost Installations and Recommendations

	Type	# CFL in place	# Replaced	# Recommend		Existing	# Installed	# Recommend
CFLs:	13w	10	2	0	Showerhead	--	1	0
	20w	12	1	0	Kitchen Sink Aerator	--	1	0
	23w	4	2	0	Bathroom Sink Aerator	--	1	0
	3-way	0	N/A	N/A	Pipe Wrap Insulation	(Y) N	6 ft	0 ft
	Dim-14	0	N/A	N/A	LED Night Light	(Y) N	1	1
	Dim-23	0	N/A	N/A	Program Thermostat	Y (N)	0	1
	Globe	0	N/A	N/A	Smart Plug Strip	Y (N)	0	7
	Flood	0	0	0	Hot Water Temperature	setting WARM	new setting ___	setting WARM
	Other				Hot Water Heater	Elec (Gas)	--	--

Energy Consultation Assessment and Recommendations

Shell

Opportunity	Existing Condition	Recommend	Priority
Attic Insulation, Area ___	Inches Type INCLOSED STAIRS? R-Value	R-value R-49	1
Attic Insulation, Area /	Inches / Type / R Value /	R-value /	/
Wall Insulation	Present Yes (No) Unknown	R-value R-13	3
Basement	Walls Insulated Yes (No) Rim Joists Insulated Yes (No)	R-13 R-10	1
Crawlspace	Underfloor Insulated Yes (No)	N/A	N/A
Windows	Single% 25% Double% 75% Triple/Low-E% ___	USE PLASTIC & STORM WINDOWS	

System

Opportunity	Existing Condition	Recommend	Priority
Space Heat	Gas ☑ Electric ☐ Age ___ Efficiency ___ ?	NO CHANGE @ THIS TIME	
Air Conditioner	Central Air Yes (No) Window Units #	NO CHANGE @ THIS TIME	
Ductwork, Unheated Area	(Yes) No Sealed and Insulated Yes (No)	WRAP & SEAL THE DUCTS 3	
Appliances	Refrigerator 1 age 40+ Refrigerator 2 age N/A Freezer age N/A Washing Machine Front Load Yes (No)	REPLACE W/ HIGH "E" APP	

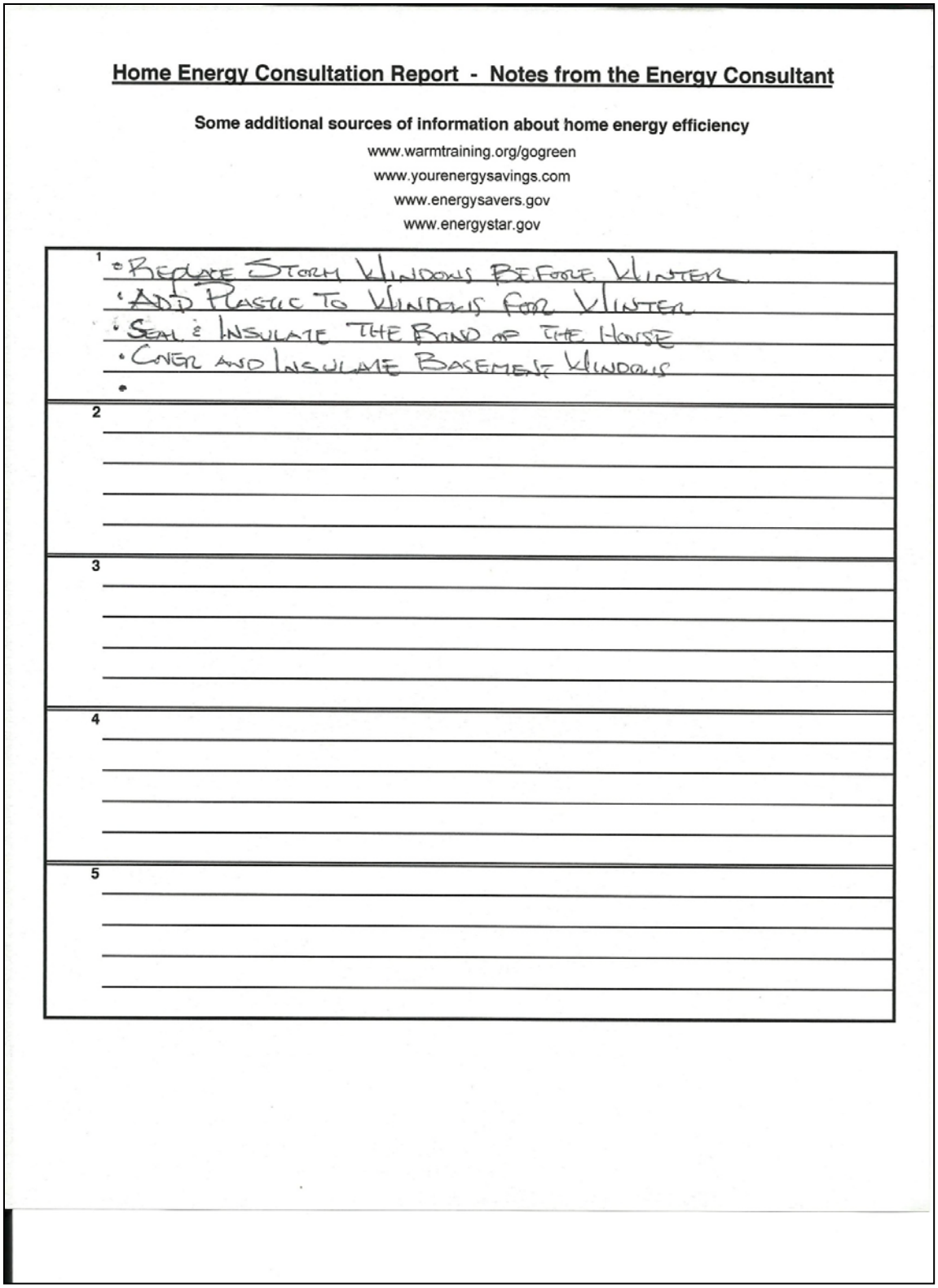
The installations listed above were performed to my satisfaction.

Signed

18 AUG 10

Date

Figure 24. DTE Neighborhood Energy-Savings Outreach Home Energy Consultation Report for the Demonstration House (page 1).



Home Energy Consultation Report - Notes from the Energy Consultant

Some additional sources of information about home energy efficiency

www.warmtraining.org/gogreen
www.yourenergysavings.com
www.energysavers.gov
www.energystar.gov

1
- REPLACE STORM WINDOWS BEFORE WINTER
- ADD PLASTIC TO WINDOWS FOR WINTER
- SEAL & INSULATE THE BAND OF THE HOUSE
- COVER AND INSULATE BASEMENT WINDOWS
-

2

3

4

5

Figure 25. DTE Neighborhood Energy-Savings Outreach Home Energy Consultation Report for the Demonstration House (page 2).

Appendix E. Transcribed Workshop Notes

Notes from the Recycling, Illegal Dumping, and City Services Workshop

While illegal dumping is not a priority for police, it seriously impacts communities. The concern for communities is small sites in alleys, empty lots, streets, etc. It is a health hazard, attracts rodents, causes blight, and is unsightly. Barham Street in Morningside is an example of a problem area; there are not many houses and it is very open, making an easy target for dumping. Big companies are under regulations for waste management, so dumping of household waste by residents and smaller businesses are the main problems. Illegal dumping is a crime and people can be prosecuted if caught in the act. People do this because it is the least costly way to get rid of unwanted materials. An example of such motivation is tire piles: proper disposal costs $1-$3 per tire, but a fraudulent disposal service may ask less and simply dump them in an improper place. It is also an education problem, since people simply may not know that services and locations do exist to dispose of particular wastes.

Wayne County's program for dealing with illegal dumping is CLEAN – County Lending Environmental Assistance to Neighborhoods. They can clean up dump sites and/or provide materials for residents to clean up dump sites themselves. An application is required for assistance from CLEAN. Two types of cleanups can be provided. They can send a work crew to clean up a site, or residents can do it themselves and CLEAN simply provides a dumpster, bags/gloves, and pickup service. The second option is faster and less costly than the first. To be eligible, the dump site must be on publicly owned land (e.g. vacant lots owned by the city, sidewalks, alleys, or streets). Sites on private property are not eligible unless they have reverted to the city or county. The site selection committee usually does not deny applications from Detroit. CLEAN is trying to create partnerships with residents and neighborhood organizations to prevent dumping from occurring.

Cleanups do not necessarily discourage further dumping, since people seem to continually dump at particular sites. This may be prevented by monitoring vulnerable sites (such as with a neighborhood watch group), noting when it happens, and caring for vacant lots. Possibilities for dumping are reduced if there is more awareness around the issue, and if vulnerable spaces seemed cared for. For vacant lots, mowing, gardens, and even signage (perhaps not "no dumping" signs, as these do not appear to discourage dumping) can be effective. When questioned about the lack of response some residents experience when contacting the city about dump sites, the response was that the city does not have the resources to care for the thousands of vacant properties in Detroit. Residents must try to keep up vacant lots near their homes to discourage dumping. Ordinances do exist for properties (e.g. rules for high weeds, or that grass cannot exceed 4 inches), but with the number of vacant lots and contiguousness of these lots, it is difficult to keep up with fines. Six to ten years ago it was possible for crews to go out and issue tickets, but now they are overwhelmed. There are also some difficulties in finding owners, and some issues around the legal rights of the owners and dealing with speculative landowners. GIS applications could possibly assist these efforts, though are not currently used. The city still tries to issues tickets and baits for rodents, though they try to encourage compliance with warnings rather than punish (warnings are still recorded). If a resident knows the owner of a vacant lot that is not being cared for, they can notify the city. Though not advertised, residents can also contact Patrick Cullen in order to find out who owns a particular lot. In addition, a program exists to purchase neighboring vacant lots (perhaps as low as $200).

The Department of Public Works offers disposal services for bulky waste. It costs $120/cubic yard to dispose of wastes at designated collection centers; an additional $40/cubic yard is charged to have it collected. Up to one cubic yard of bulky material per day is allowed. This service is only provided to city residents; identification must be presented). There is also a quarterly bulk collection system (the previous monthly system was overwhelmed as the tax base decreased, but this is still in line with many other cities).

Recycling in Detroit is still in the pilot stages, and no final decision has been made on which system to use city-wide. There are currently two curbside recycling pilot programs: the East side pilot zone is using a small, uncovered blue tub, while the West side pilot zone is using a roll-out garbage can with a lid. The small tubs have weekly pickup; the larger roll-pout units have biweekly pickup. The purpose of testing the two different systems is to determine which option is most cost-effective. The larger roll-out units contain 20-25% contamination weekly because the materials are covered and it is more difficult to enforce compliance regarding acceptable materials (inappropriate materials cannot be removed). Expansion will be incremental since only so many funds will be available on an annual basis (the available revenue is the $240 solid waste fee accompanying taxes). Residents cannot set out materials to be recycled if they have not been given the appropriate bins. Recycling trucks also do not pass in all streets (the trucks and their equipment is the largest expense of the pilots), but there are drop-off locations where recyclables can be taken. The city recognizes that the inconvenience of having to take materials to specific locations is a cause of illegal dumping. As an alternative, residents can give their recyclables to other residents who are in the pilot program zones. A homeowner in the pilot can have more than one bin for recyclables as long as it's marked clearly.

Currently the pilot recycling program has 18-20% participation with 13,000 households on the east side. The Governor's mandate is 40% participation, so the city is about 3 years behind schedule. The city is looking for ways to make recycling more convenient (the roll-out system is an example). The success of program depends on awareness and education; the city recognizes it should be more aggressive in this. The current rate of waste diversion is only 4% with the 18-20% participation in the pilot zones. A minimum of 10% waste should be diverted.

Recycling is cost-effective for the city: it spends less on disposal and has more opportunities for commodities from recycled materials. Even though the markets for such commodities are not as profitable now, it will still be less expensive on a per-ton basis to recycle than to dispose. Detroit household wastes are incinerated - recycling can help reduce the amount of waste incinerated and provide income to city. Currently there is not enough information from the pilot program to tell which recycling system is best, but it is known that the best way to encourage participation is convenience. Possible policy changes to make recycling mandatory are being considered, such as requiring a certain amount of recycling in each household and ticketing if the bins are used for other purposes.

Recycle Here! is a 3-year-old city-funded program that provides recycling services, drop-off locations, and recycling education. Thus far they have recycled over 4.2 million pounds of materials. They began as a single location and now even have mobile recycling drop-off locations. Their school education programs have reached over 25,000 children in Detroit. Drop-off locations like those Recycle Here! provides can take a wider range of materials than curbside ("single stream") recycling. Examples include electronics, Styrofoam, and light bulbs. To reduce household waste, Recycle Here! encourages conscious purchasing, or choosing products with recyclable packaging and avoiding products that produce a large amount of garbage. Since people typically buy similar things every week, small changes and substitutions in purchasing habits can make a difference in the amount of waste produced.

Some clarification was requested regarding which materials can be recycled and which cannot. Plastics have different numbers showing what the plastic consists of. Bottles and containers are usually #1 or #2 and are easiest to recycle. Numbers 4-7 go into a separate stream; examples include berry containers (#4), yogurt containers (#5), and Styrofoam (#6). Number 7 is a category described as "other" that can be a mix of materials. Recycling of #3 (flexible PVC, used for petroleum-based and other flammable materials) is not encouraged to recycle because it is carcinogenic (this is more for workers' protection than for its ability to be recycled). If a container is not labeled with a number, it contaminates the stream and should not be recycled. It is better to remove the tops of containers because sometimes they are made of different materials than the bottoms. It is fine to leave labels on containers as the recycling process removes them. Removing tops also ensures that there are no liquids inside containers

to be recycled, and that they do not explode during compaction. Recyclable bags include grocery store bags, dry cleaner bags, mailers, and produce bags. It was also noted that staples in paper, windowed envelopes, and metal notebook bindings are all allowed to remain with recycled items. One important material not allowed in curbside recycling is glass (it is too heavy for the city's potential revenue from its recycling).

Notes from the Water Use Efficiency and Responsibility Workshop

The presenters discussed some common sources of residential water contamination. Fertilizers leach phosphorus into surface waters, especially in spring and summer from lawns. They recommended to "mow high" to reduce fertilizer use. Pet waste is a source of bacteria. Fluids from cars, such as oils, transmission fluid, brake fluid, etc. are another major pollutant. Leaks should be managed with kitty litter or saw dust to prevent them from running into sewers. Participants asked several questions pertaining to specific materials. One regarded latex paint. Cans should be allowed to dry out and thrown away (washing brushes in the sink is not a problem). Oil-based paint is more hazardous. Other products like cleaning products and WD40 are also considered household hazardous materials and should not be put in drains. They need to go to the city's main drop-off center. Wayne County also has four collections annually for such materials.

Medical wastes have become an increasingly important contaminant in waterways. In the past it was recommended that expired or unfinished medications be flushed. This was to avoid theft of prescription drugs from trash. However, treatment plants cannot eliminate pharmaceuticals, which move to surface waters and drinking water (even after double treatment). The long-term effects of this are unknown. One worry is that "superbugs" could be created, pathogens that could become resistant to antibiotics. Proposed solutions to this problem include partnering with drug companies to take back unused pharmaceuticals, or to have a central drop location in cities. The current recommendation is to take drugs out of their original containers and mix them with another material (e.g. kitty litter or coffee grounds). The mix should then be put in an impermeable container and thrown out with the trash. This will make drugs unrecognizable and keep them out of the sewer system. For sharps, a hard plastic or metal container with a lid should be used (not something that could be mistaken for recyclable and not a clear container). It should be taped shut and labeled "not recyclable," then thrown away. A brochure containing disposal tips for medical waste and pharmaceuticals was also distributed. A second informational brochure was distributed describing the "7 simple ways to clean water," or how to best manage water use in the home, and what happens to it after use.

Detroit has a combined sewer system, which is not designed to handle water from all impervious surfaces (e.g. roofs, streets, residential). Heavy storms overwhelm system, causing what is known as Combined Sewer Overflow (CSO). It is likely that the city system will remain this way, as retention basins and sewer separation are expensive. Residents can help by making sure as little water as possible enters the system. On average, a person uses three gallons of water per day, but in the US much more.

One way to limit (or at least slow) water going to the sewer system is to install a rain barrel. There were several questions from participants regarding the purpose and use of rain barrels. Rain barrels are used for the capture and reuse of water from the roofs of houses. Examples of uses are watering yards and washing cars. They can be constructed of simple materials, such as a garbage can. They are installed under the downspout close to a home's foundation. About half of the houses in Detroit have gutters than connect directly to sewers and half that run off into streets. Insects are kept out of barrels because they have lids. Goldfish can also be kept in the bottom to eat larvae. Other advantages to installing a rain barrel are that the water it captures is free of charge and does not contain chlorine, unlike municipal water. This water cannot be used a drinking water.

Landscaping was said to be a way to conserve water, following the assumption that native plants use less water. Rain gardens are a particular kind of landscaping that hold water for a short period of time and assist its absorption into the ground. They are not meant to hold standing water. They should be grown in a depression, using native plants to absorb water. Perennials were recommended since they have stronger roots systems and only need to be planted once. In Detroit, native plants can be found at Eastern Market; other locations such as Home Depot will probably not have native species for sale.

Two critical places to save water are the kitchen and bathroom. Using the demonstration house, participants were given the following useful tips. In the kitchen, water should not be run constantly while washing dishes. Instead, a pan of rinse water could be used. An aerator can be installed in the faucet. These add air to the water as it exits so less is used (they must be the proper size for each faucet). Petroleum-free soaps and detergents are also better for preserving water quality. Faucets are labeled on their sides with their rate of water use. For drinking water, a pitcher of water can be kept in the refrigerator so people can have cold water without running the faucet (the lid can also be left off to evaporate chlorine if desired). In the bathroom, pressure-assisted toilets could be installed to use less water than conventional toilets. Toilet leaks are common and are usually small problems like the flapper. Some people place an object, such as a "toilet tank bank" balloon or brick to displace water in the toilet tank, though there was some doubt that the toilet would function as well. Showerheads from before 1994 use 3 gallons per minute. Now those using 1.5-2 gallons per minute are available. Aerated handheld showerhead units are also now available. A simple technique is putting a timer in the shower to encourage people to take shorter showers. Additionally, while waiting for water to warm, a bucket could be filled with the unused water and used in another way. Insulating water heaters and pipes will also reduce the wait time for hot shower water. Again, aerators can be put into bathroom sinks. A last tip is to look for products with the Water Sense label. This is an EPA label for products that use less water.

Fixing leaks is also important for conserving water. Leaks also make the biggest difference in water bill. The average drip amounts to about 3,000 gallons per year, or about 150 showers. Testing for household leaks is simple. A homeowner can locate the water meter and take a reading, then make sure everything in the house is shut off and remains unused for two hours. If the meter increases during this time, this is evidence of leakage. To test for toilet leaks, food coloring can be put into the tank. If after a 10-15 minute wait the coloring comes out in the bowl, there is a leak.

Notes from the Weatherization Workshop

The presentation began by noting that we are increasingly encouraged to reuse/recycle and reminded of the importance of energy independence. It is as important now as ever to use only whatwe need and eliminate waste. Participants were asked to think about all the things they plug into the wall, and to return to the attitudes of saving and reuse of older generations. A sample utility bill was given out to remind people of whatwe pay for. This equation determines electricity costs:

#WATTS x #HOURS USED = ELECTRIC BILL

(Gas, in contrast, is measured in CCF used, or in units of one hundred cubic feet.)

Participants were encouraged to make sure they are being charged one month at a time and that their bills are not estimated. Using less electricity can lower utility bills in another way: residents are guaranteed the lowest rate if they use 17 kWh/day or below. They were also discouraged from agreeing to fixed gas rates, as they are sometimes overpriced (rates range from $0.60 - $1.49/CCF). Living situations and houses vary, so can be difficult to compare one utility bill to another.

The presenter's approach to home energy was to see a house as a system, and to identify energy flows (and leaks) in that system. The simple idea that heat moves toward colder areas can help identify problem areas. For example, hot air rises, so close the attic door in the winter. Cold air sinks, so close the kitchen door in the summer. Andrea recommended a new rule for home heating: heat the people, not the whole house. Closing vents and doors to unused rooms will use less gas. Storage spaces like attics do not need to be heated, nor do basements. The cold-air return vents of forced air furnaces should be kept open and unblocked, otherwise the blower motor increases electricity bill because it keeps blowing air that's not moving, and carbon dioxide is produced from burning fuel that does not heat anything. Duct work should be insulated if there is a crawl space underneath (though not if there are pipes below, as they could freeze).This alone could save hundreds of dollars per year on heating costs. Windows are thinnest part of the wall, so vents and radiators should not be located under them (double windows are better insulated than single windows). Corrugated cardboard can act as a storm window (cutting it a little larger than the window and taping it) and bubble wrap can insulate windows (this is also reusing, not buying petroleum products, and allows light in). For homes with radiators, it is normally recommended to turn them don 4-5 degrees when no one is home. Because boilers are slower to heat than furnaces, it is also advisable to keep them at the same lowest comfortable temperature all the time. Radiators can be insulated with foil. For cooling, the most inexpensive technique is to open doors in the morning and close shades where sun enters, switching in the evening (shades should be flipped up and away for maximum reflection).

One of Andrea's most salient points was to fill in as many points of heat leakage as possible. Plastic bags can be stuffed in myriad places to prevent heat from escaping. Some examples include where molding separates from a wall, milk shoots (metal becomes colder than wood, so best to fill them in with plastic and/or Styrofoam), or around windows. If such gaps are too large, spray foam may be helpful. Gaps under doors can be remedied with door sweeps (to be placed as low on the door as possible, so it touches the floor). Weather stripping is useful in doorways as well (best if not installed over oil or paint so it stays longer). Putty is useful for filling small holes and cracks. Unused oven vents can be filled with Styrofoam. Other ways to save natural gas include keeping water heaters at the minimum temperature. The restaurant standard is 120°F, the maximum temperature of 180°F is unnecessary. This is sufficient even in apartment buildings. Timing showers can help save on water heating as well. The more heat kept inside the house, the less will be consumed. This also avoids the use of electric space heaters, which is the most expensive way to heat.

To conserve energy through reduced electricity use, Andrea recommended unplugging everything not used on a daily basis. Power strips cut off electricity from walls and save energy. For lights, if a room will go unused for more than five minutes, they should be turned off. Use of natural light and CFLs is desirable over incandescent light, as is burning only what is necessary in multi-bulb fixtures. Using CFLs can save $70 per bulb replaced. Other ways to save electricity include air-drying clothes instead of using dryers and air-drying dishes instead of heat-drying them in dishwashers.

Appliances use a lot of the electricity billed to households. When buying new appliances, residents are encouraged to look at the Energy Guide that accompanies them. As Andrea stated, "the war is won in the store." Products with an energy-saving label use at least 40% less electricity. Larger appliances will mean larger bills. The appliance consuming the most electricity is the refrigerator, followed by the freezer. Extra appliances, such as a second freezer, should be unplugged if not truly useful (especially free-standing freezers). In fact, $150-$200 is spent per year for older freezers. Again, eliminating waste saves money.

DTE has been offering free home weatherization since July 1, 2010. Fifty homes were weatherized under this program in the first month. A consultant can also walk through the home and give written energy saving recommendations. They can also host group sessions. This program is offered only in Detroit, and homes are tracked only if permission is given.

Notes from the Health & Environment Workshop

Families a few generations ago were more connected to the food they ate; grocery stores are relatively new. Many of our food habits are relatively recent, as are modern access issues. Lisa began by asking the group how the grandparents' generation ate (they grew their food), and whether we remembered them having concerns like diabetes and obesity (not really). Nowwe are experiencing a shift back to what older generations already know.

In a short period of time,our food habits have moved away from gardens/neighbors/trade andwe have seen a huge rise in obesity, decrease in environmental quality, and economic downturn. Families no longer unite around food. This is occurring while there is massive production of inexpensive food. Now the reference point for many is a gas station or a corner store. The state of being both overweight and malnourished is new. Some believe thatwe need to produce more food since there is hunger in communities, but in truth there is so much food produced that it cannot all be sold at market price (surpluses are dumped). The real problem is not the amount of food produced, but its distribution – it is a social justice issue.

One participant commented that with "using hormones, downsizing and overseas production" food is not natural anymore. Today it can be hard to trust food, to judge what is safe and healthy. It is not only a matter of education. Access to foods grown naturally can be limited. Organic foods can be expensive, and it can be difficult to know what this label means (look and taste are not necessarily different). Growing food in one's backyard could be an option. We can start to see growing food as a way to live, instead of gardening as a luxury.

In the past, 90% of people in this country were involved in food production, whereas now only 5% are involved. Though urban agriculture is not new, growing food in one's backyard is a kind of revolution since money leaves the community when people shop at grocery stores. Where there are local businesses with local buyers, money spent on food stays in the city. There are now very few food places owned by city residents in Detroit. At one time there were many different small options, owned by Detroiters; today the food system is not owned and controlled by the city. Community food security must now come from movements led by people from within their communities. In Detroit, urban growers could gain economic benefits by selling produce, or by participating in the Grown in Detroit Co-op.

Organizations like the Capuchin Soup Kitchen Earthworks Urban Farm can be catalysts for such activity. They offer several programs to help start people in urban agriculture. The Garden Resource Program is a 9-week course for people who want to lead community garden efforts. Growing Healthy Kids is another that teaches children about the origins of food and how to cook. They also grow 100,000 seedlings annually to give away to gardeners. (They have found that people are more likely to grow seedlings than seeds, and more likely to eat vegetables if they grow them themselves.)

Diet and exercise are worrisome issues seen every day in Detroit. People should be getting 5-7 servings of fresh (undressed) fruits and vegetables per day, preferably home-grown. People are now accustomed to eating high-calorie, low-nutrient food. This combined with sedentary lifestyles has many negative health effects. Low-intensity exercise (1 hour) or high-intensity exercise (30 minutes) is recommended, but can be cumulative throughout the day. Body Mass Index (BMI) is a height to weight ratio that is used to figure out national levels of overweight and obesity. Participants were able to calculate their individual BMI at the workshop.

Notes from the Rain Barrel Workshop

With the combined sewer system in Detroit, residential and street runoff goes to same system. This is a problem on days of heavy rain (greater than a half inch) and is too much for the sewer system and treatment plant to handle. The result is Combined Sewer Overflow (CSO), in which wastewater gets

released into Rouge and Detroit Rivers. Chlorine and screens are used on about half of the outfall, but nothing is used to treat the other half. Detroit is not unique, as many older cities have the same problems with a combined system.

To make the rain barrels,we procuredwe used 55-gallon plastic drums for each participant. The best way to find barrels is Craig's List (the cost is usually $10-$25); sometimes breweries, restaurants, car washed, etc. offer them for free. Other supplies included a union and plumber's tape, silicone, and wire mesh.We first drilled two holes in a large barrel– one on the bottom for the spigot, and one on the side for overflow.We wrapped the spigots three times with plumber's tape and connected them to the unions. The unions were then connected to the barrels. Silicone was used to seal the union to the barrel, and wire mesh was placed where water would enter to keep debris out.

To install a rain barrel, downspouts must first be disconnected. (Water from gutters should not run straight into the street). The gutter is cut so that rain barrel sits underneath. Special cutters (a kind of saw) can be rented from Home Depot. Grants also exist to assist people in doing this.

The barrels have overflow valves in case they fill up; they can be connected to another barrel or to a hose that will run the water to the ground. Algae may grow, but it is not of great concern. Mold should not be a problem, either. Fish can be kept in the rain barrel to eat mosquito larvae; the best time to put them in could be late May. There are no particular precautions for the winter, but it may be a good idea to drain them.

Rain gardens should be planted in a shallow depression. A flat depression is best because it will have more surface area, about 6-8 inches deep is recommended. Plants grow in and around the depression. Native plants are preferred, since they have stronger roots systems and will make more pathways in the soils for water absorption. Eastern Market may have native plants for purchase. Sometimes rainwater will collect in the rain garden, but successful gardens will never have standing water for more than 48 hours. The best soil type for a rain garden is a mixture of sand and compost. If soils contain too much clay, must be replaced since they will hold too much water. Rain gardens may be preferable to rain barrels where the gutters are too close to the house (otherwise the gutter could be angled outward). These gardens can be of any size.

Appendix F. Sample Project Brochure

Figure 26. Sample project brochure, side 1.

What is a
Sustainable Urban Neighborhood?

Sustainable Urban Neighborhoods are those that respect the environment, are economically viable, and foster a sense of community among their residents.

Who we are

We are a team of five graduate students pursuing masters' degrees at the University of Michigan School of Natural Resources and Environment. We have developed this project in conjunction with several partner organizations in Detroit as part of our program.

The project

We aim to create a "**Sustainable Urban Neighborhood**" in Detroit through a series of events and workshops promoting awareness of urban environmental issues. We present sustainability as the new guiding principle for building and rebuilding urban communities. Our primary initiative is home weatherization, which not only saves energy but also cuts the cost of energy bills. We will provide free weatherization kits to participating households and measure their effectiveness. Our other workshops consist of variety of topics: home weatherization, stormwater management, recycling, dump site remediation, rain barrel creation, and environmental and community health and wellness.

Our area of focus is part of the Morningside community on the East Side of Detroit. We are open to ideas from community members and will encourage community-wide participation. The primary goal of this project is to put residents in greater control of their resource use, demonstrating the environmental benefits and economic savings that can be achieved by implementing creative sustainable solutions to urban environmental issues.

demonstration house

We have rented a house in the Morningside community, **3975 Nottingham**, a few blocks north of Mack Avenue. This house will serve as our home base in the neighborhood and be used to demonstrate weatherization techniques and to host educational sessions and community gatherings.

See our Web site for more details.

Figure 27. Sample project brochure, side 2

Appendix G. List of Demonstration House Characteristics Used in the Home Energy Saver Program

Year Built = 1941
Heated or Cooled Floor Space = 912-sq. ft.
Stories Above Ground = 2
Type of Foundation = Conditioned Basement
Foundation/Floor Insulation = No/Don't Know
Ceiling Insulation Level = R-0
Roof Insulation Level = R-0
Attic Type = Unconditioned
Wall Insulation = No/Don't Know
Does House Have Weatherstripping of Caulk to Prevent Air Leakage? = No
Windows Location, Size, Type:
- Front, 44.5-sq. ft, Single pane, clear, wood, or vinyl
- Back, 16.7-sq. ft., Single pane, clear, wood, or vinyl
- Left, 65.5-sq. ft., Single pane, clear, wood, or vinyl
- Right, 54.0-sq. ft., Single pane, clear, wood, or vinyl

Clothes Washer = Yes
Number of Refrigerators = 1
Water Heater:
- Year Purchased = 1992
- Tank Size = 40-gal.
- Fuel = Natural Gas

Heating Equipment:
- Type = Central Gas Furnace
- Year Purchased = 1976

Cooling Equipment = None
Duct Location = Conditioned Space
Ducts Insulated = No/Don't Know
Boiler Pipe Insulation = No/Don't Know
Cost of Electricity = $0.112/kWh
Cost of Natural Gas = $0.9043/CCF

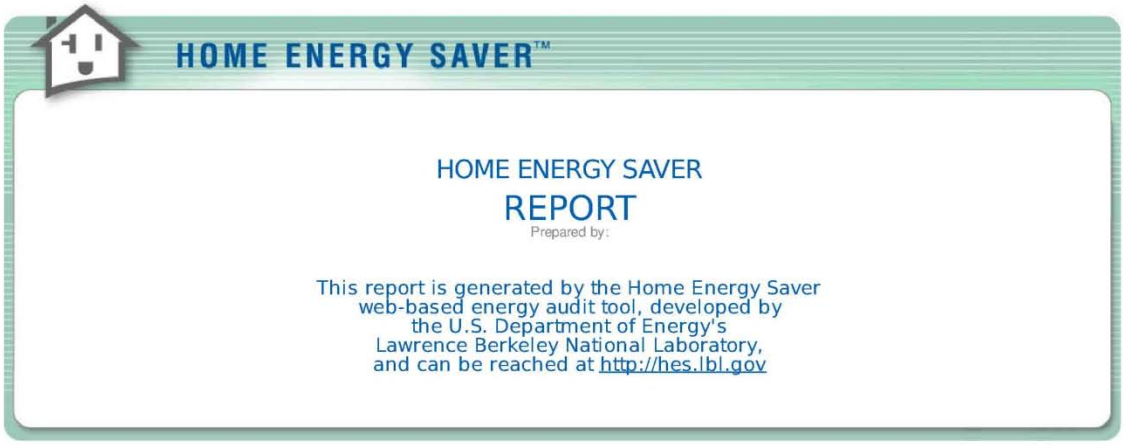
Appendix H. Summary of Results from Demonstration House Energy Analysis

Table 2. Summary of results from Demonstration House Energy Analysis

	Electricity (kWh) (5)	Electricity (kWh) (10)	Electricity (kWh) (20)	CO2 Emissions (lbs. CO2) (5)	CO2 Emissions (lbs. CO2) (10)	CO2 Emissions (lbs. CO2) (20)	Natural Gas (Therms) (5)	Natural Gas (Therms) (10)	Natural Gas (Therms) (20)	Money ($) (5)	Money ($) (10)	Money ($) (20)
Lighting	938	938	938	1,466	1,466	1,466	0	0	0	105	105	105
Large Appliances	1,559	1,559	2,141	1,502	1,502	2,412	-80	-80	-80	103	103	168
Hot Water	0	0	0	1,718	1,718	1,718	147	147	147	132	132	132
Heating	86	86	145	7,866	8,544	10,576	662	720	886	605	657	813
Total 5-Year	2,583			12,552			729			945		
Total 10-Year		2,583			13,230			787			997	
Total 20-Year			3,224			16,172			953			1,218
Total for All Occupied Single Family Homes in Project Area (137-homes)	353,871	353,871	441,688	1,719,624	1,812,510	2,215,564	99,873	107,819	130,561	129,465	136,589	166,866

Appendix I. Full 5-, 10-, and 20-year output from the Home Energy Saver Program

5-Year Analysis



HOME ENERGY SAVER™

HOME ENERGY SAVER
REPORT
Prepared by:

This report is generated by the Home Energy Saver
web-based energy audit tool, developed by
the U.S. Department of Energy's
Lawrence Berkeley National Laboratory,
and can be reached at http://hes.lbl.gov

HOME ENERGY SAVER™

HOUSE CONFIGURATION

General Information

Name or other identifier this home/session : **Nottingham**; User's email address : **karyncb@umich.edu**; Purpose of this assessment : **Hypothetical analysis**; Address : **3975 Nottingham Rd.**; City : **Detroit**; State : **Michigan**; City with most similar climate to modeled house : **Detroit**; Year house was built : **1941**; People living in the house, by the age - 0-5 : **1**; People living in the house, by the age - 6-13 : **1**; People living in the house, by the age - 14-64 : **2**; People living in the house, by the age - 65 plus : **0**; Check for actual electricity prices in your area. : **no**; Utilities List : **no**; Select your tariff from the list below. : **no**;

Energy Prices

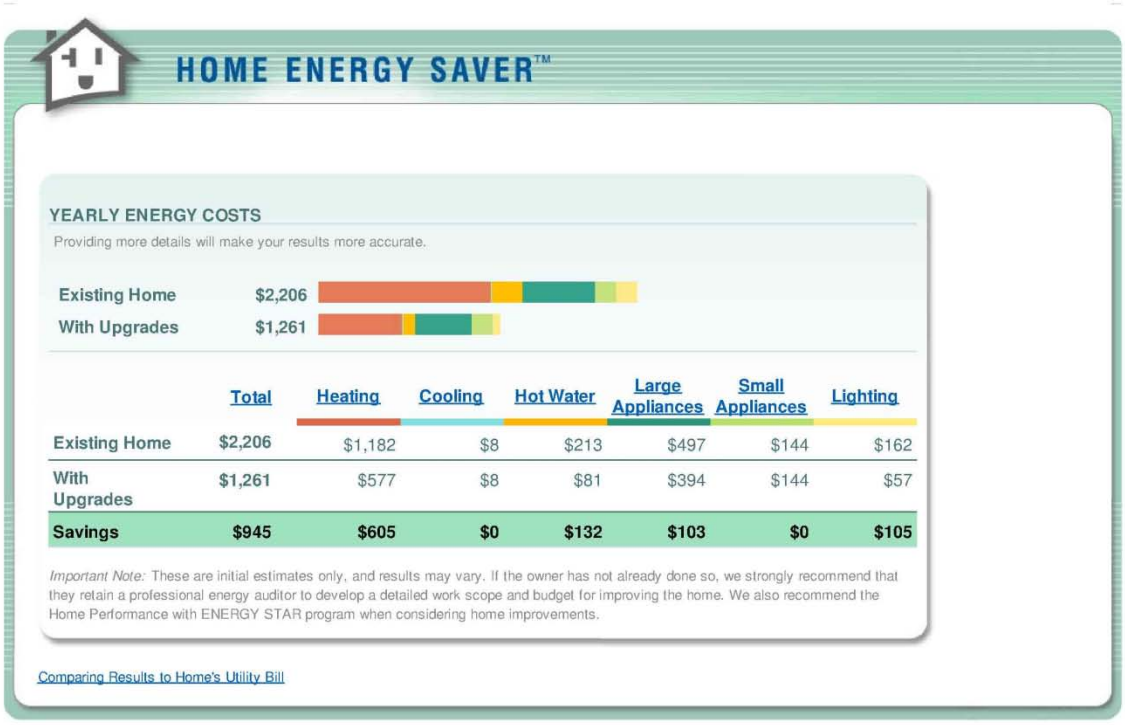
Energy Prices - Electricity : **0.112**; Energy Prices - Piped Natural Gas : **0.900**; Energy Prices - Liquid Propane Gas (LPG) : **0.010**; Energy Prices - Fuel Oil : **0.010**;

Building Design

Foundation or floor insulation : **No/Don't Know**; Attic type : **Unconditioned Attic**; Wall insulation : **No/Don't Know**; Does the house have weather-stripping and/or caulking : **No**; Describe windows on each side of house - Front Type : **Single-pane, clear, Wood or Vinyl**; Describe windows on each side of house - Front SqFt : **44.50**; Describe windows on each side of house - Back Type : **Single-pane, clear, Wood or Vinyl**; Describe windows on each side of house - Back SqFt : **16.70**; Describe windows on each side of house - Left Type : **Single-pane, clear, Wood or Vinyl**; Describe windows on each side of house - Left SqFt : **65.50**; Describe windows on each side of house - Right Type : **Single-pane, clear, Wood or Vinyl**; Describe windows on each side of house - Rgith SqFt : **54.00**; Stories above ground level : **2**; Roof Insulation level : **R-0**; Conditioned floor area (all stories combined) ? : **912**; Type of foundation : **Conditioned Basement**; Ceiling Insulation level : **R-0 (no insulation)**;

Appliances Equipment

Clothes Washer : **Yes**; Number of refrigerators : **1 Refrigerator**; Water heater - year purchased : **1 Refrigerator**; Water heater - Tank Size : **40**; Water heater - Fuel : **Natural Gas**; Heating equipment - Type : **Central Gas furnace**; Heating equipment - Year purchased : **Central Gas furnace**; Cooling equipment - Type : **No Cooling Equipment**; Cooling equipment - Year Purchased : **No Cooling Equipment**; Thermal distribution - Duct Location : **Conditioned space**; Thermal distribution - Ducts Insulated : **No/Don't Know**; Thermal distribution - Boiler pipe insulation : **No/Don't Know**;



HOME ENERGY SAVER™

YEARLY ENERGY COSTS

Providing more details will make your results more accurate.

Existing Home	$2,206
With Upgrades	$1,261

	Total	Heating	Cooling	Hot Water	Large Appliances	Small Appliances	Lighting
Existing Home	$2,206	$1,182	$8	$213	$497	$144	$162
With Upgrades	$1,261	$577	$8	$81	$394	$144	$57
Savings	**$945**	**$605**	**$0**	**$132**	**$103**	**$0**	**$105**

Important Note: These are initial estimates only, and results may vary. If the owner has not already done so, we strongly recommend that they retain a professional energy auditor to develop a detailed work scope and budget for improving the home. We also recommend the Home Performance with ENERGY STAR program when considering home improvements.

Comparing Results to Home's Utility Bill

HOME ENERGY SAVER™

YEARLY WHOLE HOUSE RESULTS

		Existing Home	With Upgrades	Savings	Percentage Reductions
Whole House	Energy Bill	$2,206	$1,261	**$945**	43%
	Electricity	6,643 kWh	4,061 kWh	**2,582 kWh**	39%
	Natural Gas	1,626 Therms	897 Therms	**729 Therms**	45%
	Emissions	29,382 CO2	16,830 CO2	**12,552 lb. CO_2**	43%
Heating	Energy Bill	$1,182	$577	**$605**	51%
	Electricity	440 kWh	354 kWh	**86 kWh**	20%
	Natural Gas	1,259 Therms	597 Therms	**662 Therms**	53%
	Emissions	15,397 lb. CO_2	7,531 lb. CO_2	**7,866 lb. CO_2**	51%
Cooling	Energy Bill	$8	$8	**$0**	0%
	Electricity	75 kWh	75 kWh	**0 kWh**	0%
	Emissions	117 lb. CO_2	117 lb. CO_2	**0 lb. CO_2**	0%
Hot Water	Energy Bill	$213	$81	**$132**	62%
	Natural Gas	237 Therms	90 Therms	**147 Therms**	62%
	Emissions	2,769 lb. CO_2	1,051 lb. CO_2	**1,718 lb. CO_2**	62%
Large Appliances	Energy Bill	$497	$394	**$103**	21%
	Electricity	3,393 kWh	1,834 kWh	**1,559 kWh**	46%
	Natural Gas	130 Therms	210 Therms	**-80 Therms**	-62%
	Emissions	6,823 lb. CO_2	5,321 lb. CO_2	**1,502 lb. CO_2**	22%
Small Appliances	Energy Bill	$144	$144	**$0**	0%
	Electricity	1,290 kWh	1,290 kWh	**0 kWh**	0%
	Emissions	2,017 lb. CO_2	2,017 lb. CO_2	**0 lb. CO_2**	0%
Lighting	Energy Bill	$162	$57	**$105**	65%
	Electricity	1,445 kWh	507 kWh	**938 kWh**	65%
	Emissions	2,259 lb. CO_2	793 lb. CO_2	**1,466 lb. CO_2**	65%

Heating electricity values include fan or pumping energy for homes that have forced-air or water-based heating systems powered by circulation pumps. The values for Hot Water include taps and faucets only; the energy consumed by the water heater to supply hot water for appliances such as clothes washers and dishwashers is included instead in the rows for those appliances.

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YEARLY HEATING AND COOLING RESULTS

Show Details

	Total Cost
Cost	$1,190
Heating	$1,182
Cooling	$8

	Total Energy
Energy Use	1,259 therms 515 kWh
Heating	1,259 therms 440 kWh
Cooling	75 kWh

Notes: this house is 0% heated by wood fuel.
100% of the floor area is heated and 100% cooled.

Heating electricity values include fan or pumping energy for homes that have forced-air or water-based heating systems powered by circulation pumps.

What if my results don't match my energy bill?

HOME ENERGY SAVER™

YEARLY LARGE APPLIANCES AND WATER HEATING RESULTS

Show Details

Appliance	Total Cost
First Refrigerator	$120
Stove	$41
Oven	$27
Clothesdryer	$163
Clotheswasher	$102
Dishwasher	$44
Hot Water: Taps and Faucets	$213
Totals	$710

Equipment energy is the energy used by motors, heating elements, and burners inside your appliances. This number excludes the energy consumed by your water heater to supply hot water for appliances such as clothes washers and dishwashers (which is included instead in the rows for those appliances).

What if my results don't match my energy bill?

HOME ENERGY SAVER™

YEARLY SMALL APPLIANCES RESULTS

Show Details

Category	Energy Use	Energy Costs
Entertainment	345 kWh	$39
Home Office	361 kWh	$40
Miscellaneous Kitchen	464 kWh	$52
Other Appliances	120 kWh	$13

What if my results don't match my energy bill?

HOME ENERGY SAVER™

YEARLY LIGHTING RESULTS

Here is the calculated Yearly lighting bill based on the inputs you provided:

Show Details

Room	Energy Use	Energy Costs
All Bathrooms	202 kwh	$23
All Bedrooms	68 kwh	$8
Dining Room	120 kwh	$13
Family Room	77 kwh	$9
Garage	75 kwh	$8
Hall	114 kwh	$13
Kitchen	208 kwh	$23
Living Room	273 kwh	$31
Master Bedroom	68 kwh	$8
Outdoor Lighting	240 kwh	$27

What if my results don't match my energy bill?

HOME ENERGY SAVER™

UPGRADE RECOMMENDATIONS SUMMARY

Visit 'Recommendations' to see more information on each upgrade.

	Yearly Savings	Estimated Added Cost	How Much is Too Much?	Simple Payback Time	Estimated ROI	Avoided Emissions (lbs. CO_2)
Total for recommended upgrades	**$945**	**$2,222**	**$4,725**	**2**	**41%**	**12,552**

Important Note: These are initial estimates only, and results may vary. If the owner has not already done so, we strongly recommend that they retain a professional energy auditor to develop a detailed work scope and budget for improving the home. We also recommend the Home Performance with ENERGY STAR program when considering home improvements.

Upgrades Requiring Investment

1. Indoor lights
2. Electric clothes dryer
3. Basement wall insulation
4. Clothes washer
5. Gas furnace
6. Attic insulation
7. Gas water heater
8. Thermostat

Other benefits that often come along with these energy-saving upgrades

- Fluorescent lamps last several times longer than ordinary incandescent bulbs, which saves you the time and expense of replacing bulbs when they burn out.
- Natural gas clothes dryers reduce your home's peak load on the power grid compared to an electric dryer.
- Well-insulated basement walls can make your home more comfortable and quieter, and guard against moisture problems and water pipe breakage.
- ENERGY STAR® clothes washers can reduce water use significantly, leave the clothes drier thus reducing drying time and energy consumption, and reduce wear and tear on clothes.
- ENERGY STAR® gas-fired furnaces make your home more comfortable. Some models are less prone to causing indoor air quality problems or house fires.
- A well-insulated ceiling can make your home more comfortable and quieter, reduce the risk of moisture damage, enhance fire safety, make your home more disaster-resistant, and help guard against pipe freezing.
- Efficient gas-fired water heaters may hold their temperature longer following power interruptions and operate more safely.
- Programmable thermostats can help keep your home more comfortable.

HOME ENERGY SAVER™

UPGRADE RECOMMENDATIONS

What efficiency level would you like to model for the initial selection of upgrades? EnergyStar

What simple payback period would you like to use for selecting upgrades? 5

RECALCULATE Rows that are dimmed are not included in the calculated values for the retrofit package. To include them check their boxes and recalculate.

Add/ Remove	Upgrade	Upgrade Choice & Description	Yearly Savings	Estimated Added Cost	How Much is Too Much?	Simple Payback Time	Estimated Return on Investment	Avoided Emissions (lbs. CO_2)
☐	Check/Uncheck All Upgrades	**Total for Selected Upgrades:**	**$945**	**$2,222**	**$4,725**	**2**	**41%**	**12,552**
☑	Indoor lights	CFLs in high-use fixtur	$57	$ 88	$285	2	58%	1,466
☑	Electric clothes dryer	Switch to gas dryer	$81	$ 160	$405	2	50%	1,210
☑	Basement wall insulation	R-11	$126	$ 299	$630	2	42%	1,636
☑	Clothes washer	MEF=1.42 WF=9.5 EN	$56	$ 180	$280	3	30%	528
☑	Gas furnace	AFUE=90 ENERGY S	$167	$ 549	$835	3	30%	2,177
☑	Attic insulation	R-19	$118	$ 456	$590	4	26%	1,531
☑	Gas water heater	EF=0.62	$37	$ 170	$185	5	20%	479
☑	Thermostat	ENERGY STAR-label	$66	$ 320	$330	5	19%	865
☐	Air sealing	25% air leakage reduc	$83	$ 850	$415	10	9%	1,087
☐	Refrigerator	15% better than standa	$8	$ 87	$40	11	8%	114
☐	Wall insulation	R-11 wall cavity	$205	$ 388	$1,025	19	3%	2,664
☐	Windows	2-pane/solar-control lo	$27	$ 543	$135	20	3%	351
☐	Dishwasher	EF=0.58 ENERGY ST.	$17	$ 360	$85	21	NCE	193
☐	Ceiling fan	ENERGY STAR-label	$1	$ 60	$5	60	NCE	13
☐	Cool roof	Solar reflectance = 0.1	$0	$ 31	$0	9,999	NCE	0

Important Note: These are initial estimates only, and results may vary. If the owner has not already done so, we strongly recommend that they retain a professional energy auditor to develop a detailed work scope and budget for improving the home. We also recommend the Home Performance with ENERGY STAR program when considering home improvements.

NCE = Not Cost Effective. This upgrade will not pay for itself in your situation. There may be other reasons, such as improved comfort, to implement the upgrade, or it could be made more cost-effective if the investment cost is reduced.

Note: Each of the upgrades in the table above are evaluated in isolation from the others. If the efficiency level is changed for one upgrade, its potential impact on other upgrades will not be counted in the row-by-row estimates. However, these kinds of interactions are included in the "package" totals associated with the whole-house totals and chart at the top of the page, for the upgrades selected as part of the package. For example, if the furnace efficiencies are raised, the energy savings from wall insulation will not change in the row estimate, but the incremental savings from including insulation in the package will be less due to the more efficient furnace's impact on reducing the energy required to make up heat losses through the wall (there is less energy being used, so less to save).

HOME ENERGY SAVER™

DETAILED UPGRADE RECOMMENDATIONS REPORT

This is a printable report of the upgrades selected for the home. These upgrades have the potential to save $945 each year on the utility bill.

Upgrade Package Summary:

Estimate Yearly Bill Savings:	$945
Estimated Lifetime Energy Savings:	$16,065
Estimated Added Cost:	$278
Maximum Price for 10 Year Payback:	$4,444
Return on Investment:	41%
Upgrade Pays for Itself in:	2 years

You selected the following upgrades:

- Replace high use incandescent lamps with compact fluorescent lamps
- When replacing your electric clothes dryer, switch to natural gas model
- Insulate basement walls to R-11
- When replacing your clothes washer, choose an ENERGY STAR-labeled model
- When replacing your gas furnace, choose an ENERGY STAR-labeled model
- Increase attic floor insulation to R-19
- When replacing your gas water heater, choose an energy efficient model
- Install a programmable thermostat

Note: The economic benefits for each of the upgrades below are evaluated in isolation from the other upgrades. If the efficiency level is changed for one upgrade, its potential impact on other upgrades will not be counted in the individual upgrade estimates. However, these kinds of interactions are included in the "package" totals associated with the whole-house totals and chart at the top of the page (above). For example, if the furnace efficiency is increased, the energy savings from wall insulation will not change in the table below, but the incremental savings from including insulation in the package will be less due to the more efficient furnace's impact on reducing the energy required to make up heat losses through the wall (there is less energy being used, so less to save).

Replace high use incandescent lamps with compact fluorescent lamps

Economic Benefits:

Estimate Yearly Bill Savings:	$57
Estimated Lifetime Energy Savings:	$969
Estimated Added Cost:	$88
Maximum Price for 10 Year Payback:	$285
Return on Investment:	58%
Upgrade Pays for Itself in:	2 years

Additional Benefits:

Fluorescent lamps last several times longer than ordinary incandescent bulbs, which saves you the time and expense of replacing bulbs when they burn out.

Upgrade Description:

Replace high-use incandescent lamps with compact fluorescent lamps. These units can save up to 75% of the energy used by an ordinary incandescent bulb.

Purchasing Tips:

- Compare the light output in Lumens of the bulb you are replacing to ensure you are using the appropriate CFL. Most CFLs list their light output and equivalent incandescent wattage on their package.
- CFLs are available in many shapes and sizes, which will allow replacing nearly any incandescent bulb.
- When buying new light fixtures, look for ENERGY STAR qualified models.
- CFLs are a good investment for lights that are used 2-3 hours per day on average or more.

More Information:

- ENERGY STAR qualifying lighting product list
- General information about lighting from DOE

[Return to upgrades list]

When replacing your electric clothes dryer, switch to natural gas model

Economic Benefits:

Estimate Yearly Bill Savings:	**$81**
Estimated Lifetime Energy Savings:	**$1,377**
Estimated Added Cost:	**$160**
Maximum Price for 10 Year Payback:	**$405**
Return on Investment:	**50%**
Upgrade Pays for Itself in:	**2 years**

Additional Benefits:
Natural gas clothes dryers reduce your home's peak load on the power grid compared to an electric dryer.

Upgrade Description:
When replacing your electric clothes dryer, select a natural gas model. In many situations, this willreduce your overall energy bill because natural gas tends to cost less than electricity, for the same heating value.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness are for a minimum-efficiency natural gas dryer model. The defaultupgrade cost provided here assumes that a natural gas connection is available at your clothes dryer. If this is not the case, be sure to include the costof extending

Purchasing Tips:

- To use a gas dryer, your laundry room must have a gas hookup, with proper connections and safe venting of the gas's exhaust, in addition to an electrical outlet
- Look for a dryer with a moisture sensor, and use the dryness settings rather than timed drying.
- When replacing your clothes washer, choose a model with high-speed spin cycles. This feature removes more water from clothes, which reduces the energy and time required for drying.

More Information:

- General Information from DOE
- Laundry tips from ACEEE
- Information from the California Energy Commission

[Return to upgrades list]

Insulate basement walls to R-11

Economic Benefits:

Estimate Yearly Bill Savings:	**$126**
Estimated Lifetime Energy Savings:	**$2,142**
Estimated Added Cost:	**$299**
Maximum Price for 10 Year Payback:	**$630**
Return on Investment:	**42%**
Upgrade Pays for Itself in:	**2 years**

Additional Benefits:
Well-insulated basement walls can make your home more comfortable and quieter, and guard against moisture problems and water pipe breakage.

Upgrade Description:
Insulate your basement walls to at least R-11. Uninsulated basements can account for as much as 25% of a home's total heat loss. Proper insulation, as well as sealing air leaks in your home's thermal shell, is vital to reducing these energy losses.

Note: The annual bill savings and cost-effectiveness assume that you upgrade the entire basement wall area to R-11. The bill savings will be

less if you do not upgrade the entire area, but the cost-effectiveness of upgrading less than all of the basement wall area should be approximately the same as shown above.

Purchasing Tips:

- When comparing contractors' bids, make sure they are for the same insulating value R-value, not just the same number of inches. [7]
- For a finished or heated basement, the best insulation option is to add 2x4 studs inside the basement walls, insulate between the studs with fiberglass insulation, and cover with drywall. This option is costly, but may be worth it as it also gives a more finished look to the basement. [7]
- To protect the insulation from moisture damage, be sure to provide an air space between the basement walls and the insulation. [7]
- Before insulating, you should correct drainage problems on the outside of your house if water leaks into your basement. Hire a qualified contractor who understands foundation drainage. [8]

More Information:

- General Information
- DOE Insulation Tips
- Installation Tips
- Tips for determining the R-value of old insulation

[Return to upgrades list]

When replacing your clothes washer, choose an ENERGY STAR-labeled model

Economic Benefits:

Estimate Yearly Bill Savings:	**$56**
Estimated Lifetime Energy Savings:	**$952**
Estimated Added Cost:	**$180**
Maximum Price for 10 Year Payback:	**$280**
Return on Investment:	**30%**
Upgrade Pays for Itself in:	**3 years**

Additional Benefits:
ENERGY STAR® clothes washers can reduce water use significantly, leave the clothes drier thus reducing drying time and energy consumption, and reduce wear and tear on clothes.

Upgrade Description:
When replacing your clothes washer, choose an ENERGY STAR-labeled model. ENERGY STAR clothes washers can reduce energy consumption by up to 70% and are available in top-loading and front-loading designs. Some ENERGY STAR models use up to 50% less water in addition to saving energy.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness are for a model with the lowest efficiency that qualifies for the ENERGY STAR label.

Purchasing Tips:

- Choose a clothes washer with high-speed spin cycles. This feature removes more water from clothes, which reduces the energy and time required for drying.
- Select a low water-use, high efficiency washer. Front-loading tumble-action washers can cut energy use by up to 70 percent, reduce water consumption significantly, and may actually get clothes cleaner. [1]
- Look for pre-soaking and/or "suds saver" options which conserve energy.
- Clothes washers come with EnergyGuide yellow and black labels. Use these labels to select the most efficient model for the capacity you have chosen.

More Information:

- ENERGY STAR clothes washer product list
- General Information from DOE
- Top-Rated Energy-Efficient Clothes Washers from ACEEE

[Return to upgrades list]

When replacing your gas furnace, choose an ENERGY STAR-labeled model

Economic Benefits:

Estimate Yearly Bill Savings:	**$167**

Estimated Lifetime Energy Savings:	**$2,839**
Estimated Added Cost:	**$549**
Maximum Price for 10 Year Payback:	**$835**
Return on Investment:	**30%**
Upgrade Pays for Itself in:	**3 years**

Additional Benefits:
ENERGY STAR® gas-fired furnaces make your home more comfortable. Some models are less prone to causing indoor air quality problems or house fires.

Upgrade Description:
When replacing your gas furnace, choose an ENERGY STAR-labeled model. These units can save 15% or more of your heating bill.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness are for a furnace with the lowest efficiency that qualifies for the ENERGY STAR label 90 AFUE. Higher efficiency models are available, which can provide additional bill savings.

Purchasing Tips:

- Buy the right size of furnace for your needs. If you have upgraded your home's insulation or windows since your last furnace was installed, you may be able to down-size your furnace i.e., buy a smaller-capacity furnace which can reduce the cost. If you buy a furnace that is too big for your home's needs, it will have short cycle times and reduced efficiency as a result. A furnace that is properly sized costs less to operate. Be sure to have your contractor perform a heat-loss, heat-gain calculation, and do not rely on rule-of-thumb sizing estimates, which are often inaccurate. [3]
- If you live in a large house, consider purchasing one of the higher efficiency furnaces that come with two-stage burners. These burners allow the furnace to operate at lower burn rates using less fuel when the home's heating demand is low. When the heating demand is higher, the second stage burner is employed. The additional savings from this feature may well be worth the cost if you live in a large home. [3]
- New and/or efficient furnaces often have different venting and flue requirements. When replacing your furnace make sure your contractor assesses your existing flue, follows new code requirements for venting furnaces, and obtains necessary permits and inspections. [3]
- All new furnaces are labeled with their Annual Fuel Utilization Efficiency AFUE. The higher the AFUE, the more efficient the unit.
- Consider selecting a furnace with an electronically commutated, or ECM, blower motor. ECM motors are considerably more efficient than standard motors. Consider this feature especially if you run your furnace fan all year long for such things as comfort or air cleaning. A furnace fan with an ECM motor could cut the cost of running the furnace fan by a factor of 5.[3]
- If your duct system has leaks or disconnected portions, you will not reap the full energy savings you could get from a high efficiency furnace. Consider having your heating contractor check the entire length of your ductwork for leaks and seal any leaks with mastic-type sealant, not duct tape. It's now possible for a contractor to perform verified duct sealing by using a special fan to test duct system leakage before and after sealing. Also have the contractor check for and repair disconnected ducts - a common problem. Insulate any ducts in unheated spaces to at least R-6.
- If you don't already have one, consider purchasing a programmable thermostat and having your contractor install it along with your new furnace.

More Information:

- ENERGY STAR furnace product list
- Consortium for Energy Efficiency furnace product list
- Top-Rated Energy-Efficient Furnaces from ACEEE
- General Information from DOE click on "Space Heating and Cooling"
- Sizing and Installation of Heating and Cooling Equipment
- How to prevent health and safety problems with combustion equipment

|Return to upgrades list|

Increase attic floor insulation to R-19

Economic Benefits:

Estimate Yearly Bill Savings:	**$118**
Estimated Lifetime Energy Savings:	**$2,006**
Estimated Added Cost:	**$456**
Maximum Price for 10 Year Payback:	**$590**
Return on Investment:	**26%**
Upgrade Pays for Itself in:	**4 years**

Additional Benefits:
A well-insulated ceiling can make your home more comfortable and quieter, reduce the risk of moisture damage, enhance fire safety, make

your home more disaster-resistant, and help guard against pipe freezing.

Upgrade Description:
Insulate your ceiling to at least R-19. In a typical home, half or more of the energy loss is through the exterior walls, floor and roof. Proper insulation, as well as sealing air leaks in your home's shell, is vital to reducing these energy losses.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness assume the ceiling insulation is upgraded to R-19. Insulating to a higher R-value would provide additional energy savings.

Purchasing Tips:

- Make sure all holes in the attic floor are sealed before you install insulation. Make sure there is a vapor retarder between the attic floor and the insulation to help prevent excess moisture from condensing on the insulation. However, if you are adding insulation on top of pre-existing insulation, don't install a vapor retarder, since it may trap moisture in the old insulation underneath. [5]
- If access to the attic is limited, blown-in cellulose or fiberglass insulation is your best bet. [5]
- Make sure the insulation does not block the attic vents, and that it is even and free of gaps. [5]
- When comparing contractors' bids, make sure they are for the same insulating value R-value, not just the same number of inches. [7]
- If you are doing the installation yourself, consider using cellulose. Cellulose insulation is less expensive and has a higher R-value per inch than fiberglass, and will not irritate your skin and lungs. [7]

More Information:

- General Information
- DOE Insulation Tips
- Installation Tips
- Tips for determining the R-value of old insulation

|Return to upgrades list|

When replacing your gas water heater, choose an energy efficient model

Economic Benefits:

Estimate Yearly Bill Savings:	**$37**
Estimated Lifetime Energy Savings:	**$629**
Estimated Added Cost:	**$170**
Maximum Price for 10 Year Payback:	**$185**
Return on Investment:	**20%**
Upgrade Pays for Itself in:	**5 years**

Additional Benefits:
Efficient gas-fired water heaters may hold their temperature longer following power interruptions and operate more safely.

Upgrade Description:
When replacing your gas water heater, choose an energy-efficient model with an Energy Factor of 0.62 or higher.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness assume the efficient water heater has an energy factor of 0.62 and recovery efficiency of 0.76. Higher efficiency units are available, and would provide additional energy savings.

Purchasing Tips:

- The most important measure of efficiency for water heaters is the Energy Factor EF. The higher the EF, the more efficient the water heater.
- Purchase a water heater whose tank is internally insulated with at least R-16. [5]
- A water heater that is too large for your home not only has a higher purchase cost but will increase your energy costs due to excessive cycling and standby losses. The resources below provide good, simple guidance on proper sizing of water heaters. The size, or "capacity", of a fuel-fired water heater should be judged by its first hour rating FHR, not its tank size. Due to larger burners, some gas water heaters with smaller tanks actually have higher capacities FHRs than models with larger tanks.
- Many types of water heaters are now available, such as "demand" tankless, "indirect" or "integrated", and solar-assisted water heaters. More Information
- New and/or efficient gas water heaters may have different venting and flue requirements. When replacing your water heater make sure your contractor assesses your existing flue, follows new code requirements for venting water heaters, and obtains necessary permits and inspections. [3]

More Information:

- General Information from DOE
- DOE Water Heating fact sheet
- Top-Rated Energy-EfficientWater Heaters from ACEEE

- GAMA consumer's directory click on "Consumers"
- How to prevent health and safety problems with combustion equipment

[Return to upgrades list]

Install a programmable thermostat

Economic Benefits:

Estimate Yearly Bill Savings:	**$66**
Estimated Lifetime Energy Savings:	**$1,122**
Estimated Added Cost:	**$320**
Maximum Price for 10 Year Payback:	**$330**
Return on Investment:	**19%**
Upgrade Pays for Itself in:	**5 years**

Additional Benefits:
Programmable thermostats can help keep your home more comfortable.

Upgrade Description:
Install an ENERGY STAR labeled programmable thermostat, and program it to change the temperature settings when you are away from home and at night. EPA estimates that ENERGY STAR-labeled programmable thermostats can save consumers 10-15% on heating and cooling bills when used properly. Note: Our calculations bill savings and cost-effectiveness assume that the heating-season set-point is decreased 4 degrees F during the day 9 am to 5 pm and at night 11 am to 7 pm, while the cooling-season set-point is increased 3 degrees F during those same periods. Larger set-point adjustments can provide additional bill savings.

Purchasing Tips:

- Some programmable thermostats have a "smart" feature designed to maximize energy savings. These thermostats continually monitor usage patterns in order to determine the best time to turn the system on in order to reach the desired temperature setting, while minimizing energy use.

More Information:

- ENERGY STAR thermostat product list
- General Information

[Return to upgrades list]

HOME ENERGY SAVER™

ROADMAP TO RESULTS

Ease into the process of making your home more efficient. If you're new to this, or you're on a very tight budget, start with the lowest-hanging fruit like double-checking your water heater's temperature setting.

The next easy steps are simple things that will fit into your shopping basket: maybe a few compact fluorescent lamps or a roll of weatherstripping.

When it's time to replace that old fridge, or other appliances, take time to shop smart. At a minimum, look for the ENERGY STAR rating. There are detailed lists of products that will take you even farther. Remember: you're not simply spending money, you're investing for profit and comfort.

Redoing your kitchen? New roof? Finally adding that in-law unit? Creating successful projects can take some work. Take the time to find a home performance specialist to help you think thru all the options ahead of time, and then find the right contractor with the skills to do the job right.

Not only will these upgrades pay for themselves many times over, there are all kinds of financial incentives to help you trim the cost. And many of the "non-energy benefits" will be worth more than money can buy.

And, don't forget about saving water (which also saves energy).

Stumped? Ask an expert.

HOME ENERGY SAVER™

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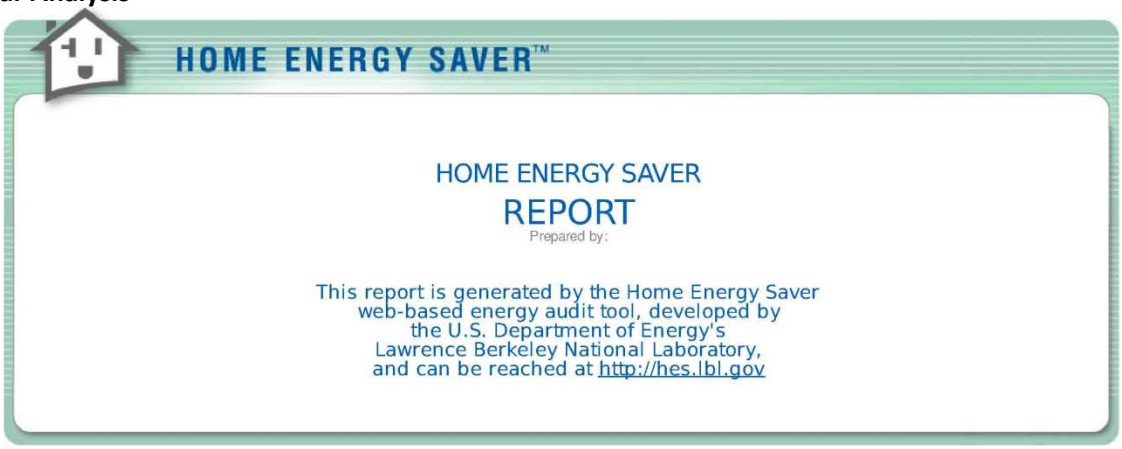
10-Year Analysis



HOME ENERGY SAVER™

HOME ENERGY SAVER

REPORT

Prepared by:

This report is generated by the Home Energy Saver web-based energy audit tool, developed by the U.S. Department of Energy's Lawrence Berkeley National Laboratory, and can be reached at http://hes.lbl.gov

HOME ENERGY SAVER™

HOUSE CONFIGURATION

General Information

Name or other identifier this home/session : **Nottingham**; User's email address : **karyncb@umich.edu**; Purpose of this assessment : **Hypothetical analysis**; Address : **3975 Nottingham Rd.**; City : **Detroit**; State : **Michigan**; City with most similar climate to modeled house : **Detroit**; Year house was built : **1941**; People living in the house, by the age - 0-5 : **1**; People living in the house, by the age - 6-13 : **1**; People living in the house, by the age - 14-64 : **2**; People living in the house, by the age - 65 plus : **0**; Check for actual electricity prices in your area. : **no**; Utilities List : **no**; Select your tariff from the list below. : **no**;

Energy Prices

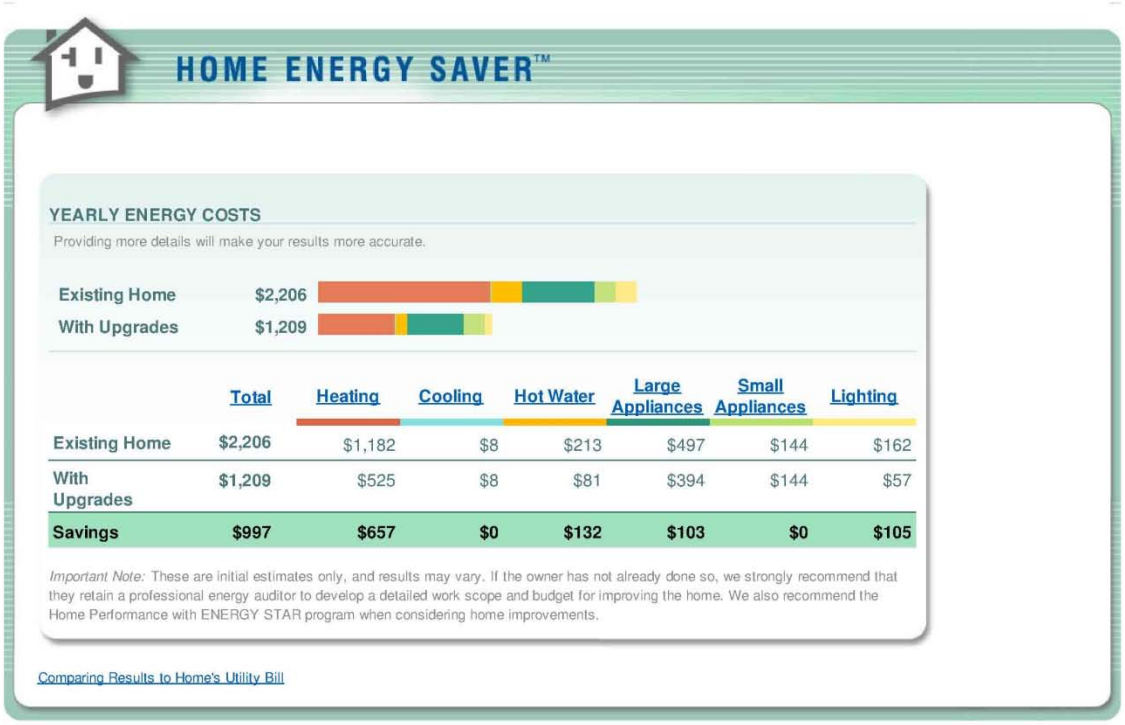
Energy Prices - Electricity : **0.112**; Energy Prices - Piped Natural Gas : **0.900**; Energy Prices - Liquid Propane Gas (LPG) : **0.010**; Energy Prices - Fuel Oil : **0.010**;

Building Design

Foundation or floor insulation : **No/Don't Know**; Attic type : **Unconditioned Attic**; Wall insulation : **No/Don't Know**; Does the house have weather-stripping and/or caulking : **No**; Describe windows on each side of house - Front Type : **Single-pane, clear, Wood or Vinyl**; Describe windows on each side of house - Front SqFt : **44.50**; Describe windows on each side of house - Back Type : **Single-pane, clear, Wood or Vinyl**; Describe windows on each side of house - Back SqFt : **16.70**; Describe windows on each side of house - Left Type : **Single-pane, clear, Wood or Vinyl**; Describe windows on each side of house - Left SqFt : **65.50**; Describe windows on each side of house - Right Type : **Single-pane, clear, Wood or Vinyl**; Describe windows on each side of house - Rgith SqFt : **54.00**; Stories above ground level : **2**; Roof Insulation level : **R-0**; Conditioned floor area (all stories combined) ? : **912**; Type of foundation : **Conditioned Basement**; Ceiling Insulation level : **R-0 (no insulation)**;

Appliances Equipment

Clothes Washer : **Yes**; Number of refrigerators : **1 Refrigerator**; Water heater - year purchased : **1 Refrigerator**; Water heater - Tank Size : **40**; Water heater - Fuel : **Natural Gas**; Heating equipment - Type : **Central Gas furnace**; Heating equipment - Year purchased : **Central Gas furnace**; Cooling equipment - Type : **No Cooling Equipment**; Cooling equipment - Year Purchased : **No Cooling Equipment**; Thermal distribution - Duct Location : **Conditioned space**; Thermal distribution - Ducts Insulated : **No/Don't Know**; Thermal distribution - Boiler pipe insulation : **No/Don't Know**;



HOME ENERGY SAVER™

YEARLY ENERGY COSTS

Providing more details will make your results more accurate.

Existing Home	$2,206
With Upgrades	$1,209

	Total	Heating	Cooling	Hot Water	Large Appliances	Small Appliances	Lighting
Existing Home	$2,206	$1,182	$8	$213	$497	$144	$162
With Upgrades	$1,209	$525	$8	$81	$394	$144	$57
Savings	**$997**	**$657**	**$0**	**$132**	**$103**	**$0**	**$105**

Important Note: These are initial estimates only, and results may vary. If the owner has not already done so, we strongly recommend that they retain a professional energy auditor to develop a detailed work scope and budget for improving the home. We also recommend the Home Performance with ENERGY STAR program when considering home improvements.

Comparing Results to Home's Utility Bill

HOME ENERGY SAVER™

YEARLY WHOLE HOUSE RESULTS

		Existing Home	With Upgrades	Savings	Percentage Reductions
Whole House	Energy Bill	$2,206	$1,209	**$997**	45%
	Electricity	6,643 kWh	4,061 kWh	**2,582 kWh**	39%
	Natural Gas	1,626 Therms	839 Therms	**787 Therms**	48%
	Emissions	29,382 CO2	16,152 CO2	**13,230 lb. CO_2**	45%
Heating	Energy Bill	$1,182	$525	**$657**	56%
	Electricity	440 kWh	354 kWh	**86 kWh**	20%
	Natural Gas	1,259 Therms	539 Therms	**720 Therms**	57%
	Emissions	15,397 lb. CO_2	6,853 lb. CO_2	**8,544 lb. CO_2**	56%
Cooling	Energy Bill	$8	$8	**$0**	0%
	Electricity	75 kWh	75 kWh	**0 kWh**	0%
	Emissions	117 lb. CO_2	117 lb. CO_2	**0 lb. CO_2**	0%
Hot Water	Energy Bill	$213	$81	**$132**	62%
	Natural Gas	237 Therms	90 Therms	**147 Therms**	62%
	Emissions	2,769 lb. CO_2	1,051 lb. CO_2	**1,718 lb. CO_2**	62%
Large Appliances	Energy Bill	$497	$394	**$103**	21%
	Electricity	3,393 kWh	1,834 kWh	**1,559 kWh**	46%
	Natural Gas	130 Therms	210 Therms	**-80 Therms**	-62%
	Emissions	6,823 lb. CO_2	5,321 lb. CO_2	**1,502 lb. CO_2**	22%
Small Appliances	Energy Bill	$144	$144	**$0**	0%
	Electricity	1,290 kWh	1,290 kWh	**0 kWh**	0%
	Emissions	2,017 lb. CO_2	2,017 lb. CO_2	**0 lb. CO_2**	0%
Lighting	Energy Bill	$162	$57	**$105**	65%
	Electricity	1,445 kWh	507 kWh	**938 kWh**	65%
	Emissions	2,259 lb. CO_2	793 lb. CO_2	**1,466 lb. CO_2**	65%

Heating electricity values include fan or pumping energy for homes that have forced-air or water-based heating systems powered by circulation pumps. The values for Hot Water include taps and faucets only; the energy consumed by the water heater to supply hot water for appliances such as clothes washers and dishwashers is included instead in the rows for those appliances.

HOME ENERGY SAVER™

YEARLY HEATING AND COOLING RESULTS

Show Details

	Total Cost
Cost	$1,190
Heating	$1,182
Cooling	$8

	Total Energy
Energy Use	1,259 therms 515 kWh
Heating	1,259 therms 440 kWh
Cooling	75 kWh

Notes: this house is 0% heated by wood fuel.
100% of the floor area is heated and 100% cooled.

Heating electricity values include fan or pumping energy for homes that have forced-air or water-based heating systems powered by circulation pumps.

What if my results don't match my energy bill?

HOME ENERGY SAVER™

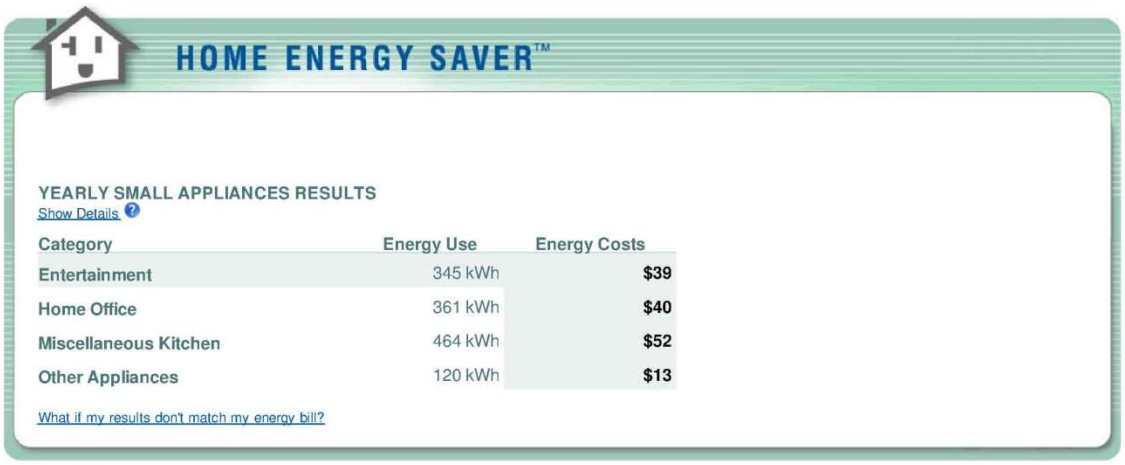
YEARLY LARGE APPLIANCES AND WATER HEATING RESULTS

Show Details

Appliance	Total Cost
First Refrigerator	$120
Stove	$41
Oven	$27
Clothesdryer	$163
Clotheswasher	$102
Dishwasher	$44
Hot Water: Taps and Faucets	$213
Totals	$710

Equipment energy is the energy used by motors, heating elements, and burners inside your appliances. This number excludes the energy consumed by your water heater to supply hot water for appliances such as clothes washers and dishwashers (which is included instead in the rows for those appliances).

What if my results don't match my energy bill?



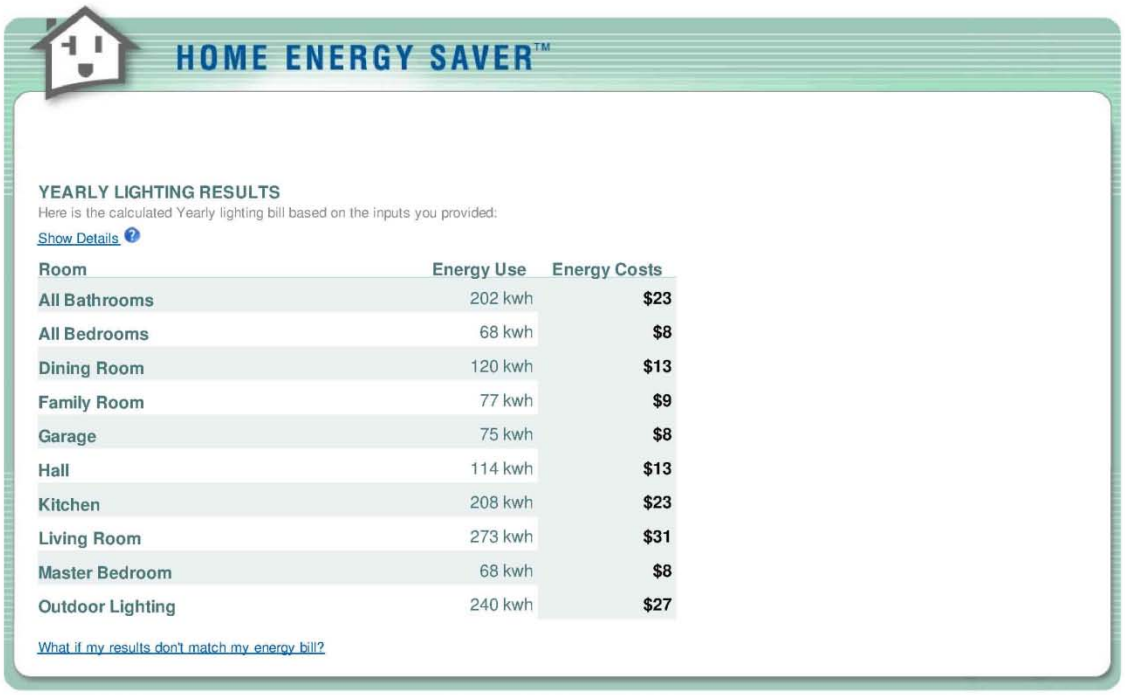
HOME ENERGY SAVER™

YEARLY SMALL APPLIANCES RESULTS

Show Details

Category	Energy Use	Energy Costs
Entertainment	345 kWh	$39
Home Office	361 kWh	$40
Miscellaneous Kitchen	464 kWh	$52
Other Appliances	120 kWh	$13

What if my results don't match my energy bill?



HOME ENERGY SAVER™

YEARLY LIGHTING RESULTS

Here is the calculated Yearly lighting bill based on the inputs you provided:

Show Details

Room	Energy Use	Energy Costs
All Bathrooms	202 kwh	$23
All Bedrooms	68 kwh	$8
Dining Room	120 kwh	$13
Family Room	77 kwh	$9
Garage	75 kwh	$8
Hall	114 kwh	$13
Kitchen	208 kwh	$23
Living Room	273 kwh	$31
Master Bedroom	68 kwh	$8
Outdoor Lighting	240 kwh	$27

What if my results don't match my energy bill?

HOME ENERGY SAVER™

UPGRADE RECOMMENDATIONS SUMMARY

Visit 'Recommendations' to see more information on each upgrade.

	Yearly Savings	Estimated Added Cost	How Much is Too Much?	Simple Payback Time	Estimated ROI	Avoided Emissions (lbs. CO_2)
Total for recommended upgrades	**$997**	**$3,072**	**$9,970**	**3**	**31%**	**13,230**

Important Note: These are initial estimates only, and results may vary. If the owner has not already done so, we strongly recommend that they retain a professional energy auditor to develop a detailed work scope and budget for improving the home. We also recommend the Home Performance with ENERGY STAR program when considering home improvements.

Upgrades Requiring Investment

1. Indoor lights
2. Electric clothes dryer
3. Basement wall insulation
4. Clothes washer
5. Gas furnace
6. Attic insulation
7. Gas water heater
8. Thermostat
9. Air sealing

Other benefits that often come along with these energy-saving upgrades

- Fluorescent lamps last several times longer than ordinary incandescent bulbs, which saves you the time and expense of replacing bulbs when they burn out.
- Natural gas clothes dryers reduce your home's peak load on the power grid compared to an electric dryer.
- Well-insulated basement walls can make your home more comfortable and quieter, and guard against moisture problems and water pipe breakage.
- ENERGY STAR® clothes washers can reduce water use significantly, leave the clothes drier thus reducing drying time and energy consumption, and reduce wear and tear on clothes.
- ENERGY STAR® gas-fired furnaces make your home more comfortable. Some models are less prone to causing indoor air quality problems or house fires.
- A well-insulated ceiling can make your home more comfortable and quieter, reduce the risk of moisture damage, enhance fire safety, make your home more disaster-resistant, and help guard against pipe freezing.
- Efficient gas-fired water heaters may hold their temperature longer following power interruptions and operate more safely.
- Programmable thermostats can help keep your home more comfortable.
- Having a professional seal your home's air leaks can make your home more comfortable, reduce the risk of moisture damage, improve indoor air quality and fire safety, and help to prevent frozen water pipes.

HOME ENERGY SAVER™

UPGRADE RECOMMENDATIONS

What efficiency level would you like to model for the initial selection of upgrades? EnergyStar

What simple payback period would you like to use for selecting upgrades? 10

RECALCULATE Rows that are dimmed are not included in the calculated values for the retrofit package. To include them check their boxes and recalculate.

Add/ Remove	Upgrade	Upgrade Choice & Description	Yearly Savings	Estimated Added Cost	How Much is Too Much?	Simple Payback Time	Estimated Return on Investment	Avoided Emissions (lbs. CO_2)
☐	Check/Uncheck All Upgrades	**Total for Selected Upgrades:**	**$997**	**$3,072**	**$9,970**	**3**	**31%**	**13,230**
☑	Indoor lights	CFLs in high-use fixtur	$57	$ 88	$570	2	58%	1,466
☑	Electric clothes dryer	Switch to gas dryer	$81	$ 160	$810	2	50%	1,210
☑	Basement wall insulation	R-11	$126	$ 299	$1,260	2	42%	1,636
☑	Clothes washer	MEF=1.42 WF=9.5 EN	$56	$ 180	$560	3	30%	528
☑	Gas furnace	AFUE=90 ENERGY S	$167	$ 549	$1,670	3	30%	2,177
☑	Attic insulation	R-19	$118	$ 456	$1,180	4	26%	1,531
☑	Gas water heater	EF=0.62	$37	$ 170	$370	5	20%	479
☑	Thermostat	ENERGY STAR-label	$66	$ 320	$660	5	19%	865
☑	Air sealing	25% air leakage reduc	$83	$ 850	$830	10	9%	1,087
☐	Refrigerator	15% better than standa	$8	$ 87	$80	11	8%	114
☐	Wall insulation	R-11 wall cavity	$205	$ 388	$2,050	19	3%	2,664
☐	Windows	2-pane/solar-control lo	$27	$ 543	$270	20	3%	351
☐	Dishwasher	EF=0.58 ENERGY ST.	$17	$ 360	$170	21	NCE	193
☐	Ceiling fan	ENERGY STAR-label	$1	$ 60	$10	60	NCE	13
☐	Cool roof	Solar reflectance = 0.1	$0	$ 31	$0	9,999	NCE	0

Important Note: These are initial estimates only, and results may vary. If the owner has not already done so, we strongly recommend that they retain a professional energy auditor to develop a detailed work scope and budget for improving the home. We also recommend the Home Performance with ENERGY STAR program when considering home improvements.

NCE = Not Cost Effective. This upgrade will not pay for itself in your situation. There may be other reasons, such as improved comfort, to implement the upgrade, or it could be made more cost-effective if the investment cost is reduced.

Note: Each of the upgrades in the table above are evaluated in isolation from the others. If the efficiency level is changed for one upgrade, its potential impact on other upgrades will not be counted in the row-by-row estimates. However, these kinds of interactions are included in the "package" totals associated with the whole-house totals and chart at the top of the page, for the upgrades selected as part of the package. For example, if the furnace efficiencies are raised, the energy savings from wall insulation will not change in the row estimate, but the incremental savings from including insulation in the package will be less due to the more efficient furnace's impact on reducing the energy required to make up heat losses through the wall (there is less energy being used, so less to save).

HOME ENERGY SAVER™

DETAILED UPGRADE RECOMMENDATIONS REPORT

This is a printable report of the upgrades selected for the home. These upgrades have the potential to save $997 each year on the utility bill.

Upgrade Package Summary:

Estimate Yearly Bill Savings:	$997
Estimated Lifetime Energy Savings:	$18,943
Estimated Added Cost:	$341
Maximum Price for 10 Year Payback:	$9,216
Return on Investment:	31%
Upgrade Pays for Itself in:	3 years

You selected the following upgrades:

- Replace high use incandescent lamps with compact fluorescent lamps
- When replacing your electric clothes dryer, switch to natural gas model
- Insulate basement walls to R-11
- When replacing your clothes washer, choose an ENERGY STAR-labeled model
- When replacing your gas furnace, choose an ENERGY STAR-labeled model
- Increase attic floor insulation to R-19
- When replacing your gas water heater, choose an energy efficient model
- Install a programmable thermostat
- Have a professional seal your home's air leaks

Note: The economic benefits for each of the upgrades below are evaluated in isolation from the other upgrades. If the efficiency level is changed for one upgrade, its potential impact on other upgrades will not be counted in the individual upgrade estimates. However, these kinds of interactions are included in the "package" totals associated with the whole-house totals and chart at the top of the page (above). For example, if the furnace efficiency is increased, the energy savings from wall insulation will not change in the table below, but the incremental savings from including insulation in the package will be less due to the more efficient furnace's impact on reducing the energy required to make up heat losses through the wall (there is less energy being used, so less to save).

Replace high use incandescent lamps with compact fluorescent lamps

Economic Benefits:

Estimate Yearly Bill Savings:	$57
Estimated Lifetime Energy Savings:	$1,083
Estimated Added Cost:	$88
Maximum Price for 10 Year Payback:	$570
Return on Investment:	58%
Upgrade Pays for Itself in:	2 years

Additional Benefits:

Fluorescent lamps last several times longer than ordinary incandescent bulbs, which saves you the time and expense of replacing bulbs when they burn out.

Upgrade Description:

Replace high-use incandescent lamps with compact fluorescent lamps. These units can save up to 75% of the energy used by an ordinary incandescent bulb.

Purchasing Tips:

- Compare the light output in Lumens of the bulb you are replacing to ensure you are using the appropriate CFL. Most CFLs list their light output and equivalent incandescent wattage on their package.
- CFLs are available in many shapes and sizes, which will allow replacing nearly any incandescent bulb.
- When buying new light fixtures, look for ENERGY STAR qualified models.

- CFLs are a good investment for lights that are used 2-3 hours per day on average or more.

More Information:

- ENERGY STAR qualifying lighting product list
- General information about lighting from DOE

[Return to upgrades list]

When replacing your electric clothes dryer, switch to natural gas model

Economic Benefits:

Estimate Yearly Bill Savings:	**$81**
Estimated Lifetime Energy Savings:	**$1,539**
Estimated Added Cost:	**$160**
Maximum Price for 10 Year Payback:	**$810**
Return on Investment:	**50%**
Upgrade Pays for Itself in:	**2 years**

Additional Benefits:
Natural gas clothes dryers reduce your home's peak load on the power grid compared to an electric dryer.

Upgrade Description:
When replacing your electric clothes dryer, select a natural gas model. In many situations, this willreduce your overall energy bill because natural gas tends to cost less than electricity, for the same heating value.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness are for a minimum-efficiency natural gas dryer model. The defaultupgrade cost provided here assumes that a natural gas connection is available at your clothes dryer. If this is not the case, be sure to include the costof extending

Purchasing Tips:

- To use a gas dryer, your laundry room must have a gas hookup, with proper connections and safe venting of the gas's exhaust, in addition to an electrical outlet
- Look for a dryer with a moisture sensor, and use the dryness settings rather than timed drying.
- When replacing your clothes washer, choose a model with high-speed spin cycles. This feature removes more water from clothes, which reduces the energy and time required for drying.

More Information:

- General Information from DOE
- Laundry tips from ACEEE
- Information from the California Energy Commission

[Return to upgrades list]

Insulate basement walls to R-11

Economic Benefits:

Estimate Yearly Bill Savings:	**$126**
Estimated Lifetime Energy Savings:	**$2,394**
Estimated Added Cost:	**$299**
Maximum Price for 10 Year Payback:	**$1,260**
Return on Investment:	**42%**
Upgrade Pays for Itself in:	**2 years**

Additional Benefits:
Well-insulated basement walls can make your home more comfortable and quieter, and guard against moisture problems and water pipe breakage.

Upgrade Description:
Insulate your basement walls to at least R-11. Uninsulated basements can account for as much as 25% of a home's total heat loss. Proper insulation, as well as sealing air leaks in your home's thermal shell, is vital to reducing these energy losses.

Note: The annual bill savings and cost-effectiveness assume that you upgrade the entire basement wall area to R-11. The bill savings will be less if you do not upgrade the entire area, but the cost-effectiveness of upgrading less than all of the basement wall area should be approximately the same as shown above.

Purchasing Tips:

- When comparing contractors' bids, make sure they are for the same insulating value R-value, not just the same number of inches. [7]
- For a finished or heated basement, the best insulation option is to add 2x4 studs inside the basement walls, insulate between the studs with fiberglass insulation, and cover with drywall. This option is costly, but may be worth it as it also gives a more finished look to the basement. [7]
- To protect the insulation from moisture damage, be sure to provide an air space between the basement walls and the insulation. [7]
- Before insulating, you should correct drainage problems on the outside of your house if water leaks into your basement. Hire a qualified contractor who understands foundation drainage. [6]

More Information:

- General Information
- DOE Insulation Tips
- Installation Tips
- Tips for determining the R-value of old insulation

[Return to upgrades list]

When replacing your clothes washer, choose an ENERGY STAR-labeled model

Economic Benefits:

Estimate Yearly Bill Savings:	**$56**
Estimated Lifetime Energy Savings:	**$1,064**
Estimated Added Cost:	**$180**
Maximum Price for 10 Year Payback:	**$560**
Return on Investment:	**30%**
Upgrade Pays for Itself in:	**3 years**

Additional Benefits:
ENERGY STAR® clothes washers can reduce water use significantly, leave the clothes drier thus reducing drying time and energy consumption, and reduce wear and tear on clothes.

Upgrade Description:
When replacing your clothes washer, choose an ENERGY STAR-labeled model. ENERGY STAR clothes washers can reduce energy consumption by up to 70% and are available in top-loading and front-loading designs. Some ENERGY STAR models use up to 50% less water in addition to saving energy.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness are for a model with the lowest efficiency that qualifies for the ENERGY STAR label.

Purchasing Tips:

- Choose a clothes washer with high-speed spin cycles. This feature removes more water from clothes, which reduces the energy and time required for drying.
- Select a low water-use, high efficiency washer. Front-loading tumble-action washers can cut energy use by up to 70 percent, reduce water consumption significantly, and may actually get clothes cleaner. [1]
- Look for pre-soaking and/or "suds saver" options which conserve energy.
- Clothes washers come with EnergyGuide yellow and black labels. Use these labels to select the most efficient model for the capacity you have chosen.

More Information:

- ENERGY STAR clothes washer product list
- General Information from DOE
- Top-Rated Energy-Efficient Clothes Washers from ACEEE

[Return to upgrades list]

When replacing your gas furnace, choose an ENERGY STAR-labeled model

Economic Benefits:

Estimate Yearly Bill Savings:	**$167**
Estimated Lifetime Energy Savings:	**$3,173**
Estimated Added Cost:	**$549**
Maximum Price for 10 Year Payback:	**$1,670**
Return on Investment:	**30%**
Upgrade Pays for Itself in:	**3 years**

Additional Benefits:
ENERGY STAR® gas-fired furnaces make your home more comfortable. Some models are less prone to causing indoor air quality problems or house fires.

Upgrade Description:
When replacing your gas furnace, choose an ENERGY STAR-labeled model. These units can save 15% or more of your heating bill.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness are for a furnace with the lowest efficiency that qualifies for the ENERGY STAR label 90 AFUE. Higher efficiency models are available, which can provide additional bill savings.

Purchasing Tips:

- Buy the right size of furnace for your needs. If you have upgraded your home's insulation or windows since your last furnace was installed, you may be able to down-size your furnace i.e., buy a smaller-capacity furnace which can reduce the cost. If you buy a furnace that is too big for your home's needs, it will have short cycle times and reduced efficiency as a result. A furnace that is properly sized costs less to operate. Be sure to have your contractor perform a heat-loss, heat-gain calculation, and do not rely on rule-of-thumb sizing estimates, which are often inaccurate. [3]
- If you live in a large house, consider purchasing one of the higher efficiency furnaces that come with two-stage burners. These burners allow the furnace to operate at lower burn rates using less fuel when the home's heating demand is low. When the heating demand is higher, the second stage burner is employed. The additional savings from this feature may well be worth the cost if you live in a large home. [3]
- New and/or efficient furnaces often have different venting and flue requirements. When replacing your furnace make sure your contractor assesses your existing flue, follows new code requirements for venting furnaces, and obtains necessary permits and inspections. [3]
- All new furnaces are labeled with their Annual Fuel Utilization Efficiency AFUE. The higher the AFUE, the more efficient the unit.
- Consider selecting a furnace with an electronically commutated, or ECM, blower motor. ECM motors are considerably more efficient than standard motors. Consider this feature especially if you run your furnace fan all year long for such things as comfort or air cleaning. A furnace fan with an ECM motor could cut the cost of running the furnace fan by a factor of 5.[3]
- If your duct system has leaks or disconnected portions, you will not reap the full energy savings you could get from a high efficiency furnace. Consider having your heating contractor check the entire length of your ductwork for leaks and seal any leaks with mastic-type sealant, not duct tape. It's now possible for a contractor to perform verified duct sealing by using a special fan to test duct system leakage before and after sealing. Also have the contractor check for and repair disconnected ducts - a common problem. Insulate any ducts in unheated spaces to at least R-6.
- If you don't already have one, consider purchasing a programmable thermostat and having your contractor install it along with your new furnace.

More Information:

- ENERGY STAR furnace product list
- Consortium for Energy Efficiency furnace product list
- Top-Rated Energy-Efficient Furnaces from ACEEE
- General Information from DOE click on "Space Heating and Cooling"
- Sizing and Installation of Heating and Cooling Equipment
- How to prevent health and safety problems with combustion equipment

[Return to upgrades list]

Increase attic floor insulation to R-19

Economic Benefits:

Estimate Yearly Bill Savings:	**$118**
Estimated Lifetime Energy Savings:	**$2,242**
Estimated Added Cost:	**$456**
Maximum Price for 10 Year Payback:	**$1,180**
Return on Investment:	**26%**
Upgrade Pays for Itself in:	**4 years**

Additional Benefits:
A well-insulated ceiling can make your home more comfortable and quieter, reduce the risk of moisture damage, enhance fire safety, make your home more disaster-resistant, and help guard against pipe freezing.

Upgrade Description:
Insulate your ceiling to at least R-19. In a typical home, half or more of the energy loss is through the exterior walls, floor and roof. Proper insulation, as well as sealing air leaks in your home's shell, is vital to reducing these energy losses.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness assume the ceiling insulation is upgraded to R-19. Insulating to a higher R-value would provide additional energy savings.

Purchasing Tips:

- Make sure all holes in the attic floor are sealed before you install insulation. Make sure there is a vapor retarder between the attic floor and the insulation to help prevent excess moisture from condensing on the insulation. However, if you are adding insulation on top of pre-existing insulation, don't install a vapor retarder, since it may trap moisture in the old insulation underneath. [5]
- If access to the attic is limited, blown-in cellulose or fiberglass insulation is your best bet. [5]
- Make sure the insulation does not block the attic vents, and that it is even and free of gaps. [5]
- When comparing contractors' bids, make sure they are for the same insulating value R-value, not just the same number of inches. [7]
- If you are doing the installation yourself, consider using cellulose. Cellulose insulation is less expensive and has a higher R-value per inch than fiberglass, and will not irritate your skin and lungs. [7]

More Information:

- General Information
- DOE Insulation Tips
- Installation Tips
- Tips for determining the R-value of old insulation

[Return to upgrades list]

When replacing your gas water heater, choose an energy efficient model

Economic Benefits:

Estimate Yearly Bill Savings:	**$37**
Estimated Lifetime Energy Savings:	**$703**
Estimated Added Cost:	**$170**
Maximum Price for 10 Year Payback:	**$370**
Return on Investment:	**20%**
Upgrade Pays for Itself in:	**5 years**

Additional Benefits:
Efficient gas-fired water heaters may hold their temperature longer following power interruptions and operate more safely.

Upgrade Description:
When replacing your gas water heater, choose an energy-efficient model with an Energy Factor of 0.62 or higher.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness assume the efficient water heater has an energy factor of 0.62 and recovery efficiency of 0.76. Higher efficiency units are available, and would provide additional energy savings.

Purchasing Tips:

- The most important measure of efficiency for water heaters is the Energy Factor EF. The higher the EF, the more efficient the water heater.
- Purchase a water heater whose tank is internally insulated with at least R-16. [5]
- A water heater that is too large for your home not only has a higher purchase cost but will increase your energy costs due to excessive cycling and standby losses. The resources below provide good, simple guidance on proper sizing of water heaters. The size, or "capacity", of a fuel-fired water heater should be judged by its first hour rating FHR, not its tank size. Due to larger burners, some gas water heaters with smaller tanks actually have higher capacities FHRs than models with larger tanks.
- Many types of water heaters are now available, such as "demand" tankless, "indirect" or "integrated", and solar-assisted water heaters. More Information
- New and/or efficient gas water heaters may have different venting and flue requirements. When replacing your water heater make sure your contractor assesses your existing flue, follows new code requirements for venting water heaters, and obtains necessary permits and inspections. [3]

More Information:

- General Information from DOE
- DOE Water Heating fact sheet

- Top-Rated Energy-EfficientWater Heaters from ACEEE
- GAMA consumer's directory click on "Consumers"
- How to prevent health and safety problems with combustion equipment

[Return to upgrades list]

Install a programmable thermostat

Economic Benefits:

Estimate Yearly Bill Savings:	**$66**
Estimated Lifetime Energy Savings:	**$1,254**
Estimated Added Cost:	**$320**
Maximum Price for 10 Year Payback:	**$660**
Return on Investment:	**19%**
Upgrade Pays for Itself in:	**5 years**

Additional Benefits:
Programmable thermostats can help keep your home more comfortable.

Upgrade Description:
Install an ENERGY STAR labeled programmable thermostat, and program it to change the temperature settings when you are away from home and at night. EPA estimates that ENERGY STAR-labeled programmable thermostats can save consumers 10-15% on heating and cooling bills when used properly. Note: Our calculations bill savings and cost-effectiveness assume that the heating-season set-point is decreased 4 degrees F during the day 9 am to 5 pm and at night 11 am to 7 pm, while the cooling-season set-point is increased 3 degrees F during those same periods. Larger set-point adjustments can provide additional bill savings.

Purchasing Tips:

- Some programmable thermostats have a "smart" feature designed to maximize energy savings. These thermostats continually monitor usage patterns in order to determine the best time to turn the system on in order to reach the desired temperature setting, while minimizing energy use.

More Information:

- ENERGY STAR thermostat product list
- General Information

[Return to upgrades list]

Have a professional seal your home's air leaks

Economic Benefits:

Estimate Yearly Bill Savings:	**$83**
Estimated Lifetime Energy Savings:	**$1,577**
Estimated Added Cost:	**$850**
Maximum Price for 10 Year Payback:	**$830**
Return on Investment:	**9%**
Upgrade Pays for Itself in:	**10 years**

Additional Benefits:
Having a professional seal your home's air leaks can make your home more comfortable, reduce the risk of moisture damage, improve indoor air quality and fire safety, and help to prevent frozen water pipes.

Upgrade Description:
Have a qualified professional seal your home's air leaks. Leaky houses waste energy because heated or cooled air can easily escape. Older homes tend to be leakier than newer homes. Tightening up a leaky house will reduce the heating and cooling bills.

Recent advancements in air sealing technology allow specialists to go beyond the old techniques of caulking and weatherstripping around obvious places such as doors and windows. The biggest problems are usually hidden leaks in out of the way places such as attics, floors and walls, which are easily found and sealed by a specialist.

Note: The annual bill savings and cost-effectiveness assume that your home's air leakage is reduced by 25%.

Purchasing Tips:

- To get the best results, hire a qualified contractor, preferably a "building performance contractor", or "energy auditor" to find out where the leaks are in your home's shell. Make sure the contractor uses a "blower door" test to find the air leaks. An infrared scan can be beneficial in addition to the blower door test. Check with your utility company; some offer no- or low-cost basic energy audits. However, the extra money you would spend to have the audit done by a home performance contractor is often well worth it. [5,6]
- Make sure your contractor tests the leakage rate after completing the sealing, not only to determine the degree of improvement, but also to ensure that the ventilation in your home is adequate. If you don't already have proper mechanical ventilation, consider installing a ventilation system. Proper home ventilation will make your home healthier and more comfortable.
- Make sure your contractor performs a combustion safety test after sealing your home's air leaks. This test checks for backdrafting and carbon monoxide, and will help assure the safety of your home's occupants. [9]
- If you choose to do the work yourself, follow the guidance in ENERGY STAR's Do-It-Yourself Guide to ENERGY STAR Homesealing.

More Information:

- ENERGY STAR air sealing including DIY guide to air sealing
- Common Air Leakage Sites in the Home
- Information about Air Leakage Testing
- Does your home have enough ventilation?

[Return to upgrades list]

HOME ENERGY SAVER™

ROADMAP TO RESULTS

Ease into the process of making your home more efficient. If you're new to this, or you're on a very tight budget, start with the lowest-hanging fruit like double-checking your water heater's temperature setting.

The next easy steps are simple things that will fit into your shopping basket: maybe a few compact fluorescent lamps or a roll of weatherstripping.

When it's time to replace that old fridge, or other appliances, take time to shop smart. At a minimum, look for the ENERGY STAR rating. There are detailed lists of products that will take you even farther. Remember: you're not simply spending money, you're investing for profit and comfort.

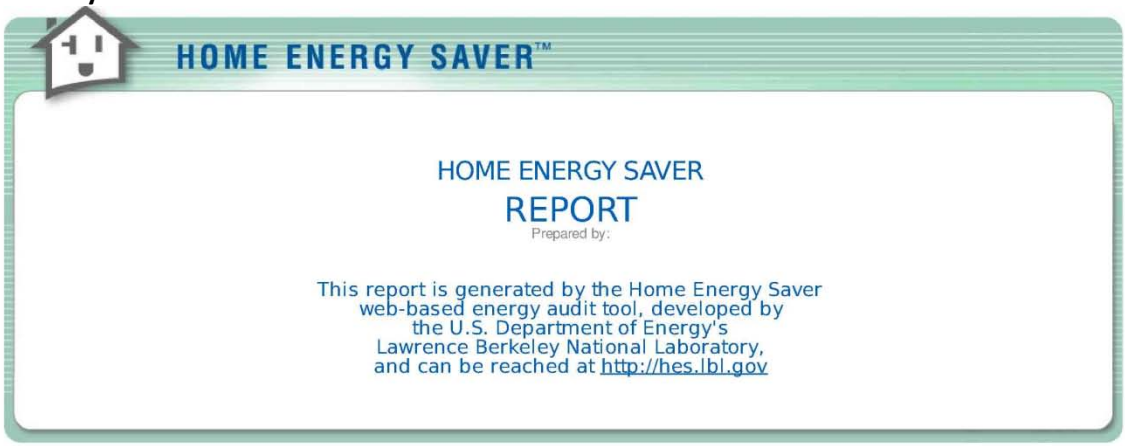
Redoing your kitchen? New roof? Finally adding that in-law unit? Creating successful projects can take some work. Take the time to find a home performance specialist to help you think thru all the options ahead of time, and then find the right contractor with the skills to do the job right.

Not only will these upgrades pay for themselves many times over, there are all kinds of financial incentives to help you trim the cost. And many of the "non-energy benefits" will be worth more than money can buy.

And, don't forget about saving water (which also saves energy).

Stumped? Ask an expert.

20-Year Analysis



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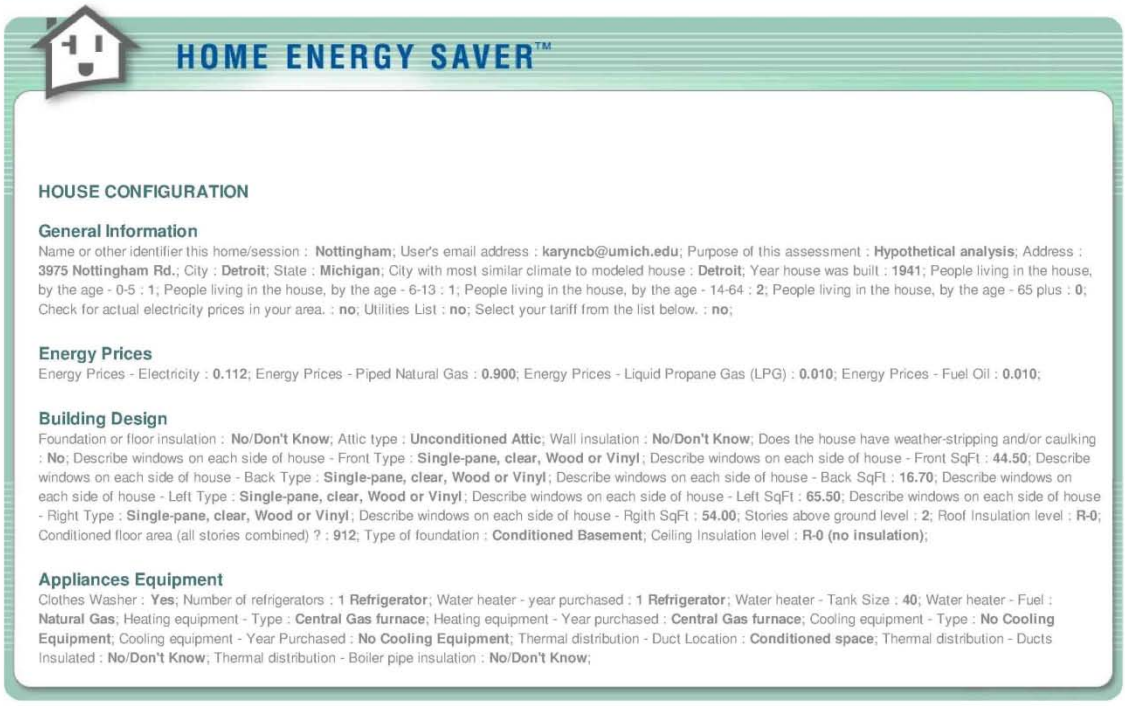
HOME ENERGY SAVER

REPORT

Prepared by:

This report is generated by the Home Energy Saver web-based energy audit tool, developed by the U.S. Department of Energy's Lawrence Berkeley National Laboratory, and can be reached at http://hes.lbl.gov



HOME ENERGY SAVER™

HOUSE CONFIGURATION

General Information

Name or other identifier this home/session : **Nottingham**; User's email address : **karyncb@umich.edu**; Purpose of this assessment : **Hypothetical analysis**; Address : **3975 Nottingham Rd.**; City : **Detroit**; State : **Michigan**; City with most similar climate to modeled house : **Detroit**; Year house was built : **1941**; People living in the house, by the age - 0-5 : **1**; People living in the house, by the age - 6-13 : **1**; People living in the house, by the age - 14-64 : **2**; People living in the house, by the age - 65 plus : **0**; Check for actual electricity prices in your area. : **no**; Utilities List : **no**; Select your tariff from the list below. : **no**;

Energy Prices

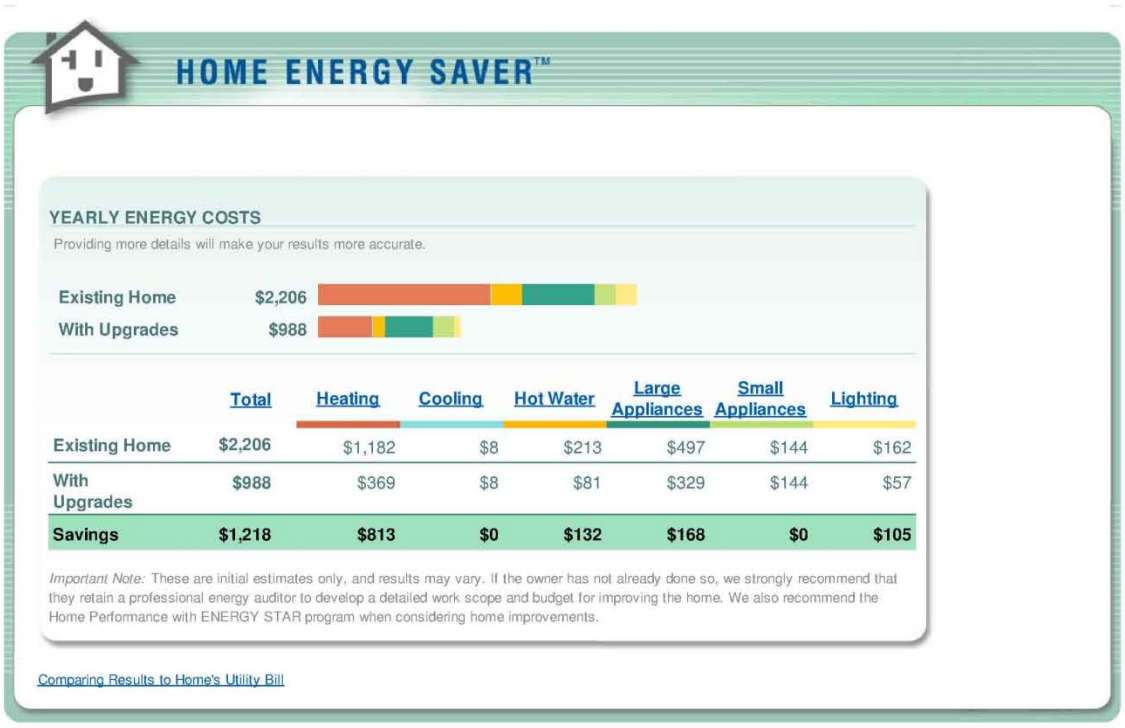
Energy Prices - Electricity : **0.112**; Energy Prices - Piped Natural Gas : **0.900**; Energy Prices - Liquid Propane Gas (LPG) : **0.010**; Energy Prices - Fuel Oil : **0.010**;

Building Design

Foundation or floor insulation : **No/Don't Know**; Attic type : **Unconditioned Attic**; Wall insulation : **No/Don't Know**; Does the house have weather-stripping and/or caulking : **No**; Describe windows on each side of house - Front Type : **Single-pane, clear, Wood or Vinyl**; Describe windows on each side of house - Front SqFt : **44.50**; Describe windows on each side of house - Back Type : **Single-pane, clear, Wood or Vinyl**; Describe windows on each side of house - Back SqFt : **16.70**; Describe windows on each side of house - Left Type : **Single-pane, clear, Wood or Vinyl**; Describe windows on each side of house - Left SqFt : **65.50**; Describe windows on each side of house - Right Type : **Single-pane, clear, Wood or Vinyl**; Describe windows on each side of house - Rgith SqFt : **54.00**; Stories above ground level : **2**; Roof Insulation level : **R-0**; Conditioned floor area (all stories combined) ? : **912**; Type of foundation : **Conditioned Basement**; Ceiling Insulation level : **R-0 (no insulation)**;

Appliances Equipment

Clothes Washer : **Yes**; Number of refrigerators : **1 Refrigerator**; Water heater - year purchased : **1 Refrigerator**; Water heater - Tank Size : **40**; Water heater - Fuel : **Natural Gas**; Heating equipment - Type : **Central Gas furnace**; Heating equipment - Year purchased : **Central Gas furnace**; Cooling equipment - Type : **No Cooling Equipment**; Cooling equipment - Year Purchased : **No Cooling Equipment**; Thermal distribution - Duct Location : **Conditioned space**; Thermal distribution - Ducts Insulated : **No/Don't Know**; Thermal distribution - Boiler pipe insulation : **No/Don't Know**;



HOME ENERGY SAVER™

YEARLY ENERGY COSTS

Providing more details will make your results more accurate.

Existing Home $2,206

With Upgrades $988

	Total	Heating	Cooling	Hot Water	Large Appliances	Small Appliances	Lighting
Existing Home	$2,206	$1,182	$8	$213	$497	$144	$162
With Upgrades	$988	$369	$8	$81	$329	$144	$57
Savings	$1,218	$813	$0	$132	$168	$0	$105

Important Note: These are initial estimates only, and results may vary. If the owner has not already done so, we strongly recommend that they retain a professional energy auditor to develop a detailed work scope and budget for improving the home. We also recommend the Home Performance with ENERGY STAR program when considering home improvements.

Comparing Results to Home's Utility Bill

HOME ENERGY SAVER™

YEARLY WHOLE HOUSE RESULTS

		Existing Home	With Upgrades	Savings	Percentage Reductions
Whole House	Energy Bill	$2,206	$988	**$1,218**	55%
	Electricity	6,643 kWh	3,420 kWh	**3,223 kWh**	49%
	Natural Gas	1,626 Therms	673 Therms	**953 Therms**	59%
	Emissions	29,382 CO2	13,211 CO2	**16,171 lb. CO_2**	55%
Heating	Energy Bill	$1,182	$369	**$813**	69%
	Electricity	440 kWh	295 kWh	**145 kWh**	33%
	Natural Gas	1,259 Therms	373 Therms	**886 Therms**	70%
	Emissions	15,397 lb. CO_2	4,821 lb. CO_2	**10,576 lb. CO_2**	69%
Cooling	Energy Bill	$8	$8	**$0**	0%
	Electricity	75 kWh	75 kWh	**0 kWh**	0%
	Emissions	117 lb. CO_2	117 lb. CO_2	**0 lb. CO_2**	0%
Hot Water	Energy Bill	$213	$81	**$132**	62%
	Natural Gas	237 Therms	90 Therms	**147 Therms**	62%
	Emissions	2,769 lb. CO_2	1,051 lb. CO_2	**1,718 lb. CO_2**	62%
Large Appliances	Energy Bill	$497	$329	**$168**	34%
	Electricity	3,393 kWh	1,252 kWh	**2,141 kWh**	63%
	Natural Gas	130 Therms	210 Therms	**-80 Therms**	-62%
	Emissions	6,823 lb. CO_2	4,411 lb. CO_2	**2,412 lb. CO_2**	35%
Small Appliances	Energy Bill	$144	$144	**$0**	0%
	Electricity	1,290 kWh	1,290 kWh	**0 kWh**	0%
	Emissions	2,017 lb. CO_2	2,017 lb. CO_2	**0 lb. CO_2**	0%
Lighting	Energy Bill	$162	$57	**$105**	65%
	Electricity	1,445 kWh	507 kWh	**938 kWh**	65%
	Emissions	2,259 lb. CO_2	793 lb. CO_2	**1,466 lb. CO_2**	65%

Heating electricity values include fan or pumping energy for homes that have forced-air or water-based heating systems powered by circulation pumps. The values for Hot Water include taps and faucets only; the energy consumed by the water heater to supply hot water for appliances such as clothes washers and dishwashers is included instead in the rows for those appliances.

HOME ENERGY SAVER™

YEARLY HEATING AND COOLING RESULTS

Show Details

	Total Cost
Cost	$1,190
Heating	$1,182
Cooling	$8

	Total Energy
Energy Use	1,259 therms 515 kWh
Heating	1,259 therms 440 kWh
Cooling	75 kWh

Notes: this house is 0% heated by wood fuel.
100% of the floor area is heated and 100% cooled.

Heating electricity values include fan or pumping energy for homes that have forced-air or water-based heating systems powered by circulation pumps.

What if my results don't match my energy bill?

HOME ENERGY SAVER™

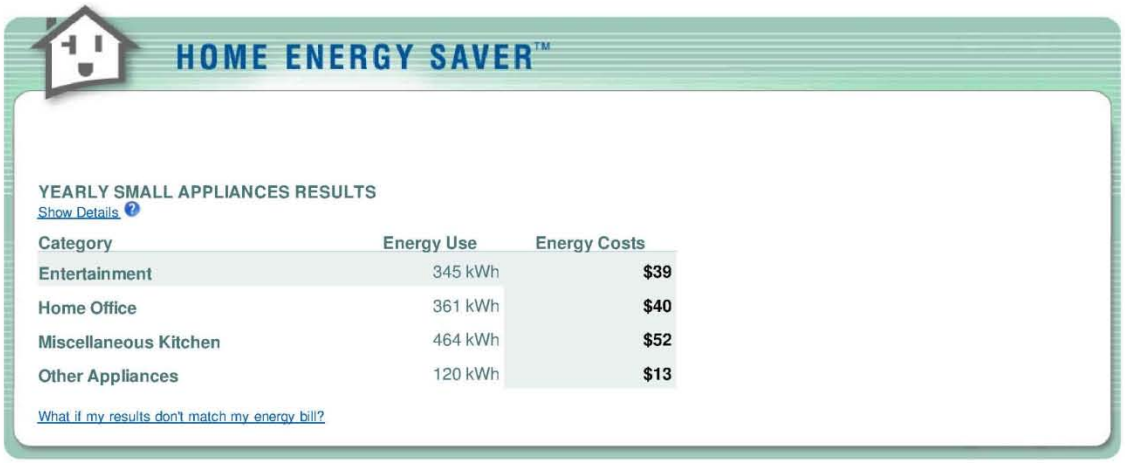
YEARLY LARGE APPLIANCES AND WATER HEATING RESULTS

Show Details

Appliance	Total Cost
First Refrigerator	$120
Stove	$41
Oven	$27
Clothesdryer	$163
Clotheswasher	$102
Dishwasher	$44
Hot Water: Taps and Faucets	$213
Totals	$710

Equipment energy is the energy used by motors, heating elements, and burners inside your appliances. This number excludes the energy consumed by your water heater to supply hot water for appliances such as clothes washers and dishwashers (which is included instead in the rows for those appliances).

What if my results don't match my energy bill?



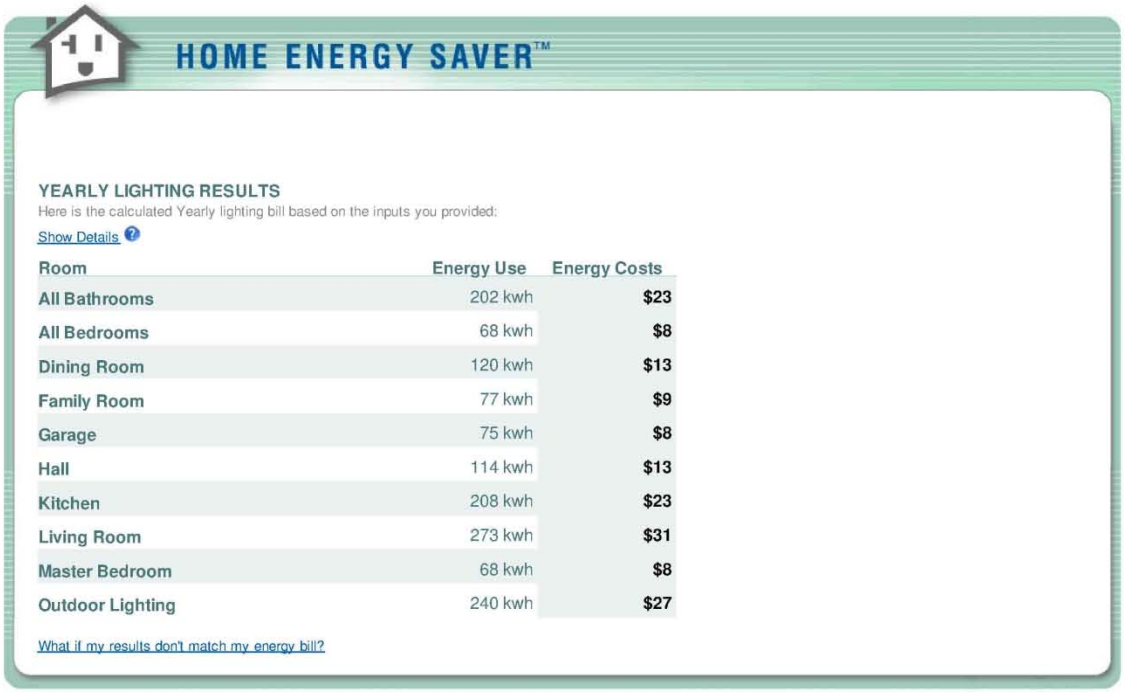
HOME ENERGY SAVER™

YEARLY SMALL APPLIANCES RESULTS

Show Details

Category	Energy Use	Energy Costs
Entertainment	345 kWh	$39
Home Office	361 kWh	$40
Miscellaneous Kitchen	464 kWh	$52
Other Appliances	120 kWh	$13

What if my results don't match my energy bill?



HOME ENERGY SAVER™

YEARLY LIGHTING RESULTS

Here is the calculated Yearly lighting bill based on the inputs you provided:

Show Details

Room	Energy Use	Energy Costs
All Bathrooms	202 kwh	$23
All Bedrooms	68 kwh	$8
Dining Room	120 kwh	$13
Family Room	77 kwh	$9
Garage	75 kwh	$8
Hall	114 kwh	$13
Kitchen	208 kwh	$23
Living Room	273 kwh	$31
Master Bedroom	68 kwh	$8
Outdoor Lighting	240 kwh	$27

What if my results don't match my energy bill?

HOME ENERGY SAVER™

UPGRADE RECOMMENDATIONS SUMMARY

Visit 'Recommendations' to see more information on each upgrade.

	Yearly Savings	Estimated Added Cost	How Much is Too Much?	Simple Payback Time	Estimated ROI	Avoided Emissions (lbs. CO_2)
Total for recommended upgrades	**$1,218**	**$7,583**	**$24,360**	**7**	**14%**	**16,171**

Important Note: These are initial estimates only, and results may vary. If the owner has not already done so, we strongly recommend that they retain a professional energy auditor to develop a detailed work scope and budget for improving the home. We also recommend the Home Performance with ENERGY STAR program when considering home improvements.

Upgrades Requiring Investment

1. Indoor lights
2. Electric clothes dryer
3. Basement wall insulation
4. Clothes washer
5. Gas furnace
6. Attic insulation
7. Gas water heater
8. Thermostat
9. Air sealing
10. Refrigerator
11. Wall insulation
12. Windows

Other benefits that often come along with these energy-saving upgrades

- Fluorescent lamps last several times longer than ordinary incandescent bulbs, which saves you the time and expense of replacing bulbs when they burn out.
- Natural gas clothes dryers reduce your home's peak load on the power grid compared to an electric dryer.
- Well-insulated basement walls can make your home more comfortable and quieter, and guard against moisture problems and water pipe breakage.
- ENERGY STAR® clothes washers can reduce water use significantly, leave the clothes drier thus reducing drying time and energy consumption, and reduce wear and tear on clothes.
- ENERGY STAR® gas-fired furnaces make your home more comfortable. Some models are less prone to causing indoor air quality problems or house fires.
- A well-insulated ceiling can make your home more comfortable and quieter, reduce the risk of moisture damage, enhance fire safety, make your home more disaster-resistant, and help guard against pipe freezing.
- Efficient gas-fired water heaters may hold their temperature longer following power interruptions and operate more safely.
- Programmable thermostats can help keep your home more comfortable.
- Having a professional seal your home's air leaks can make your home more comfortable, reduce the risk of moisture damage, improve indoor air quality and fire safety, and help to prevent frozen water pipes.
- Energy-efficient refrigerators are quieter, run less often, release less heat into your kitchen, and keep their contents cool longer during power outages.
- Wall insulation can make your home more comfortable and quieter, reduce the risk of moisture damage, enhance fire safety, make your home more disaster-resistant, and help guard against pipe freezing.
- Energy-efficient windows can make your home more comfortable year-round, reduce condensation, block outside noise, improve fire safety, and cut back on ultraviolet radiation that can fade your carpets and furniture.

HOME ENERGY SAVER™

UPGRADE RECOMMENDATIONS

What efficiency level would you like to model for the initial selection of upgrades? EnergyStar

What simple payback period would you like to use for selecting upgrades? 20

RECALCULATE Rows that are dimmed are not included in the calculated values for the retrofit package. To include them check their boxes and recalculate.

Add/ Remove	Upgrade	Upgrade Choice & Description	Yearly Savings	Estimated Added Cost	How Much is Too Much?	Simple Payback Time	Estimated Return on Investment	Avoided Emissions (lbs. CO_2)
☐	Check/Uncheck All Upgrades	**Total for Selected Upgrades:**	**$1,218**	**$7,583**	**$24,360**	**7**	**14%**	**16,171**
☑	Indoor lights	CFLs in high-use fixtur	$57	$ 88	$1,140	2	58%	1,466
☑	Electric clothes dryer	Switch to gas dryer	$81	$ 160	$1,620	2	50%	1,210
☑	Basement wall insulation	R-11	$126	$ 299	$2,520	2	42%	1,636
☑	Clothes washer	MEF=1.42 WF=9.5 EN	$56	$ 180	$1,120	3	30%	528
☑	Gas furnace	AFUE=90 ENERGY S	$167	$ 549	$3,340	3	30%	2,177
☑	Attic insulation	R-19	$118	$ 456	$2,360	4	26%	1,531
☑	Gas water heater	EF=0.62	$37	$ 170	$740	5	20%	479
☑	Thermostat	ENERGY STAR-label	$66	$ 320	$1,320	5	19%	865
☑	Air sealing	25% air leakage reduc	$83	$ 850	$1,660	10	9%	1,087
☑	Refrigerator	15% better than standa	$8	$ 87	$160	11	8%	114
☑	Wall insulation	R-11 wall cavity	$205	$ 3881	$4,100	19	3%	2,664
☑	Windows	2-pane/solar-control lo	$27	$ 543	$540	20	3%	351
☐	Dishwasher	EF=0.58 ENERGY ST.	$17	$ 360	$340	21	NCE	193
☐	Ceiling fan	ENERGY STAR-label	$1	$ 60	$20	60	NCE	13
☐	Cool roof	Solar reflectance = 0.1	$0	$ 31	$0	9,999	NCE	0

Important Note: These are initial estimates only, and results may vary. If the owner has not already done so, we strongly recommend that they retain a professional energy auditor to develop a detailed work scope and budget for improving the home. We also recommend the Home Performance with ENERGY STAR program when considering home improvements.

NCE = Not Cost Effective. This upgrade will not pay for itself in your situation. There may be other reasons, such as improved comfort, to implement the upgrade, or it could be made more cost-effective if the investment cost is reduced.

Note: Each of the upgrades in the table above are evaluated in isolation from the others. If the efficiency level is changed for one upgrade, its potential impact on other upgrades will not be counted in the row-by-row estimates. However, these kinds of interactions are included in the "package" totals associated with the whole-house totals and chart at the top of the page, for the upgrades selected as part of the package. For example, if the furnace efficiencies are raised, the energy savings from wall insulation will not change in the row estimate, but the incremental savings from including insulation in the package will be less due to the more efficient furnace's impact on reducing the energy required to make up heat losses through the wall (there is less energy being used, so less to save).

HOME ENERGY SAVER™

DETAILED UPGRADE RECOMMENDATIONS REPORT

This is a printable report of the upgrades selected for the home. These upgrades have the potential to save $1,218 each year on the utility bill.

Upgrade Package Summary:

Estimate Yearly Bill Savings:	**$1,218**
Estimated Lifetime Energy Savings:	**$24,360**
Estimated Added Cost:	**$632**
Maximum Price for 10 Year Payback:	**$53,081**
Return on Investment:	**14%**
Upgrade Pays for Itself in:	**7 years**

You selected the following upgrades:

- Replace high use incandescent lamps with compact fluorescent lamps
- When replacing your electric clothes dryer, switch to natural gas model
- Insulate basement walls to R-11
- When replacing your clothes washer, choose an ENERGY STAR-labeled model
- When replacing your gas furnace, choose an ENERGY STAR-labeled model
- Increase attic floor insulation to R-19
- When replacing your gas water heater, choose an energy efficient model
- Install a programmable thermostat
- Have a professional seal your home's air leaks
- When replacing your main refrigerator, choose an ENERGY STAR-labeled model
- Insulate exterior walls to at least R-11
- When replacing your windows, choose a double-pane solar-control low-E aluminum frame window

Note: The economic benefits for each of the upgrades below are evaluated in isolation from the other upgrades. If the efficiency level is changed for one upgrade, its potential impact on other upgrades will not be counted in the individual upgrade estimates. However, these kinds of interactions are included in the "package" totals associated with the whole-house totals and chart at the top of the page (above). For example, if the furnace efficiency is increased, the energy savings from wall insulation will not change in the table below, but the incremental savings from including insulation in the package will be less due to the more efficient furnace's impact on reducing the energy required to make up heat losses through the wall (there is less energy being used, so less to save).

Replace high use incandescent lamps with compact fluorescent lamps

Economic Benefits:

Estimate Yearly Bill Savings:	**$57**
Estimated Lifetime Energy Savings:	**$1,140**
Estimated Added Cost:	**$88**
Maximum Price for 10 Year Payback:	**$1,140**
Return on Investment:	**58%**
Upgrade Pays for Itself in:	**2 years**

Additional Benefits:

Fluorescent lamps last several times longer than ordinary incandescent bulbs, which saves you the time and expense of replacing bulbs when they burn out.

Upgrade Description:

Replace high-use incandescent lamps with compact fluorescent lamps. These units can save up to 75% of the energy used by an ordinary incandescent bulb.

Purchasing Tips:

- Compare the light output in Lumens of the bulb you are replacing to ensure you are using the appropriate CFL.Most CFLs list their light output and equivalent incandescent wattage on their package.
- CFLs are available in many shapes and sizes, which will allow replacing nearly any incandescent bulb.
- When buying new light fixtures, look for ENERGY STAR qualified models.
- CFLs are a good investment for lights that are used 2-3 hours per day on average or more.

More Information:

- ENERGY STAR qualifying lighting product list
- General information about lighting from DOE

[Return to upgrades list]

When replacing your electric clothes dryer, switch to natural gas model

Economic Benefits:

Estimate Yearly Bill Savings:	**$81**
Estimated Lifetime Energy Savings:	**$1,620**
Estimated Added Cost:	**$160**
Maximum Price for 10 Year Payback:	**$1,620**
Return on Investment:	**50%**
Upgrade Pays for Itself in:	**2 years**

Additional Benefits:
Natural gas clothes dryers reduce your home's peak load on the power grid compared to an electric dryer.

Upgrade Description:
When replacing your electric clothes dryer, select a natural gas model. In many situations, this willreduce your overall energy bill because natural gas tends to cost less than electricity, for the same heating value.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness are for a minimum-efficiency natural gas dryer model. The defaultupgrade cost provided here assumes that a natural gas connection is available at your clothes dryer. If this is not the case, be sure to include the costof extending

Purchasing Tips:

- To use a gas dryer, your laundry room must have a gas hookup, with proper connections and safe venting of the gas's exhaust, in addition to an electrical outlet
- Look for a dryer with a moisture sensor, and use the dryness settings rather than timed drying.
- When replacing your clothes washer, choose a model with high-speed spin cycles. This feature removes more water from clothes, which reduces the energy and time required for drying.

More Information:

- General Information from DOE
- Laundry tips from ACEEE
- Information from the California Energy Commission

[Return to upgrades list]

Insulate basement walls to R-11

Economic Benefits:

Estimate Yearly Bill Savings:	**$126**
Estimated Lifetime Energy Savings:	**$2,520**
Estimated Added Cost:	**$299**
Maximum Price for 10 Year Payback:	**$2,520**
Return on Investment:	**42%**
Upgrade Pays for Itself in:	**2 years**

Additional Benefits:
Well-insulated basement walls can make your home more comfortable and quieter, and guard against moisture problems and water pipe

breakage.

Upgrade Description:
Insulate your basement walls to at least R-11. Uninsulated basements can account for as much as 25% of a home's total heat loss. Proper insulation, as well as sealing air leaks in your home's thermal shell, is vital to reducing these energy losses.

Note: The annual bill savings and cost-effectiveness assume that you upgrade the entire basement wall area to R-11. The bill savings will be less if you do not upgrade the entire area, but the cost-effectiveness of upgrading less than all of the basement wall area should be approximately the same as shown above.

Purchasing Tips:

- When comparing contractors' bids, make sure they are for the same insulating value R-value, not just the same number of inches. [7]
- For a finished or heated basement, the best insulation option is to add 2x4 studs inside the basement walls, insulate between the studs with fiberglass insulation, and cover with drywall. This option is costly, but may be worth it as it also gives a more finished look to the basement. [7]
- To protect the insulation from moisture damage, be sure to provide an air space between the basement walls and the insulation. [7]
- Before insulating, you should correct drainage problems on the outside of your house if water leaks into your basement. Hire a qualified contractor who understands foundation drainage. [6]

More Information:

- General Information
- DOE Insulation Tips
- Installation Tips
- Tips for determining the R-value of old insulation

[Return to upgrades list]

When replacing your clothes washer, choose an ENERGY STAR-labeled model

Economic Benefits:

Estimate Yearly Bill Savings:	**$56**
Estimated Lifetime Energy Savings:	**$1,120**
Estimated Added Cost:	**$180**
Maximum Price for 10 Year Payback:	**$1,120**
Return on Investment:	**30%**
Upgrade Pays for Itself in:	**3 years**

Additional Benefits:
ENERGY STAR® clothes washers can reduce water use significantly, leave the clothes drier thus reducing drying time and energy consumption, and reduce wear and tear on clothes.

Upgrade Description:
When replacing your clothes washer, choose an ENERGY STAR-labeled model. ENERGY STAR clothes washers can reduce energy consumption by up to 70% and are available in top-loading and front-loading designs. Some ENERGY STAR models use up to 50% less water in addition to saving energy.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness are for a model with the lowest efficiency that qualifies for the ENERGY STAR label.

Purchasing Tips:

- Choose a clothes washer with high-speed spin cycles. This feature removes more water from clothes, which reduces the energy and time required for drying.
- Select a low water-use, high efficiency washer. Front-loading tumble-action washers can cut energy use by up to 70 percent, reduce water consumption significantly, and may actually get clothes cleaner. [1]
- Look for pre-soaking and/or "suds saver" options which conserve energy.
- Clothes washers come with EnergyGuide yellow and black labels. Use these labels to select the most efficient model for the capacity you have chosen.

More Information:

- ENERGY STAR clothes washer product list
- General information from DOE
- Top-Rated Energy-Efficient Clothes Washers from ACEEE

[Return to upgrades list]

When replacing your gas furnace, choose an ENERGY STAR-labeled model

Economic Benefits:

Estimate Yearly Bill Savings:	**$167**
Estimated Lifetime Energy Savings:	**$3,340**
Estimated Added Cost:	**$549**
Maximum Price for 10 Year Payback:	**$3,340**
Return on Investment:	**30%**
Upgrade Pays for Itself in:	**3 years**

Additional Benefits:

ENERGY STAR® gas-fired furnaces make your home more comfortable. Some models are less prone to causing indoor air quality problems or house fires.

Upgrade Description:

When replacing your gas furnace, choose an ENERGY STAR-labeled model. These units can save 15% or more of your heating bill.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness are for a furnace with the lowest efficiency that qualifies for the ENERGY STAR label 90 AFUE. Higher efficiency models are available, which can provide additional bill savings.

Purchasing Tips:

- Buy the right size of furnace for your needs. If you have upgraded your home's insulation or windows since your last furnace was installed, you may be able to down-size your furnace i.e., buy a smaller-capacity furnace which can reduce the cost. If you buy a furnace that is too big for your home's needs, it will have short cycle times and reduced efficiency as a result. A furnace that is properly sized costs less to operate. Be sure to have your contractor perform a heat-loss, heat-gain calculation, and do not rely on rule-of-thumb sizing estimates, which are often inaccurate. [3]
- If you live in a large house, consider purchasing one of the higher efficiency furnaces that come with two-stage burners. These burners allow the furnace to operate at lower burn rates using less fuel when the home's heating demand is low. When the heating demand is higher, the second stage burner is employed. The additional savings from this feature may well be worth the cost if you live in a large home. [3]
- New and/or efficient furnaces often have different venting and flue requirements. When replacing your furnace make sure your contractor assesses your existing flue, follows new code requirements for venting furnaces, and obtains necessary permits and inspections. [3]
- All new furnaces are labeled with their Annual Fuel Utilization Efficiency AFUE. The higher the AFUE, the more efficient the unit.
- Consider selecting a furnace with an electronically commutated, or ECM, blower motor. ECM motors are considerably more efficient than standard motors. Consider this feature especially if you run your furnace fan all year long for such things as comfort or air cleaning. A furnace fan with an ECM motor could cut the cost of running the furnace fan by a factor of 5.[3]
- If your duct system has leaks or disconnected portions, you will not reap the full energy savings you could get from a high efficiency furnace. Consider having your heating contractor check the entire length of your ductwork for leaks and seal any leaks with mastic-type sealant, not duct tape. It's now possible for a contractor to perform verified duct sealing by using a special fan to test duct system leakage before and after sealing. Also have the contractor check for and repair disconnected ducts - a common problem. Insulate any ducts in unheated spaces to at least R-6.
- If you don't already have one, consider purchasing a programmable thermostat and having your contractor install it along with your new furnace.

More Information:

- ENERGY STAR furnace product list
- Consortium for Energy Efficiency furnace product list
- Top-Rated Energy-Efficient Furnaces from ACEEE
- General Information from DOE click on "Space Heating and Cooling"
- Sizing and Installation of Heating and Cooling Equipment
- How to prevent health and safety problems with combustion equipment

[Return to upgrades list]

Increase attic floor insulation to R-19

Economic Benefits:

Estimate Yearly Bill Savings:	**$118**
Estimated Lifetime Energy Savings:	**$2,360**
Estimated Added Cost:	**$456**
Maximum Price for 10 Year Payback:	**$2,360**

Return on Investment:	**26%**
Upgrade Pays for Itself in:	**4 years**

Additional Benefits:
A well-insulated ceiling can make your home more comfortable and quieter, reduce the risk of moisture damage, enhance fire safety, make your home more disaster-resistant, and help guard against pipe freezing.

Upgrade Description:
Insulate your ceiling to at least R-19. In a typical home, half or more of the energy loss is through the exterior walls, floor and roof. Proper insulation, as well as sealing air leaks in your home's shell, is vital to reducing these energy losses.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness assume the ceiling insulation is upgraded to R-19. Insulating to a higher R-value would provide additional energy savings.

Purchasing Tips:

- Make sure all holes in the attic floor are sealed before you install insulation. Make sure there is a vapor retarder between the attic floor and the insulation to help prevent excess moisture from condensing on the insulation. However, if you are adding insulation on top of pre-existing insulation, don't install a vapor retarder, since it may trap moisture in the old insulation underneath. [5]
- If access to the attic is limited, blown-in cellulose or fiberglass insulation is your best bet. [5]
- Make sure the insulation does not block the attic vents, and that it is even and free of gaps. [5]
- When comparing contractors' bids, make sure they are for the same insulating value R-value, not just the same number of inches. [7]
- If you are doing the installation yourself, consider using cellulose. Cellulose insulation is less expensive and has a higher R-value per inch than fiberglass, and will not irritate your skin and lungs. [7]

More Information:

- General Information
- DOE Insulation Tips
- Installation Tips
- Tips for determining the R-value of old insulation

[Return to upgrades list]

When replacing your gas water heater, choose an energy efficient model

Economic Benefits:

Estimate Yearly Bill Savings:	**$37**
Estimated Lifetime Energy Savings:	**$740**
Estimated Added Cost:	**$170**
Maximum Price for 10 Year Payback:	**$740**
Return on Investment:	**20%**
Upgrade Pays for Itself in:	**5 years**

Additional Benefits:
Efficient gas-fired water heaters may hold their temperature longer following power interruptions and operate more safely.

Upgrade Description:
When replacing your gas water heater, choose an energy-efficient model with an Energy Factor of 0.62 or higher.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness assume the efficient water heater has an energy factor of 0.62 and recovery efficiency of 0.76. Higher efficiency units are available, and would provide additional energy savings.

Purchasing Tips:

- The most important measure of efficiency for water heaters is the Energy Factor EF. The higher the EF, the more efficient the water heater.
- Purchase a water heater whose tank is internally insulated with at least R-16. [5]
- A water heater that is too large for your home not only has a higher purchase cost but will increase your energy costs due to excessive cycling and standby losses. The resources below provide good, simple guidance on proper sizing of water heaters. The size, or "capacity", of a fuel-fired water heater should be judged by its first hour rating FHR, not its tank size. Due to larger burners, some gas water heaters with smaller tanks actually have higher capacities FHRs than models with larger tanks.
- Many types of water heaters are now available, such as "demand" tankless, "indirect" or "integrated", and solar-assisted water heaters. More Information
- New and/or efficient gas water heaters may have different venting and flue requirements. When replacing your water heater make sure your contractor assesses your existing flue, follows new code requirements for venting water heaters, and obtains necessary permits and inspections. [3]

More Information:

- General Information from DOE
- DOE Water Heating fact sheet
- Top-Rated Energy-EfficientWater Heaters from ACEEE
- GAMA consumer's directory click on "Consumers"
- How to prevent health and safety problems with combustion equipment

[Return to upgrades list]

Install a programmable thermostat

Economic Benefits:

Estimate Yearly Bill Savings:	**$66**
Estimated Lifetime Energy Savings:	**$1,320**
Estimated Added Cost:	**$320**
Maximum Price for 10 Year Payback:	**$1,320**
Return on Investment:	**19%**
Upgrade Pays for Itself in:	**5 years**

Additional Benefits:
Programmable thermostats can help keep your home more comfortable.

Upgrade Description:
Install an ENERGY STAR labeled programmable thermostat, and program it to change the temperature settings when you are away from home and at night. EPA estimates that ENERGY STAR-labeled programmable thermostats can save consumers 10-15% on heating and cooling bills when used properly. Note: Our calculations bill savings and cost-effectiveness assume that the heating-season set-point is decreased 4 degrees F during the day 9 am to 5 pm and at night 11 am to 7 pm, while the cooling-season set-point is increased 3 degrees F during those same periods. Larger set-point adjustments can provide additional bill savings.

Purchasing Tips:

- Some programmable thermostats have a "smart" feature designed to maximize energy savings. These thermostats continually monitor usage patterns in order to determine the best time to turn the system on in order to reach the desired temperature setting, while minimizing energy use.

More Information:

- ENERGY STAR thermostat product list
- General Information

[Return to upgrades list]

Have a professional seal your home's air leaks

Economic Benefits:

Estimate Yearly Bill Savings:	**$83**
Estimated Lifetime Energy Savings:	**$1,660**
Estimated Added Cost:	**$850**
Maximum Price for 10 Year Payback:	**$1,660**
Return on Investment:	**9%**
Upgrade Pays for Itself in:	**10 years**

Additional Benefits:
Having a professional seal your home's air leaks can make your home more comfortable, reduce the risk of moisture damage, improve indoor air quality and fire safety, and help to prevent frozen water pipes.

Upgrade Description:
Have a qualified professional seal your home's air leaks. Leaky houses waste energy because heated or cooled air can easily escape. Older homes tend to be leakier than newer homes. Tightening up a leaky house will reduce the heating and cooling bills.

Recent advancements in air sealing technology allow specialists to go beyond the old techniques of caulking and weatherstripping around obvious places such as doors and windows. The biggest problems are usually hidden leaks in out of the way places such as attics, floors

and walls, which are easily found and sealed by a specialist.

Note: The annual bill savings and cost-effectiveness assume that your home's air leakage is reduced by 25%.

Purchasing Tips:

- To get the best results, hire a qualified contractor, preferably a "building performance contractor", or "energy auditor" to find out where the leaks are in your home's shell. Make sure the contractor uses a "blower door" test to find the air leaks. An infrared scan can be beneficial in addition to the blower door test. Check with your utility company; some offer no- or low-cost basic energy audits. However, the extra money you would spend to have the audit done by a home performance contractor is often well worth it. [5,6]
- Make sure your contractor tests the leakage rate after completing the sealing, not only to determine the degree of improvement, but also to ensure that the ventilation in your home is adequate. If you don't already have proper mechanical ventilation, consider installing a ventilation system. Proper home ventilation will make your home healthier and more comfortable.
- Make sure your contractor performs a combustion safety test after sealing your home's air leaks. This test checks for backdrafting and carbon monoxide, and will help assure the safety of your home's occupants. [9]
- If you choose to do the work yourself, follow the guidance in ENERGY STAR's Do-It-Yourself Guide to ENERGY STAR Homesealing.

More Information:

- ENERGY STAR air sealing including DIY guide to air sealing
- Common Air Leakage Sites in the Home
- Information about Air Leakage Testing
- Does your home have enough ventilation?

[Return to upgrades list]

When replacing your main refrigerator, choose an ENERGY STAR-labeled model

Economic Benefits:

Estimate Yearly Bill Savings:	**$8**
Estimated Lifetime Energy Savings:	**$160**
Estimated Added Cost:	**$87**
Maximum Price for 10 Year Payback:	**$160**
Return on Investment:	**8%**
Upgrade Pays for Itself in:	**11 years**

Additional Benefits:

Energy-efficient refrigerators are quieter, run less often, release less heat into your kitchen, and keep their contents cool longer during power outages.

Upgrade Description:

When replacing your main refrigerator, choose an ENERGY STAR®-labeled model. ENERGY STAR refrigerators must exceed federal efficiency standards by at least 15%. Models that are up to 40% more efficient than the federal standards are available.

Note: Our calculations bill savings, typical upgrade costs, and cost-effectiveness are for a model with the lowest efficiency that qualifies for the ENERGY STAR label.

Purchasing Tips:

- Be especially careful in choosing a refrigerator because it will use more energy than any other kitchen appliance.
- Refrigerators with the freezer on the bottom or the top are the most efficient. Bottom-mounted freezer models use about 16% less energy than side-by-side models. Top-mounted freezer models use about 13% less energy than a side-by side. [1]
- Through-the-door icemakers and water dispensers are convenient and reduce the need to open the door, which helps maintain a more constant temperature. However, these convenient items will increase your refrigerator's energy use by 14 to 20%. [1]
- Too large a refrigerator wastes space and energy. One that is too small can mean extra trips to the grocery store. Decide which size fits your needs, then compare the EnergyGuide yellow and black label on each so you can purchase the most energy efficient make and model. The most efficient refrigerator size is 16-20 cubic feet. [1,2]

More Information:

- ENERGY STAR refrigerator product list
- Consortium for Energy Efficiency refrigerator product list
- Top-Rated Refrigerators from ACEEE
- Energy Saving Tips for refrigerators from "Energy Savers"

[Return to upgrades list]

Insulate exterior walls to at least R-11

Economic Benefits:

Estimate Yearly Bill Savings:	**$205**
Estimated Lifetime Energy Savings:	**$4,100**
Estimated Added Cost:	**$3,881**
Maximum Price for 10 Year Payback:	**$4,100**
Return on Investment:	**3%**
Upgrade Pays for Itself in:	**19 years**

Additional Benefits:
Wall insulation can make your home more comfortable and quieter, reduce the risk of moisture damage, enhance fire safety, make your home more disaster-resistant, and help guard against pipe freezing.

Upgrade Description:
Insulate exterior walls to at least R-11. In a typical home, half or more of the energy loss is through the exterior walls, floor and roof. Proper insulation, as well as sealing air leaks in your home's shell, is vital to reducing these energy losses. Exterior walls can be the most important part of your shell to insulate, because of their large area.

Note: The annual bill savings and cost-effectiveness assume that you upgrade all of your exterior walls to R-11. The bill savings will be less if you do not upgrade the entire wall area, but the cost-effectiveness of upgrading less than all of your wall area should be approximately the same as shown above.

Purchasing Tips:

- You may be able to tell if your walls are insulated by removing an outlet cover on an exterior wall and looking into the wall cavity. Or, choose a closet or cabinet along an exterior wall. Drill two 1/4" holes into the wall about 4" apart, with one hole above the other; any insulation should be apparent. If you don't see any insulation inside the wall cavity, hire an insulation contractor to blow cellulose or fiberglass insulation into the exterior walls. Blown-in insulation does not require the walls to be torn open. [6]
- When comparing contractors' bids, make sure they are for the same insulating value R-value, not just the same number of inches. [7]
- Be sure to check the contractor's work. For blown-in insulation, make sure the contractors install the correct number of bags of insulation for your wall area, as listed on the bags. [7]

More Information:

- General Information
- DOE Insulation Tips
- Installation Tips
- Tips for determining the R-value of old insulation

[Return to upgrades list]

When replacing your windows, choose a double-pane solar-control low-E aluminum frame window

Economic Benefits:

Estimate Yearly Bill Savings:	**$27**
Estimated Lifetime Energy Savings:	**$540**
Estimated Added Cost:	**$543**
Maximum Price for 10 Year Payback:	**$540**
Return on Investment:	**3%**
Upgrade Pays for Itself in:	**20 years**

Additional Benefits:
Energy-efficient windows can make your home more comfortable year-round, reduce condensation, block outside noise, improve fire safety, and cut back on ultraviolet radiation that can fade your carpets and furniture.

Upgrade Description:
When replacing windows, choose a double-pane, solar-control low-E, aluminum frame window.

Note: The annual bill savings and cost-effectiveness assume that you replace all of your windows with windows that have U-factor=0.67 and SHGC=0.37 see the links in More Information for an explanation of these units. Bill savings will be less if you do not replace all of your windows, but the cost-effectiveness of replacing less than all of your windows should be approximately the same as shown above. Windows with even better performance are available, and could provide additional energy savings.

Purchasing Tips:

- Choose a window that is appropriate for your climate. ENERGY STAR window labels have a Climate Region Map that indicates which of four broad climate regions Northern, North/Central, South/Central, or Southern the window qualifies for. Make sure the window you choose is appropriate for the region you live in.
- Consider different types of glazing for windows on different sides of your house to benefit from passive solar energy and maximize energy benefits. Install the lowest U-value windows you can afford on north-facing windows. Select windows with appropriate low-e coatings for your location on the east, west, and south sides of your house. [6]
- To maximize energy performance, choose windows with larger unbroken glazing areas instead of multi-pane or true-divided-light windows. Applied grills that simulate true- divided-light windows, however, do not reduce energy efficiency. [6]
- Choose windows with good warranties against the loss of the air seal. If the glazing seal is lost, not only will fogging occur, but also any low-conductivity gas between the layers of glass will immediately be lost.[6]
- If summer heat gain is a problem in your house, look for windows with low-e coatings, especially spectrally selective low-e coatings, which significantly reduce solar heat gain and improve insulation without affecting visible light or color. Tinted windows also reduce solar heat gain, but they transmit less visible light.
- Look for the National Fenestration Rating Council NFRC label to help you compare performance and other features."
- Select windows with low air leakage ratings - between 0.01 and 0.06 cfm/ft. [6]

More Information:

- ENERGY STAR Windows
- Tips about efficient windows from DOE
- General Information from the Efficient Windows Collaborative
- ACEEE Consumer Guide to Windows
- California Energy Commission

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HOME ENERGY SAVER™

ROADMAP TO RESULTS

Ease into the process of making your home more efficient. If you're new to this, or you're on a very tight budget, start with the lowest-hanging fruit like double-checking your water heater's temperature setting.

The next easy steps are simple things that will fit into your shopping basket: maybe a few compact fluorescent lamps or a roll of weatherstripping.

When it's time to replace that old fridge, or other appliances, take time to shop smart. At a minimum, look for the ENERGY STAR rating. There are detailed lists of products that will take you even farther. Remember: you're not simply spending money, you're investing for profit and comfort.

Redoing your kitchen? New roof? Finally adding that in-law unit? Creating successful projects can take some work. Take the time to find a home performance specialist to help you think thru all the options ahead of time, and then find the right contractor with the skills to do the job right.

Not only will these upgrades pay for themselves many times over, there are all kinds of financial incentives to help you trim the cost. And many of the "non-energy benefits" will be worth more than money can buy.

And, don't forget about saving water (which also saves energy).

Stumped? Ask an expert.

HOME ENERGY SAVER™

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Appendix J. Financial incentives for energy efficient home improvements

Table 3. Financial incentives for energy efficiency home improvements

Type	Description of service	Amount	Area	Eligibility	website	contact info
grant	weatherization (audits included)	up to $6500 per unit	national - administered by local agencies	Low income, owners or renters	http://apps1.eere.energy.gov/weatherization/apply.cfm	http://www.michigan.gov/dhs/0,1607,7-124-5452_7124_7211-58707--,00.html#Wayne
tax credit	efficient products (biomass stoves, HVAC, heat pumps, AC, boilers, furnaces, insulation, roofs, water heaters, windows and doors)	30% of cost up to $1500	national	Anyone	http://www.energystar.gov/index.cfm?c=tax_credits.tx_index	
tax credit	renewable energy systems (geothermal heat pumps, small residential wind turbines, solar water heaters or solar panels, fuel cells)	30% of cost, no upper limit	national	Not available for renters	http://www.energystar.gov/index.cfm?c=tax_credits.tx_index	
mail-in rebate	appliances (washers, dishwashers, fridges, furnaces, hot water heaters, solar hot water heaters)	$50 - $300 for appliances, 20% up to $1200 for solar hot water heater	Michigan	Michigan residents	http://www.michigan.gov/dleg/0,1607,7-154-25676-217575--,00.html	
Income tax credit	Insulation, water heaters, furnaces, windows, fridges, washers, dishwashers	10%, up to $75 for individuals, $150 for couples	Michigan	Low income, Michigan residents	http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MI20F&State=federal&currentpageid=1&ee=1&re=1	
rebate	DTE sends somebody to pick up and haul away old refrigerators/freezers that have been replaced by energy efficient ones. They will also take away old room ACs and dehumidifiers at the same time.	$40 rebate for a fridge/freezer, $20 extra room air conditioners and dehumidifiers	DTE territory	DTE customers	http://www.dteenergy.com/residentialCustomers/saveEnergy/rebates/recyclingProgram.html	https://www.jacoinc.net/weborder/rebatex.aspx?ProgramID=64
grant and equipment	I think this is the same as WAP, just linked through DTE. (weatherization and equipment)	not specified	DTE territory	DTE customers, low income	http://www.dteenergy.com/residentialCustomers/saveEnergy/rebates/energyAssistance/assistanceProgram.html	Department of Human Services, City of Detroit, 313.852.5628
mail-in rebate	washers, shower heads, programmable thermostats, dehumidifiers, room ACs	$25-50 for washers, other incentives not determined until spring 2010	DTE territory	DTE customers	http://www.dteenergy.com/residentialCustomers/saveEnergy/rebates/energyStar/resEnergyStar.html	
audits and rebate incentives	Varying levels of home energy audits that are paired with increasing rebate incentives for audit costs and rebates for purchasing equipment.	varies with level of service	DTE territory	DTE customers	http://www.dteenergy.com/residentialCustomers/saveEnergy/rebates/homeAudit/resEnergyAudit.html	
rebates	air sealing, insulation, window replacement, space heating boiler wrap	up to $500 for DTE air conditioning customers, up to $1500 if customer is also a MichCon heating customer	DTE territory	DTE customers, multifamily units must have 3 or fewers units	http://www.dteenergy.com/residentialCustomers/saveEnergy/rebates/resInsulation.html	
unspecified incentives	incentives for energy efficiency in new construction, TBD early 2010	TBD	DTE territory	new homes	http://www.dteenergy.com/residentialCustomers/saveEnergy/rebates/resConstructionIncentives.html	
energy bill credits for solar power	DTE pilot program to encourage people to use solar - energy bill incentives and credits for solar power	depends on capacity installed (see web for details)	DTE territory	DTE customers	http://www.dteenergy.com/residentialCustomers/productsPrograms/solarCurrents/savingCalcSolar.html	

Appendix K. Native plant garden for vacant lots

Because of the widespread issues with vacant land in the city of Detroit and in the target area and because of significant concern about vacant property among residents, the project team explored the possibility of implementing a native plant garden in a vacant lot in the target area. Time, knowledge, and resource constraints prevented us from following through with this idea, but the project team thinks that a native plant and/or rain garden would be a viable use of vacant land and would be supported by local residents.

Within the target area, the project team counted 23 vacant lots, or approximately 11% of the total number of parcels. These lots are a continual challenge to current residents because of the difficulty in maintenance during the growing season (i.e. grass cutting, leaf management, and yard waste disposal) as well as the tendency for the lots to become dumpsites. Currently, neighbors assist in mowing these lots and monitoring illegal activity. However, maintaining an increasing number of vacant lots is a significant burden for neighbors, and extensive mowing contributes to carbon emissions.

Mowing one acre with a walk-behind mower uses approximately 1 gallon of fuel (Jones, Larson, Bracciano, Boles, & Foerste, 2010). This is a direct cost to the responsible neighbor and an indirect cost to the environment in the form of air pollution. One participant in the Recycling, Illegal Dumping, and City Services workshop stated that he was currently mowing five vacant properties within the city, although not all in the target area. Others who attended the Recycling, Illegal Dumping, and City Services workshop expressed significant concern over the problem of vacant land. Speaker Al Jordan, director of the City of Detroit Department of Public Works, stated that the problem had grown beyond the City's capabilities to manage and that there was little the City could do to help.

We believe that installing native plant gardens on vacant lots would help to alleviate the burden to neighbors and the carbon emissions associated with mowing. It would be attractive, yet it would not require any mowing. Furthermore, it could reduce storm water runoff and provide habitat for insects and birds. In order to further discourage illegal dumping, some symbol of ownership and occupancy should be incorporated such as paths, benches, and/ or signs, and ideally the project would have buy-in from neighbors who would help plan and maintain the site. Planning a native plant garden would entail approximately two years: one year of planning, preparation, and planting and another year of additional maintenance. This was beyond the scope of the SUN Project's time in the community; however, the project team thinks that a native plant garden remains a viable and long term solution for those struggling with vacant land issues.

Appendix L. Appliance Mini-Grant Program

Motivation

Home appliances are responsible for 21% of home electricity use (EIA, 2008). Newer appliances, particularly those with ENERGY STAR or other efficiency ratings, are significantly more efficient than older models. Thus, replacing old home appliances with new ones can save energy and water. Despite their environmental benefits and their potential for energy savings over time, appliances are expensive, and these up-front costs may discourage people from upgrading. Therefore, people need financial incentives to encourage them to purchase more efficient appliances.

Several federal, state, and local programs offer rebates and tax deductions for those purchasing new appliances that meet certain efficiency standards. A table of the incentives available to Detroit residents is included in Appendix J. However, even if potential purchasers knew about the available incentives and were able to apply for them (neither of which is necessarily the case), the remaining up-front costs can still be significant. Furthermore, existing programs do not emphasize consumer education with regard to the environmental benefits of their purchases. As a result, the Detroit SUN Project team recommends creating an appliance mini-grant program that educates consumers and offers further financial assistance to those purchasing energy and water efficient appliances.

The Detroit SUN Project was unable to administer an appliance mini-grant program due to a lack of funding. However, a preliminary set of plans were created and are transferrable to other organizations seeking to encourage consumers to purchase efficient appliances. These plans and ideas are described below.

Eligibility

The Detroit SUN Project mini-grants were to be available to residents of the target neighborhood who had attended at least one of the workshops, indicating that they had put in some effort to learning about energy and water efficiency. The project team believe that requiring some sort of class or information session about energy and water efficiency is important and should be required before residents are eligible for grants.

Appliances and grant amounts

The appliance mini-grant would include choice of:

- 80% (up to $700) towards the purchase of a new, Energy Star Refrigerator
- 80% (up to $500) towards the purchase of a new Energy Star Water Heater

- 80% (up to $450) towards the purchase of a new, Energy Star Washing Machine
- 80% (up to $325) towards the purchase of a new, Energy Star Dishwasher
- 80% (up to $150) towards the purchase of a water-efficient Toilet (1.28 gallons of water per flush or less; dual-flush is acceptable)
- 80% (up to $700) towards the purchase of a significant capital improvement that conserves energy or water (such as insulation or a new furnace)

The maximum values of the grants were chosen according to typical prices for each appliance type. Funding only 80% of the total cost means that the purchaser must take some financial responsibility for the item instead of simply being given a free appliance. The ENERGY STAR requirement was chosen not for a specific energy or water reduction goal but because it would be relatively easy for potential purchasers to find out which appliances meet the criteria and to learn about those appliances.

Application process

Those applying for the mini-grants would be able to choose the appliance type they need most (as long as they are replacing an existing appliance that is more than five years old), the appliance model that best suits their own needs (as long as it meets the criteria above), and decide where they want to purchase the appliance. The project team believes the element of choice is important in empowering residents to take charge of their energy consumption and also in making them consider what the optimal choice is for their families. Furthermore, it provides an educational opportunity, since they are required to research their options.

Upon choosing a desired appliance, the potential purchaser would submit an application to the grant administrator specifying the appliance model, total price (including installation costs), and desired purchase location. If approved, the grant administrator would send a check on their behalf to the purchase location specifying the item number for which the check may be used.

Purchasers would be strongly encouraged to apply for all available national, state, and local financial incentives. The grand administrators would provide a list of those incentives and information about how to apply and would offer assistance to those who need it.

Furthermore, recipients must *replace* their old appliance. They must not keep and continue to use the old one in addition to the new one. They would be required to properly dispose of their old appliance through a recycling or disposal program. The grant administrators would provide information about how to do this.

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