ENERGY CONSERVATION FOR HOMEOWNERS:

AN ACTION PROGRAM FOR THE CITY OF SAINT PAUL

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December, 1980

The content of this report is the responsibility of the authors and is not necessarily endorsed by the Center for Urban and Regional Affairs or the College of Business Administration of the University of Minnesota, Twin Cities.

ACKNOWLEDGEMENTS

We would like to thank the following organizations for helping finance this study: the City of Saint Paul Energy Office and The College of Business Administration, the Center for Urban and Regional Affairs, and the University Computer Center of the University of Minnesota.

We are especially grateful to five people for their ideas and assistance on the project: Gary Dodge of the City of Saint Paul Energy Office; David Naumann of the Management Sciences Department, University of Minnesota; Fred Homan of Northern States Power; Gary Nelson of the Minnesota Energy Agency; and Gary Anderson of the City of Saint Paul Energy Office.

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1. SUMMARY

On February 13-15, 1980, Saint Paul mobilized for energy. Thousands of city workers and volunteers conducted the Saint Paul Energy Mobilization Survey to collect information from some 34,000 city households and businesses on their energy-conservation activities.

The initial analysis of the survey information summarized answers provided by households and gave detailed data for all 17 Saint Paul neighborhoods. The present study attempts to develop action recommendations from the basic survey information.

Objectives

Our overall goal is to identify actions Saint Paul can take to encourage its homeowners to conserve energy in their homes. The specific objectives are: (1) to review existing household energy-action programs at all government levels, (2) to determine what energy-conservation activities Saint Paul homeowners have already taken and which they are likely to take, (3) to estimate the total potential energy savings in Saint Paul if various energy actions are taken by specific demographic groups of homeowners, and (4) to recommend action programs Saint Paul might direct at these groups to provide the greatest energy savings at the least cost -- both to the city and its homeowners. (The present study does not cover renters, businesses, or transportation.)

Sources of Information

Three main sources of information were used in the study. First, relevant published studies were examined that identified federal, state, and local government programs for energy conservation in homes. Second, the data from the Saint Paul Energy Mobilization Survey were analyzed in depth. Third, additional data were collected from Northern States Power, the Minnesota Energy Agency, and the Saint Paul Energy Office that identified the savings and costs to homeowners of taking specific energy-conservation actions in three typical types of Saint Paul homes.

Findings and Recommendations

General Guidelines for Action. The main incentive for energy actions to households is economic, to save money. Yet few homeowners really

understand which specific energy-saving actions will accomplish this. So Saint Paul should:

1. Tell households, in simple dollar terms, about the benefits and costs of various energy actions, for the kinds of homes in which they live.

2. Help households take specific energy actions by providing appropriate information, technical assistance, and financial incentives.

Actions Directed at Specific Groups of Homeowners, Stages in Their Decision Process, and Kinds of Energy-Saving Actions. Energy savings, so far and in the future, vary significantly according to the age and income of the homeowner. The stage of decision-making of the household also makes a difference. The later the stage -- from problem awareness, to choice among alternatives, to implementation, to use and evaluation -- the greater the likelihood of action. And among the kinds of actions that can save energy (continuous, seasonal, and one-time), one-time actions offer, by far, the greatest total potential for energy savings. So Saint Paul should:

3. Seek energy savings from all households in the city.

4. Focus special effort on groups for which the energy savings potential is the greatest -- those whose heads of household are under 60 years of age; those whose annual incomes exceed $20,000; and those who live in larger homes (3 floors and 4 bedrooms).

5. Direct programs and messages at households who need help at the "choice" and "implementation" stages, to encourage them to take energy-saving actions. These can include: providing loan, grant, or tax assistance programs for those unable to take action (for physical or financial reasons); providing lists of approved contractors, lenders, and suppliers; and providing information on the dollar benefits and costs of energy-saving actions.

6. Direct "reminder" advertising at the "use and evaluation" stage of a household's decision process to promote energy conservation from continuous activities (such as setting back thermostats and turning off lights) throughout the year and for seasonal activities in the fall and spring.

7. Stress the potential energy savings from one-time energy-conservation actions such as installing a clock set-back thermostat.

Actions for Communicating Energy-Saving Ideas. Since Saint Paul has a very limited budget, it must devise an effective system of energy messages to communicate, media to communicate them in, and personal assistance for homeowners. So Saint Paul should:

8. Arrange to adapt, print, and distribute the information on five-year net dollar savings of various energy-conservation actions. A sheet should be provided for each of the three types of typical homes studied here.

9. Encourage, especially, the following energy-saving actions by all homeowners. Each represents a savings in five years of at least $100 (with an initial outlay of less than $100, whether the homeowner does the activity or hires someone to do it):

   - One-time actions - install clock set-back thermostat
   - Seasonal actions - caulk cracks; weatherstrip doors and windows
   - Continuous actions - close off rooms; turn down furnace thermostat

10. Encourage owners of larger homes to insulate their attics, whether they do it themselves or pay to have it done.

11. Use public-service announcements on TV and radio; inside-the-bus posters; neighborhood newspapers; direct-mail inserts in tax statements and utility bills; and pamphlets distributed by hardware stores, home-improvement centers, and neighborhood groups. Develop a series of informative advertisements for local newspapers that show energy results for various neighborhood income levels and sizes of home. Install a City Hall energy hot-line to handle both routine and unusual questions from residents.

12. Use Saint Paul's neighborhood nonprofit Energy Companies to communicate energy-saving ideas to local neighborhood residents. Where necessary, these groups can be augmented by local churches, PTA's, and other public-service groups that reach local residents. In addition, private organizations like hardware stores and home-improvement centers should be used to assist Saint Paul homeowners in buying and installing materials needed for effective energy-saving actions.

Future Information and Research Needs. To measure the effectiveness of its programs to save home energy, Saint Paul should continue its information collection and research activities. Specifically, it should

try to assess the best way of communicating energy messages to homeowners. To do so, the city should verify and update the information presented; run simple experiments to determine which communication programs are most effective in stimulating energy actions by homeowners; and verify the actual energy savings and which kinds of households are achieving them. Such efforts should help Saint Paul continue its pioneering action to save its city's energy.

2. BACKGROUND

Saint Paul mobilized. On February 13, 14, 15, and 16, 1980, nearly 3,000 Saint Paul city employees and volunteers collected 34,000 questionnaires from city households and businesses about their energy conservation activities. The initial analysis of this questionnaire information -- called the Saint Paul Energy Mobilization Survey -- summaried the respondents' answers.

Origin of the Present Study

After the initial study, the Saint Paul Energy Office suggested that further analysis of the energy data might help to promote energy conservation in the city. The College of Business Administration and the Center for Urban and Regional Affairs of the University of Minnesota then joined the Saint Paul Energy Office to fund this research. The immediate goal: discover what the City of Saint Paul can do to encourage its homeowners to conserve energy in their homes. Another hope is that communities and cities throughout the United States will use Saint Paul's findings.

This analysis focuses on what homeowners can do. Renters, private businesses, and transportation issues, covered in the original survey, are outside the scope of this research.

Objectives

This study has four objectives:

1. To review existing federal, state, and local energy programs and identify those that have apparently been successful.

2. To use data provided by the Saint Paul Energy Mobilization Survey (see Appendix B) to determine what energy conservation actions home owners have already accomplished, what their future plans are in this area, and why they may be reluctant to take actions.

3. To estimate the potential energy savings that could occur in the City of Saint Paul if various demographic groups of homeowners took specific energy actions.

4. To recommend actions the City of Saint Paul might take to encourage various groups of homeowners to save energy without incurring major capital expenditures.

Outline of Report

In this report, Section 3 details the general research approach. Section 4 reviews published information on other energy conservation programs at the federal, state, and local levels. Section 5 analyzes data from the Saint Paul Energy Mobilization Survey. Section 6 explores the potential energy savings of various programs. And Section 7 recommends action programs for Saint Paul. Specialized information appears in Appendixes to the report.

3. APPROACH

The approach used involves four main steps: (1) reviewing published research, (2) developing a rationale for data collection and analysis, (3) analyzing the data available from the Saint Paul Energy Mobilization Survey, and (4) collecting additional pertinent energy data. Each of these steps is described briefly below.

Published Research

A systematic review of published material on federal, state, and local programs to promote energy conservation by the general public was conducted. The Saint Paul Energy Office provided copies of reports its "Committee of 100+" and various subcommittees had published. The University of Minnesota library undertook a computerized literature search using appropriate key words and topics. When materials of special interest were found, follow-up telephone calls and letters were used to obtain additional information.

Rationale for Data Collection and Analysis

The main source of information for the study was the Saint Paul Energy Mobilization Survey. However, before analyzing these data in detail, it was necessary to find a structure for the analysis, one that could lead to specific action recommendations for the City of Saint

Paul. This structure, we felt, should provide both a framework for analyzing existing data and a means for suggesting further data needs.

The problem for the City of Saint Paul is to achieve maximum energy savings on a limited budget. So our research task is to help the city identify the best opportunities, suggest actions, and discover ways to measure their success. Four energy measurement methods, are identified below, all of which involve collecting additional data. They are shown in Figures 3-1, 3-2, 3-3, and 3-4 and discussed below.

Annual Tracking Data

Figure 3-1 shows a hypothetical graph of the percentage of homeowners in two different age groups that have put insulation in the walls of their houses. Note that the percentages vary by the ages of the heads of the households. While the Saint Paul Energy Mobilization Survey actually provided the 1980 values shown in the figure, the earlier values are assumed. Saint Paul might use these data to try to have 100 percent of homeowners in a particular demographic segment perform an energy-saving activity. The main problems: no easy means of comparing energy savings between activities. Still, because the effectiveness of various energy conservation programs needs to be measured periodically to assess their effectiveness, plans should be made to obtain such "tracking data" in future years.

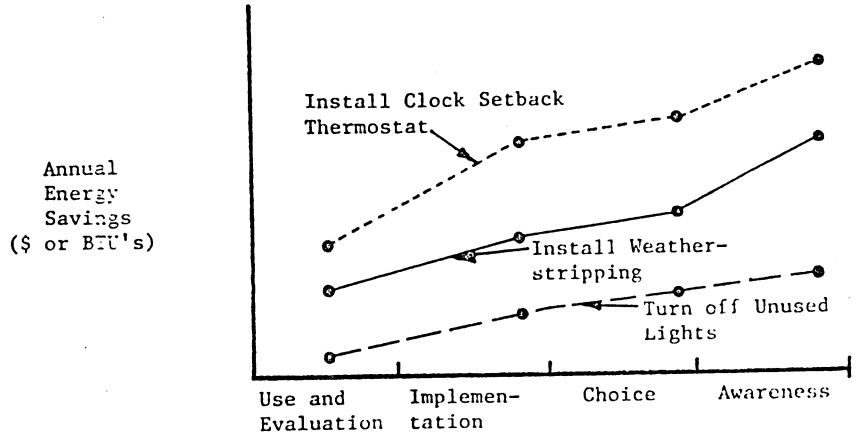


Figure 3-3. Stage-of-Decision-Process Data. This figure shows the potential annual energy savings of three different energy conservation activities for one demographic group whose members are in different stages in making decisions about taking an action.

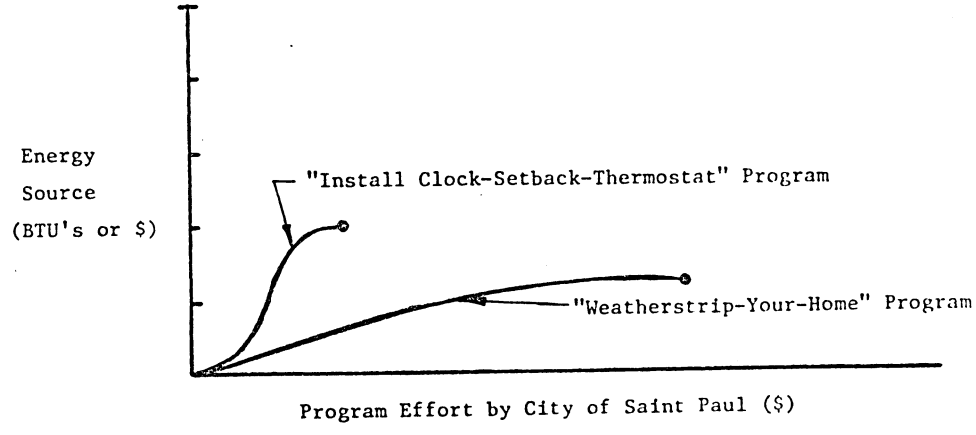


Figure 3-4. Response to Energy Conservation Programs of Saint Paul. This figure estimates how much energy (or dollars) has been saved by various energy conservation programs.

Profiles of Energy Conservation Activities

Figure 3-2 shows the percentage of homeowners in two different age groups that have completed four different energy conservation activities identified in the Saint Paul Energy Mobilization Survey. It is also possible to plot similar profiles, for example, for homeowners who plan to do the activity or who cannot do it because they are physically or economically unable to do it. Saint Paul can use these profiles to make visual comparisons between the various energy conservation activities -- to see where the greatest "opportunities for improvement" might be in terms of the percentage who have completed the activity. However, the profiles give no indication where the greatest returns for future program efforts of the City of Saint Paul might lie because they do not show the potential energy savings possible from each activity.

Stage-of-Decision-Process Data

As discussed later in the report, all consumers go through a sequence of stages in making a decision to purchase any product or service. These stages start with gaining awareness or understanding and end with the actual decision to act -- to buy. These stages for making energy conservation decisions are shown as the horizontal axis in Figure 3-3, but in reverse order so that moving from awareness to action involves going from right to left along the scale. The result is that Figure 3-3 shows the actual annual energy savings for three different energy actions in the left-hand portion of the figure. Moving to the right in the figure shows energy savings that are possible by moving households closer to action, one stage at a time. Figure 3-3 is valuable to Saint Paul in pointing out energy

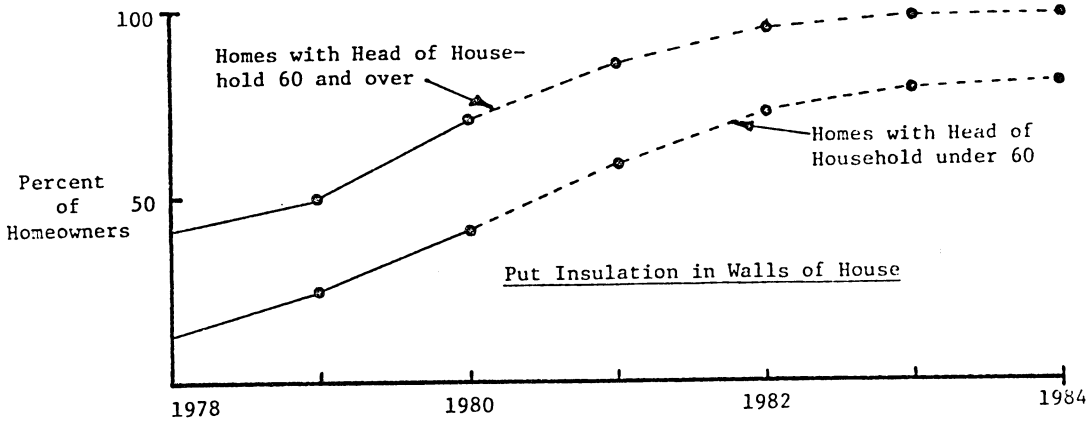


Figure 3-1. Annual Tracking Data. This figure shows the percentage of homeowners in two different age groups that have performed a specific energy conservation activity in a given year.

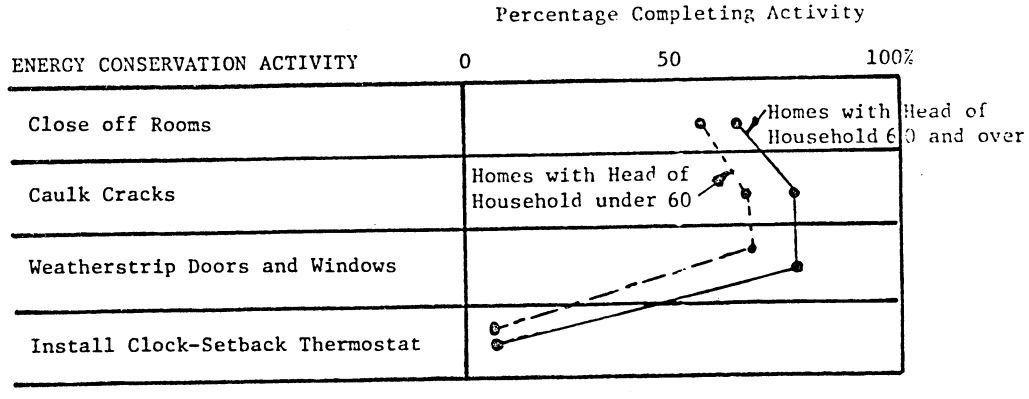


Figure 3-2. Profiles of Energy Conservation Activities. This figure shows how homeowners in two different age groups compare in terms of having completed a variety of energy conservation activities -- but measured at a single point in time.

savings possible from various energy-conservation activities, so that the City can focus its efforts on those activities likely to save the most energy. But Figure 3-3 does not really tell the cost to Saint Paul of programs aimed at achieving that energy savings. As will be shown later in this report, it is possible to use the data from the Saint Paul Energy Mobilization Survey -- along with other data identified in the next section -- to identify where future Saint Paul energy conservation programs are likely to save the largest amounts of energy.

Response to Energy Conservation Programs of Saint Paul

Figure 3-4 shows, in a somewhat ideal way, what energy savings (in BTU's or dollars) result from Saint Paul's promoting two different energy conservation programs. It goes a step beyond Figure 3-3. It raises the key question of whether the energy-savings returns from putting additional dollars into information campaigns to promote installing weatherstripping are greater or less than those that might be used to promote installing a clock setback thermostat. Realistically, it is probably impossible to measure precisely how many households are influenced by a specific energy-conservation program. This is where judgment and common sense will play vital roles in interpreting which programs are likely to succeed.

Analysis of Data From the Saint Paul Energy Mobilization Survey

Two aspects in analyzing the data from the Saint Paul Energy Mobilization Survey deserve explanation: (1) selecting a representative sample of questionnaires from the original survey and (2) selecting three "typical" Saint Paul homes.

Selecting a Representative Sample of Questionnaires

Of the households responding to the Saint Paul Energy Mobilization Survey, approximately 82 percent are homeowners and 18 percent are tenants. A 1978 study indicates that 58 percent of households in the City of Saint Paul are owned and 42 percent are rented. These results suggest that renters are severely underrepresented in the Energy Mobilization Survey.

Several factors influenced renter response rates. The survey was sent to all postal patrons in the City of Saint Paul using regular mail delivery. This process caused many surveys to fail to reach individual tenants renting units in a multiple dwelling. A second problem involved home pick-up of questionnaires from renters. Gaining entrance to apartment buildings and contacting renters proved difficult or impossible for many convassers. Finally, the lower tenant response rate may have been partly because renters lack much control over certain aspects of energy usage so some did not see the survey applied to them and did not bother to fill it out.

To adjust for the overrepresentation of homeowners, a stratified random sample of 3,000 respondents was selected for data analysis. This sample weights homeowners and renters as well as neighborhoods proportional to their true population size in Saint Paul. Relevant percentage estimates of the size of age and income groups were computed from this sample file.

Selecting "Typical" Saint Paul Homes

In order to determine the influence of type of home on energy conservation, several representative homes were selected for further

analysis. Three characteristics of a home that influence its energy use -- number of floors, number of bedrooms, and age of home -- were used to select the typical Saint Paul homes presented below:

Typical Home	Year Built	Percent of Total Homes in Saint Paul represented by House Type
1 Floor, 2 Bedroom	1946-1965	26%
2 Floor, 3 Bedroom	1946-1965	37%
3 Floor, 4 Bedroom	Before 1945	37%

Clearly, these three typical homes do not completely describe all of the homes in Saint Paul. Therefore, estimates of the percentage of Saint Paul homes represented by each of the three "typical" homes were developed based on the experience of personnel from the City of Saint Paul Energy Office and the researchers.

Collection of Additional Energy Data

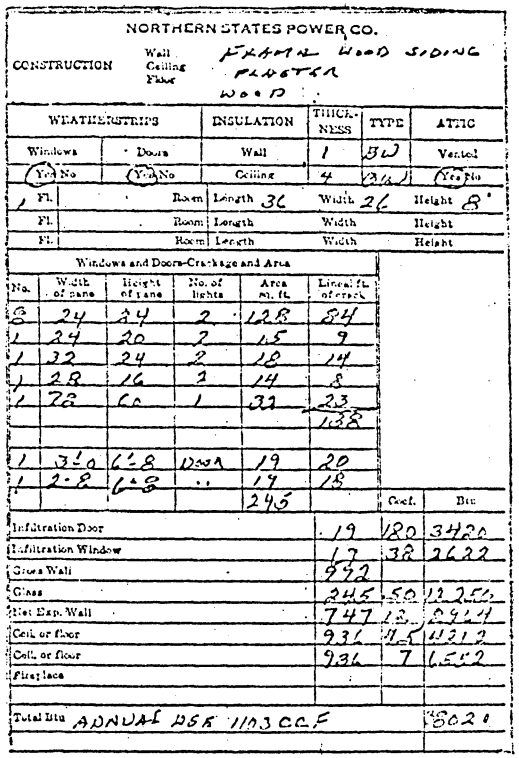
To complete the study two additional kinds of information were sought: (1) the characteristics of the three typical Saint Paul homes and (2) the costs of various energy saving actions for each type of home and the potential annual energy savings from these actions.

Characteristics of the Typical Saint Paul Homes

To fulfill the objective of estimating the potential energy savings of various energy actions, additional data were needed to describe the expected energy savings of each of the three typical homes. For these estimates to be made, additional information was needed which described specific characteristics of each type of home. This information, presented in Figure 3-5, was supplied by Northern States Power.

Costs and Benefits of Energy-Saving Activities by Type of Home

In order to recommend action programs focused on particular demographic groups that might provide the greatest savings at the least cost, additional information was required describing the expected cost of performing each energy action for each of the three typical homes identified above. This information, along with the potential annual energy savings of each energy action, was provided with the assistance of personnel from the Saint Paul Energy Office, the Minnesota Energy Agency, and Northern States Power. It is summarized in Tables C-1, C-2, and C-3 given in Appendix C.



NORTHERN STATES POWER CO.

CONSTRUCTION — Wall: FRAME WOOD SIDING; Ceiling: PLASTER; Floor: WOOD

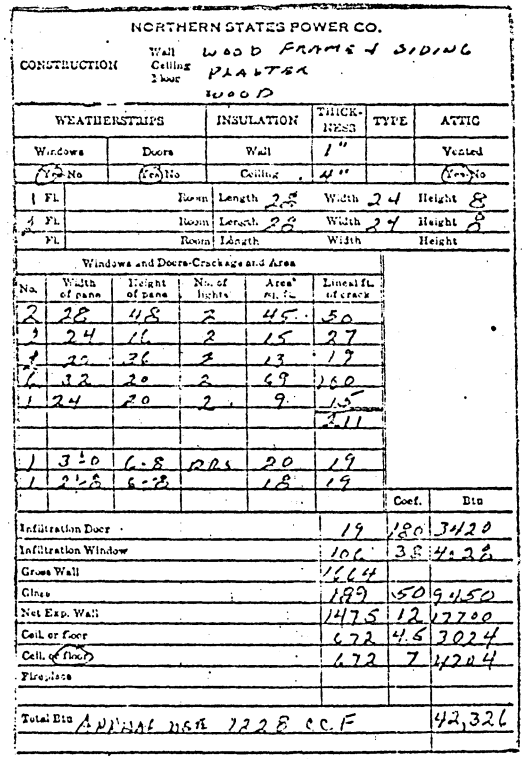
WEATHERSTRIPS		INSULATION	THICKNESS	TYPE	ATTIC
Windows	Doors	Wall	1	BW	Vented
(Yes) No	(Yes) No	Ceiling	4	RW	(Yes) No

1 Fl.	Room	Length 36	Width 26	Height 8'		
Fl.	Room	Length	Width	Height		
Fl.	Room	Length	Width	Height		

Windows and Doors-Crackage and Area

No.	Width of pane	Height of pane	No. of lights	Area sq. ft.	Lineal ft. of crack		
6	24	24	2	128	84		
1	24	20	2	15	9		
1	32	24	2	18	14		
1	28	16	2	14	8		
1	28	60	1	33	23		
					138		
1	3'0	6'8	DBR	19	20		
1	2'8	6'8	"	19	18		
				245		Coef.	Btu
Infiltration Door				19	180		3420
Infiltration Window				17	38		2622
Gross Wall				972			
Glass				245	50		12250
Net Exp. Wall				747	12		8964
Ceil. or floor				936	4.5		11312
Ceil. or floor				936	7		6552
Fireplace							
Total Btu ANNUAL DSR 1103 CCF							86020

Typical 1 Floor, 2 Bedroom
House Built from 1946 to 1965



NORTHERN STATES POWER CO.

CONSTRUCTION — Wall: WOOD FRAME & SIDING; Ceiling: PLASTER; Floor: WOOD

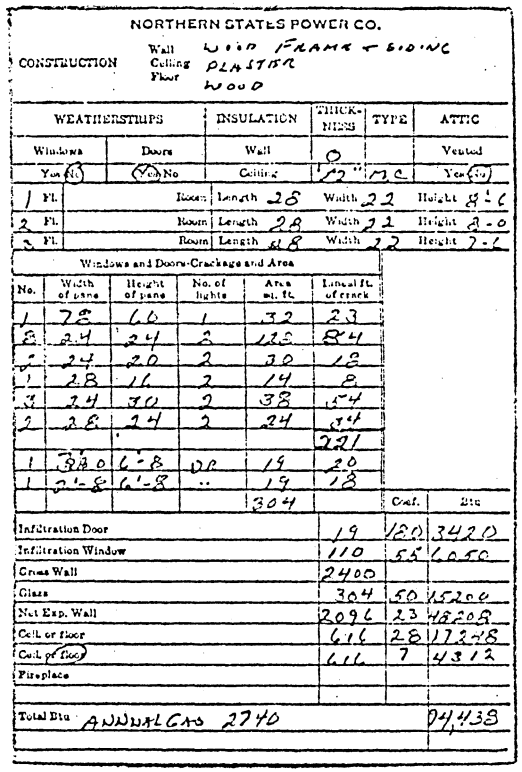
WEATHERSTRIPS		INSULATION	THICKNESS	TYPE	ATTIC
Windows	Doors	Wall	1"		Vented
(Yes) No	(Yes) No	Ceiling	4"		(Yes) No

1 Fl.	Room	Length 28	Width 24	Height 8		
1 Fl.	Room	Length 28	Width 24	Height 8		
Fl.	Room	Length	Width	Height		

Windows and Doors-Crackage and Area

No.	Width of pane	Height of pane	No. of lights	Area sq. ft.	Lineal ft. of crack		
2	28	48	2	45	50		
3	24	16	2	15	27		
4	20	36	2	13	17		
6	32	20	2	69	160		
1	24	20	2	9	15		
					211		
1	3'0	6'8	DBR	20	19		
1	2'8	6'8		18	19		
						Coef.	Btu
Infiltration Door					19	180	3420
Infiltration Window					106	38	4028
Gross Wall					1264		
Glass					189	50	9450
Net Exp. Wall					1475	12	17700
Ceil. or floor					672	4.6	3024
Ceil. or floor					672	7	4704
Fireplace							
Total Btu ANNUAL DSR 1228 CCF							42,326

Typical 2 Floor, 3 Bedroom
House Built from 1946 to 1965



NORTHERN STATES POWER CO.

CONSTRUCTION — Wall: WOOD FRAME + SIDING; Ceiling: PLASTER; Floor: WOOD

WEATHERSTRIPS		INSULATION	THICKNESS	TYPE	ATTIC
Windows	Doors	Wall	0		Vented
(Yes) No	(Yes) No	Ceiling	12"	MC	Yes (No)

1 Fl.	Room	Length 26	Width 22	Height 8'-1		
2 Fl.	Room	Length 28	Width 22	Height 8'-0		
2 Fl.	Room	Length 28	Width 22	Height 7'-1		

Windows and Doors-Crackage and Area

No.	Width of pane	Height of pane	No. of lights	Area sq. ft.	Lineal ft. of crack		
1	28	60	1	32	23		
8	24	24	2	128	84		
2	24	20	2	20	18		
1	28	16	2	14	8		
3	24	20	2	38	54		
2	28	24	2	24	34		
					221		
1	3'0	6'8	DR	19	20		
1	2'8	6'8	"	19	18		
				304		Coef.	Btu
Infiltration Door					19	180	3420
Infiltration Window					110	55	6050
Gross Wall					2400		
Glass					304	50	15200
Net Exp. Wall					2096	23	48208
Ceil. or floor					616	28	17248
Ceil. or floor					616	7	4312
Fireplace							
Total Btu ANNUAL GAS 2740							94,438

Typical 3 Floor, 4 Bedroom
House Built Prior to 1945

Figure 3-5. Assumed housing characteristics for each of the three typical Saint Paul homes. The estimates were provided by Northern States Power.

4. ENERGY PROGRAMS OF FEDERAL, STATE, AND LOCAL GOVERNMENTS

Energy programs by federal, state, and local governments try to influence energy consumers in various ways. Some of these involve:

1. Promoting problem awareness. Is there a serious energy crisis, one that requires me to conserve in my household?

2. Influencing choice. Which energy conservation actions offer me the highest payoff?

3. Aiding implementation. What products or contractors should I use to perform this energy-saving action, and how should the product be installed?

4. Assisting in use and evaluation. How can I continue my energy-saving actions and be sure they will save me money?

These questions parallel the kinds of questions that consumers and households make in deciding whether or not to purchase any product or service.

Figure 4-1 shows the sequence of four main stages a household goes through in becoming aware of an energy problem around the home and taking steps to solve it. The four key stages shown in the figure are (1) awareness, (2) choice, (3) implementation, and (4) use and evaluation. It is important to recognize that for energy-saving actions like turning unused lights off that require continuing efforts -- households make repeated evaluations about the value of actions they have taken. So for those energy-conserving actions by households that are not one-shot decisions, the repeated evaluations that reinforce consumer convictions that the action is a good idea are necessary for successful energy conservation programs.

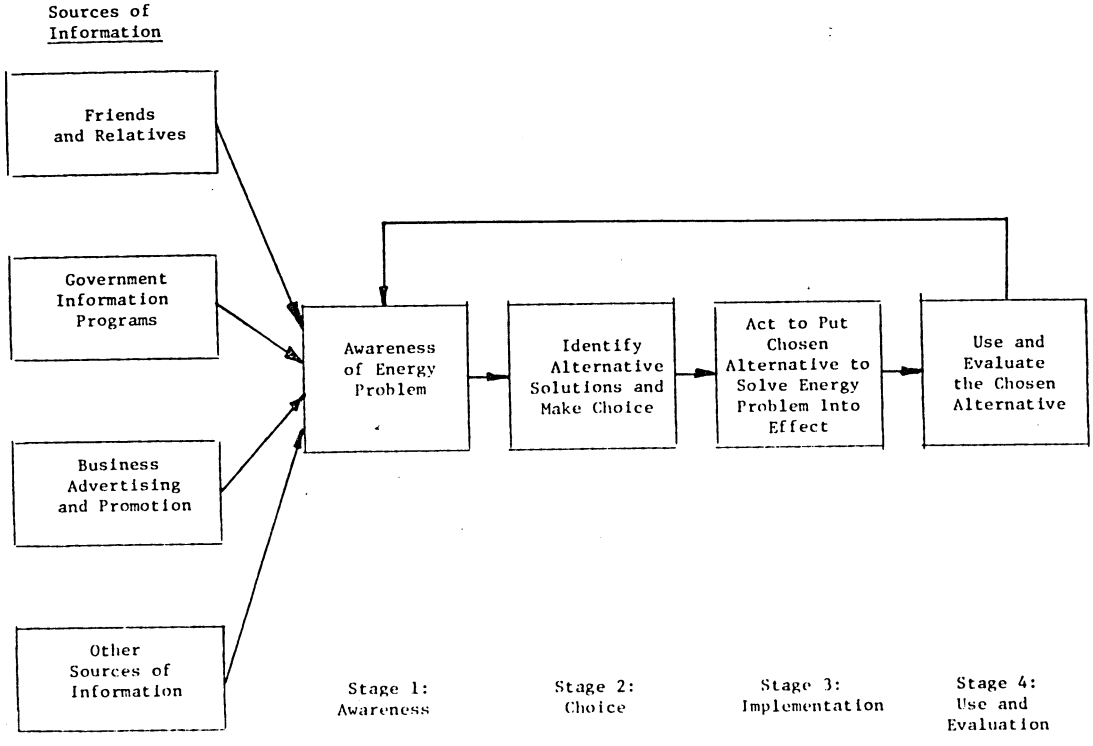


Figure 4-1. Sequence of stages a household goes through to become aware of an energy problem around the home and take steps to solve it.

The federal and state governments have established specific energy programs that attempt to influence individuals in each of these four steps. A key question for the City of Saint Paul is what types of programs it should develop and how each of these programs should attempt to influence energy-conserving behavior of households. Before we attempt to answer these questions, an understanding of the programs offered by other governments and gas and electric utilities will aid Saint Paul in understanding how it might encourage consumer actions.

Energy Programs of the Federal Government

From tip sheets to energy audits to loans for solar "co-ops," federal government programs try to encourage energy savings. The programs fall into three categories, described below.

Programs Directed at Household Awareness and Choice

The federal government has attempted to increase consumer awareness and choice through the use of publications, films, and citizen's workshops. Examples of some of the publications available from the Department of Energy (DOE) [1, p. 215]* include:

- Tips for Energy Savers
- Insulation Fact Sheet
- How to Improve the Efficiency of Your Oil-Fired Furnace
- Energy Savings Through Automatic Thermostat Controls
- Insulate Your Water Heater and Save Fuel
- Home Energy Savers Quiz

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*Numbers in brackets refers to the numbered sources cited in the Appendix A: References. Where appropriate, page numbers are also given.

The DOE also provides assistance with Citizen's Workshops that give people an opportunity to learn more about energy problems [1, p. 219]. Many of these workshops now being scheduled have three parts: (1) a slide orientation dealing with the basic facts related to energy problems, (2) a decision-making game played by participants to observe the effects of a wide range of decisions involving energy use, and (3) a feedback session where questions raised by the program are discussed.

Along with education programs that influence consumer choices, federal legislation requires that local utilities offer energy audits to residential customers to help them identify appropriate energy conservation and solar energy measures. Utilities are required to provide an estimate of purchasing and installation costs, energy savings, and to arrange installation and financing of such measures [1, pp. 69-77].

Programs Directed at Implementation

The federal government offers several programs that assist households in implementing energy conservation decisions. Low income homeowners and renters can get help in weatherizing their home for the winter. Qualified applicants are eligible for up to $1,000 worth of materials and labor needed for insulating their ceilings, caulkings, weatherstripping, installing storm window, and modifying furnaces to waste less fuel. These funds are channeled through states to local Community Action Agencies that provide weatherizing services to those applicants who need them the most [1, pp. 41-66].

The Energy Tax Act of 1978 allows tax credits to encourage consumers in making energy saving purchases. Up to $300 in tax credit can be

claimed for the purchase of insulation, storm windows, weatherstripping, caulking, thermostat setback devices, and certain energy-saving furnace and flue equipment [1, pp. 157-164]. Up to $2,200 can be claimed for the purchase of equipment to generate solar, wind, or geothermal energy for home heating or cooling or for hot water.

A $100 million Solar Loan Support Program gives loans of up to $8,000 to homeowners and builders for purchasing and installing solar heating and cooling equipment in residences [1, p. 209].

Community and neighborhood cooperatives can get federal funding for small-scale energy projects that meet specific local needs. The National Consumer Cooperative Bank was set up to lend money to a variety of community revitalization and development projects by cooperatives. In New York, insulation was installed and a power-generating windmill was erected on the roof of a cooperative's apartment house. In Maine, neighbors cooperatively purchased heating oil to save money. In California, a cooperative builds solar collectors for members. Some of the other activities that local energy cooperatives might be used for are listed below:

- Boiler maintenance and repair in older buildings
- Weatherization and energy conservation
- Leasing and installation of alternative energy systems
- Energy education
- Energy job training
- Energy planning
- Energy auditing
- Energy advocacy

Programs Directed at Use and Education

The federal government aids evaluation of energy-saving maintenance performed on residential homes through consumer-protection education. The

most direct protection against false advertising and shoddy workmanship is consumer education about the products or services to be purchased. If consumers feel they have been defrauded, they can utilize a variety of federal, state, and local consumer protection laws by contacting a local consumer office [1, pp. 125-7].

Energy Programs of the State of Minnesota

The State of Minnesota also offers a variety of energy conservation programs -- from hotlines to windmill inspections -- some of which might help the City of Saint Paul in its efforts. As with the federal government, these programs attempt to influence consumers at various stages of the decision process.

Programs Directed at Household Awareness

Both the Public Information Program and the Education Program of the Minnesota Energy Agency (MEA) are directed at influencing consumer awareness of the energy crisis and choice of appropriate energy actions. The Public Information Program seeks to promote and support energy conservation, the development of alternative energy resources, and an awareness of the energy supply situation by providing accurate information and publicizing the availability of MEA conservation programs and energy-related documents. Some of the key activities involved in educating the public have included [2, pp. 59-61]:

- Publication of Residential Conservation Guides on topics such as home energy audits, ceiling reinsulation, home cooling, weatherstripping and caulking, and proper use of water heaters

- Publication of brochures on financial assistance available for energy actions
- Production and distribution of TV and radio public service announcements and advertising
- Publicity on availability of residential audit and retrofit workshops
- Provision of a library and toll-free hotline to provide answers to energy user questions

The MEA Education Program seeks to provide reliable information about energy sources, uses, and conservation to students and adults through the existing educational institutions in Minnesota. This program is directed at elementary and secondary pupils, post-secondary students and adults, and educators. Programs involve curriculum development, information dissemination, and teacher in-service training [2, p. 72].

Comprehensive Programs Directed at All Stages of the Decision Process

The MEA has also established the Minnesota Energy Conservation Service (MECS) Plan [3]. This plan is designed to fulfill in part both federal and state energy conservation requirements. The MEA, public utilities, and heating suppliers take part in this plan, which impacts all stages of the consumer purchase process.

Public utilities and heating suppliers are required to send program announcements to new and existing customers to ensure they are aware of the program. Besides describing energy savings, they must offer to provide the following services with descriptions of each:

- Energy audits
- Services to arrange installation
- Services to arrange financing
- Lists of approved contractors, lenders, and suppliers

In addition, the public utilities and heating suppliers must provide an explanation of the benefits of the federal and state agency tax credits, a description of the benefits and eligibility requirements of the Weatherization Assistance Program, and actively promote the MECS program.

As part of this program, the MEA provides public education to promote the program, encourages eligible households to request an audit, and provides information and assistance to customers in implementing the recommended practices and measures. In turn, public utilities and heating suppliers must assist consumers by providing energy audits and arranging for financing, materials, and installation of any program requested by consumers. This is accomplished primarily by providing customers with a master list of approved lenders, suppliers, and contractors. The MEA will be responsible for preparing and maintaining the master list of MECS suppliers, installers, and lenders. This list begins publication in December, 1980 and is to be revised every 30 days thereafter.

The MECS plan requires participating utilities and heating suppliers to arrange for or to conduct post-installation inspections. Mandatory inspections are required with the installation of flue opening modifications, electric or mechanical ignition systems, and wind energy devices. Random audits are required for all contractors, and for 10 percent of the installations arranged by utilities. Inspections will be conducted on any consumer complaints received by the Office of Consumer Services that were arranged by the utility or supplier. The Office of Consumer Services is responsible for mediating complaints against lenders, suppliers, and contractors acting under the MECS plan. Finally, customers are allowed to pay loans for energy saving improvements arranged by utilities and suppliers along with their utility bills.

Energy Programs of Local Governments

At the local level, energy programs can be found from Seattle, Washington to Osage, Iowa, from Hibbing, Minnesota to Springfield, Missouri. They include features such as free floor insulation, seven-minute air conditioner cut-offs, aerial photographs, and an energy-mobile.

Seattle, Washington Program

One of the most comprehensive energy conservation plans ever developed by a local government is the Seattle "Energy 1990" study. This study was initiated when Seattle's city-owned utility sought to participate with other utilities in constructing two nuclear power plans [4, pp. 321-332]. The building of nuclear plants became a very controversial issue for Seattle. Citizen's groups demanded evidence on whether this additional generating capacity was really needed. A citizen's committee was formed to recommend whether or not to support the building of the nuclear plants. This committee recommended a conservation program aimed at saving 193 megawatts per day of energy to meet 1990 energy requirements and not participating in constructing the two nuclear power plants.

Table 4-1 presents the objectives of the residential portion of the 1979 Seattle Conservation program [5, pp. 12-20]. The estimated savings from Seattle's conservation program in 1977 was approximately 72 megawatts per day or about 8 percent of the city's normal energy requirements. No comprehensive studies have been performed in the past to evaluate the effectiveness of the various energy-conservation programs in Seattle. One preliminary result, supplied by Marya Sharer, Program Manager, of the Seattle Office of Conservation, suggests that their home energy audit program has provided a 4 percent savings on residential energy use. The local utility recently established an evaluation unit to measure the effectiveness of Seattle's energy-conservation programs.

TABLE 4-1

OBJECTIVES OF SEATTLE'S 1979 ENERGY CONSERVATION PROGRAM FOR LIGHT-RESIDENTIAL HOUSEHOLDS

Stage of Decision Process	Specific Objectives
Awareness	• To hold community meetings on conservation • To participate in displays, home shows, exhibits, and fairs • To provide speakers on energy conservation and solar energy for community groups • To develop and present programs and tours for students • To provide workshops, curriculum assistance, and materials for teachers • To develop and present solar outreach programs and displays
Choice	• To answer inquiries on special "conservation phone line" • To develop insulation standards that comply with city, state, and federal regulations • To have each residence installing electric heat meet a maximum heat loss standard of 10 watts per square feet and complete an approved heat loss form • To provide thermographs with an interpreter at community meetings and at an energy information center
Implementation	• To provide free attic and floor insulation to eligible low-income elderly and handicapped persons • To assist low-income customers in saving energy by installing weatherization measures • To assist approximately 30,000 customers to reduce their energy consumption over 20 years by financing weatherization items in homes and apartments • To help meet the residential energy-savings goal by the year 1990, let contracts to community groups to conduct electricity conservation projects • To develop and distribute lists of participating lending institutions • To develop and distribute lists of approved insulation contractors
Use and Evaluation	• To develop an insulation inspection form and certificate

Osage, Iowa Program

A number of other communities and municipal utilities have implemented energy-conservation programs. Osage, Iowa, in response to a need for new expensive generation equipment, decided to start a conservation program [6, pp. 18-22]. Their objective was to reduce summertime peak loads, thereby deferring the need for new, costly power-generation equipment. The local utility at Osage accomplished this objective through a program of load management and energy conservation. Load management was accomplished by installing equipment designed to cut off air conditioners seven-and-a-half minutes out of each half hour during a three to four-hour peak use period, and further designed to cut off electric water heaters for those entire three- to four-hour periods.

The Osage utility's conservation program included bill stuffers, newspaper ads and stories with testomonials, local radio announcements, direct mail brochures, and a bimonthly newsletter to customers. The newsletter proved to be the most effective means of communication. In addition, energy audits and electrical meters to record the usage of each home appliance are supplied to customers at no charge. New gas-heating customers are hooked up only if they can meet certain insulation specifications. Aerial thermograms and a hand-held infrared scanner are used to aid energy audits.

Their energy program has proven quite successful. While the nation's electric output rose 2.8 percent, Osage's load actually decreased by 2.9 percent. Based on degree days, Osage's average residential gas customer uses 20 percent less gas than it did five years earlier.

Hibbing, Minnesota Program

The municipal utility at Hibbing, Minnesota has attempted several of the same programs as Osage, Iowa [7, pp. 79-80]. Advertising, energy audits, and infrared aerial photographs were used effectively to reduce energy usage. Another promotion that the Hibbing Public Utilities Commission considered was installing clock setback thermostats. Interestingly, when the utility explained to the customer that setback thermostats were $75 plus the cost of installation, individuals shrugged their shoulders and walked away. The Hibbing Public Utilities Commission, after a survey, dropped this idea completely because it did not want to provide setback thermostats to customers plus install them at a cost of $200 to the commission [8].

Springfield, Missouri Program

The city utility at Springfield, Missouri uses an energy bus to "drive home" energy conservation [9, pp. 55-6]. The renovated city bus contains exhibits, energy quizzes, crossword puzzles, energy-saving devices, and brochures. This energymobile can be moved to sites that are readily accessible to consumers. The Energy Bus has toured several business locations, including shopping centers and banks. Children in elementary, junior, and senior high school have toured the bus during science classes. One exhibit includes a mockup of an attic, wall, and floor used to demonstrate the suitability of different types of insulation. Funding for the bus is made available by the U.S. Department of Energy as part of a pilot energy conservation project.

Programs in Other Cities

Some communities have used monetary incentives to promote energy conservation [10, p. II-22]. Pittsburgh offers property tax exemptions for home improvements as well as a small matching program with federal funds. Boston uses cash rebates for home improvements made by medium- and low-income families.

In summary, a variety of measures have been tried by cities and municipal utilities to promote energy conservation. Table 4-2 presents a summary of the actions taken at federal, state, and local levels.

Implication for Saint Paul

The City of Saint Paul is faced with three key questions that require decisions:

- At what stages in the consumer purchasing process should Saint Paul promote conservation; awareness, choice, implementation, or use and evaluation?
- What specific energy-conservation activities should Saint Paul promote?
- To what specific groups should these energy-conservation activities be directed?

Local governments have high potential as providers of energy information and services. Local governments have four unique characteristics which are critical for success for such programs [11, pp. III-10].

- They have access to people, including those who would not seek out services on their own.
- They have the potential capability to tailor information to fit the unique needs of their area.

TABLE 4-2

SUMMARY OF ACTIONS TAKEN AT THE FEDERAL, STATE, AND LOCAL LEVELS TO PROMOTE RESIDENTIAL ENERGY-SAVINGS ACTIONS

Level at Which Action Is Taken	Stage of Consumer Decision-Making Process			
	Awareness	Choice	Implementation	Use and Evaluation
Federal Government	Provide publications, films, workshops	Set cost-effective energy standards before financing projects Publish reports on energy-efficient technologies Finance home energy-conservation improvements Provide tax credit for energy-saving home investments	Offer weatherization program for low-income families Finance energy-saving activities for neighborhood cooperatives	Provide consumer-protection information on name energy-saving actions
State or Region: State Government	Run public service announcements on radio and TV Publicize residential audits and workshops	Publish residential guides on energy conservation, financial assistance, and installation standards Provide library and toll-free hotline assistance		
State or Region: Public Utilities		Perform home energy audits	Provide services to average installation and financing of energy-saving activities Provide lists of approved contractors, lenders, and suppliers Allow payment with utility bills	Conduct post-installation inspections Organize office of consumer services to handle consumer complaints
Local Government	Organize community meetings, displays, home shows, exhibits, and fairs Provide speakers, outreach programs, and bill stuffers Run an "energy bus"	Provide energy hotlines Develop standards for insulation, heat loss, gas heating hookups for new customers Utilize energy audits, thermographs, infrared scanners, and meters to record power usage of electrical appliances Provide property tax exemptions, matching grants, and cash rebates for energy saving actions	Provide free attic and floor insulation to the needy Provide lists of contractor and lenders Provide financing for energy-saving actions Install power load management devices on water heaters and air conditioners	Design insulation inspection form and certificate

- They are the most appropriate level to provide individualized assistance that are most likely cause people to change their behavior.

- They can integrate energy programs into other functions, making these programs less expensive to administer.

Ways that Saint Paul can utilize the experience gained on energy-conservation programs at the federal, state, and local levels will be identified in the remainder of this report.

5. ENERGY CONSERVATION PLANS AND ACTIONS OF SAINT PAUL HOUSEHOLDS AND PROGRAMS TO INFLUENCE THEM

Energy conservation actions can be divided into three basic groups, described below. In each case, communication and marketing programs may be directed at homeowners in various stages of decision about these actions. This section then closes with an analysis of plans and actions for various segments of renters and homeowners.

Types of Energy-Conservation Actions

Energy-conservation actions divide into three types, depending upon the type of behavior required: one-time, seasonal, and continuous.

One-Time Conservation Actions

One-time energy-conservation activities need only to be performed once for the potential energy savings to occur. These types of activities generally require expensive capital improvements, but not always. The following one-time conservation actions were included in the Saint Paul Energy Mobilization Survey:

- Install clock setback thermostat
- Install more efficient furnace
- Turndown water heater thermostat
- Install water flow restrictors
- Insulate hot water pipes
- Insulate hot water heater
- Insulate the attic
- Insulate crawl spaces
- Insulate the walls
- Install fireplace glass doors and/or chimney caps

TABLE 5-1

THE DIFFERENT STAGES IN THE CONSUMER DECISION-MAKING PROCESS AND THE TYPES OF MESSAGES TO USE AT EACH STAGE

Decision-Making Stage	Energy Conservation Responses Relating to Each Stage[a]	Characteristics of Message Directed at Each Stage
Awareness	Won't save energy-not interested (4) Don't have the time (5) Not sure (1)	Provide facts that show there is an energy crisis. Use messages that stress fear, guilt, and ridicule. Direct messages at the point that one's neighbors have complied Direct messages at how to tell whether an energy action was performed, or recommend an energy audit.
Choice	Plan to do it soon (2) Don't know how (6)	Recommend those energy activities that provide the higher energy savings at the lowest cost Provide instruction on how to perform energy conservation action Discuss tax advantages of performing certain actions.
Implementation	Don't have enough money (7) Physically unable to (8)	Develop or recommend existing government or utility loan/grant programs Develop program to give assistance on basic energy actions that occupant cannot physically perform.
Use and Evaluation (activity completed)	Done (0)	Thank consumers for "being a friend" in solving an important social problem. Remind consumers of importance of continuing efforts needed to reap benefits of seasonal and continuous energy actions.
Problem does not involve occupant	Landlord should do it (3) Doesn't apply (9)	Direct message at landlord, not tenant for those who respond landlord should do it.

[a]From the Saint Paul Energy Mobilization Survey (shown in Appendix B). Numbers in parentheses refer to a specific choice and column in the Survey.

Seasonal Conservation Actions

Seasonal conservation activities need to be performed periodically in order for the energy savings to occur. These types of activities may be time-consuming but generally do not require major cash expenditures. These actions prepare a residence for the coming summer or winter season. The following seasonal conservation actions were included in the Energy Mobilization Survey:

- Check caulking
- Check weatherstripping or doors and windows
- Replace cracked or broken windows and storm doors
- Clean and tune up the furnace

Continuous Conservation Actions

Continuous conservation activities require constant attention for the energy savings to be achieved. These activities require no cash expenditures for energy savings to occur. These type of energy savings are especially difficult to influence because they require a permanent and continuing change in behavior. The following continuous conservation actions were included in the Saint Paul Energy Mobilization Survey:

- Regularly turn off unused lights
- Close drapes and shades at night
- Close off unused rooms
- Turn down furnace thermostat

The distinction between type of conservation action is important because each requires a totally different communication and marketing strategy to stimulate that type of energy savings. One-time changes should be advertised in the summer when individuals do major types of maintenance and repair to their homes. Seasonal conservation actions

would be promoted in early fall as a reminder of how to prepare homes for the winter months and possibly in early spring to prepare homes for all the summer months. Continuous conservation actions require a marketing program that reminds consumers 12 months out of the year of the necessity for that action.

Programs Directed at Different Decision Making Stages

For each energy conservation activity identified in the Saint Paul Energy Mobilization Survey, Saint Paul residents had an opportunity to respond whether they had performed an energy conservation activity, and if not, why not. The responses consumers were allowed to choose from have been grouped into categories broadly related to the various stages in the decision making process. Table 5-1 shows which responses have been combined to represent each of the stages of consumer decision making about energy-conservation actions identified earlier in Section 4.

In addition to the four stages discussed earlier, the bottom row of Table 5-1 shows another category that is called "problem does not involve occupant." This category includes those energy activities for which a consumer does not feel responsible. In this instance, consumers believe the landlord should perform the energy action, or that the energy saving does not apply to them, such as when a consumer does not have a fireplace on which to install glass doors.

As shown in Table 5-1, different media messages or programs should be used for consumers at different stages in the decision-making process. For renters messages should be directed at their landlords.

Programs to Increase Awareness

To increase problem awareness, several types of messages can be used. Skeptical or uninterested consumers should be given facts that show there is an energy crisis. Or fear appeals and messages showing that one's neighbors are taking energy actions may be appropriate. For consumers unsure of whether or not the energy action has been performed, messages should either describe how to tell whether an energy conservation action has been performed or recommend an energy audit.

Programs to Assist Choice

At the choice stage in the decision making process, several appeals can be made. Saint Paul can recommend that homeowners perform those energy actions that provide the highest energy savings at the lowest cost. Or it can provide instruction on how to perform certain energy conservation actions. Finally, Saint Paul can discuss the tax incentives available for performing certain conservation actions.

Programs to Encourage Implementation

For those individuals who are financially or physically incapable of implementing an energy saving action, Saint Paul can develop its own loan or grant program or recommend existing government or utility programs. The city might also decide to provide labor or organize volunteers to perform basic energy conservation actions that occupants cannot physically perform themselves. A summer program using young people to perform caulking and weatherstripping for the elderly is an example of such a program.

Programs to Assist in Use and Evaluation

Finally, messages showing appreciation for those who have already performed energy actions can be used. This can motivate the "energy concerned" person to perform other energy-conserving actions. And, as noted earlier, repetitive messages are needed to remind consumers to take seasonal and continuous conservation actions to reap the benefits.

Programs Directed at Different Demographic Groups

In developing a marketing strategy, a key consideration is whether to present the same program or communications message to all consumers or to tailor different programs and messages to specific consumer groups. To assess which marketing strategy is most appropriate for the City of Saint Paul, the plans and actions of the following consumer groups will be explored:

- Renters versus owners
- Owners age 60 and over versus those under 60
- Owners with lower, middle, and upper incomes
- Owners of three different types of homes

Plans and Actions of Renters and Owners

Renters. Figure 5-1 presents the percent of homeowners and renters at each stage in the decision making process. The stages in Figure 5-1 are mutually exclusive so that each row sums to 100 percent. This implies that a household at a later stage in the decision process has completed earlier stages. So, for example, a household that is taking the action of closing off a room has also gone through the awareness, choice, and implementation stages for this action as well.

Figure 5-1 shows that renter-occupied residences have not completed as many energy-saving actions as have homeowners. In fact, a higher

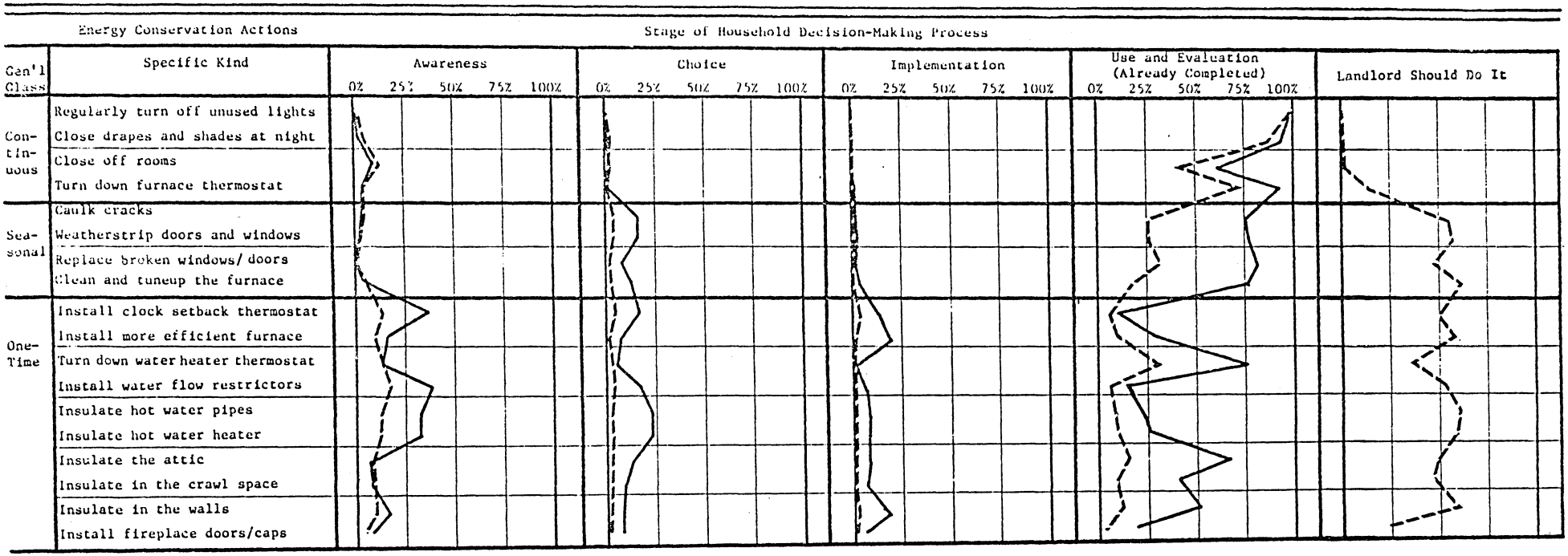

Figure 5-1. The percentage of Saint Paul owners and renters at various stages of performing energy-conservation actions.

percentage of owners than renters have completed energy saving actions on all 18 energy-conserving actions.

About 42 percent of the 106,000 Saint Paul households counted in 1978 were occupied by tenants. So it might seem that significant energy savings could be achieved by a marketing program directed at renters.

But these data suggest that an energy program directed at renters would be ineffective. On most categories, approximately 50 percent of the tenants responded that it was the landlord's responsibility to perform energy saving actions, not theirs. So an energy program should be directed at landlords, not tenants, in order to encourage energy savings on rental property. Such programs might use information campaigns to describe energy savings potential in apartment buildings, offer tax incentives to landlords for performing certain energy actions, or require tax penalties for noncompliance to legislated energy standards (see Minnesota State Law 116H.129 Sub 3).

Most rental units are part of a large multiple dwelling. A study performed for the Department of Housing and Urban Development found the following average heating load factors for different types of buildings:

Single family	11.60/unit
Townhouse	6.17/unit
Low-rise building	4.99/unit
High-rise building	4.53/unit

Smaller energy savings per household are likely to be possible for rental property as compared to owner-occupied property. Also, fewer structural modifications are possible on multiple-dwelling buildings, precluding certain energy saving actions that are possible on single-family dwellings. Further, special considerations in large buildings such as

stack effects that vary with building height and forced ventilation systems may require special kinds of energy conservation actions quite different from those used for single-family dwellings. Further research should be directed at apartment dwellings before specific energy programs are recommended for them in Saint Paul.

Owners. Figure 5-1 presents the percentage of owners at each stage in the decision-making process. This figure suggests there are problems with low awareness and choice for the following one-time energy conservation actions:

- Install clock setback thermostat
- Install water flow restrictors
- Insulate hot water pipes
- Insulate hot water heater

There is also a problem of choice with the seasonal energy actions of caulking, weatherstripping, and "tuning-up" the furnace. Problems in implementation appear to involve the more expensive type of one-time changes, such as installing a more efficient furnace and insulating walls.

Plans and Actions of Two Age Groups

Figure 5-2 shows the percentage of two age groups at each stage in the decision making process. The under-60 age group depicts high percentages for problem awareness and choice in the decision-making stages. This age group is either unaware or unconcerned about the potential energy savings from several one-time energy conservation actions. This same age group also has not taken many energy-saving seasonal or other one-time actions that those in the 60 years-and-older age group have taken.

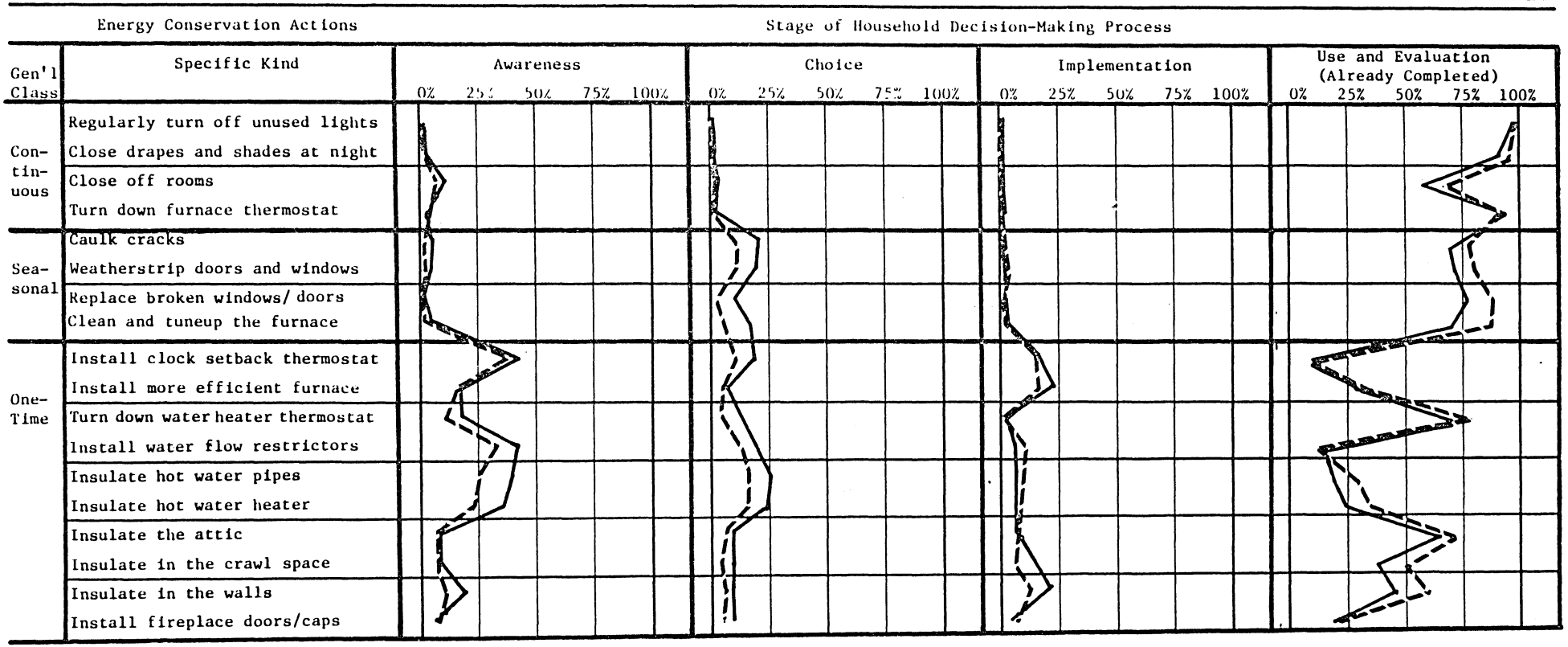

Figure 5-2. The percentage of two age groups of Saint Paul homeowners at various stages of performing energy-conservation actions.

The older age group does not have the same decision making problems as the under-60 age group. The data in Figure 5-2 suggests that the 60 years-and-older group has difficulties in implementation of conservation actions for either financial or physical reasons. However, interestingly, certain actions that are expensive and involve significant energy savings are more troublesome for the under-60 age groups to implement than the older group. These actions involve installation of more efficient furnaces and insulating walls.

In general, the 60-years-and-older age group has been more diligent in performing energy conservation actions than the under-60 age group, possibly because they are retired and have the time to do so. The younger group has already completed only four energy saving activities more often than the older one: turning down their furnace thermostat, installing a clock setback thermostat, installing a more efficient furnace, and installing water flow restrictors.

Plans and Actions of Three Income Groups

Figure 5-3 shows the percentage of various income groups at each stage in the decision making process. The results for income groups is very similar to the results found for age groups. Homeowners with higher incomes seem to have difficulties at the problem awareness and choice decision stages. They appear unaware of -- or indifferent to -- savings from many one-time energy conservation actions. For only two energy-saving actions shown in Figure 5-3 are homeowners with higher incomes the leaders in having completed the action, installing water-flow restrictors and installing fireplace doors.

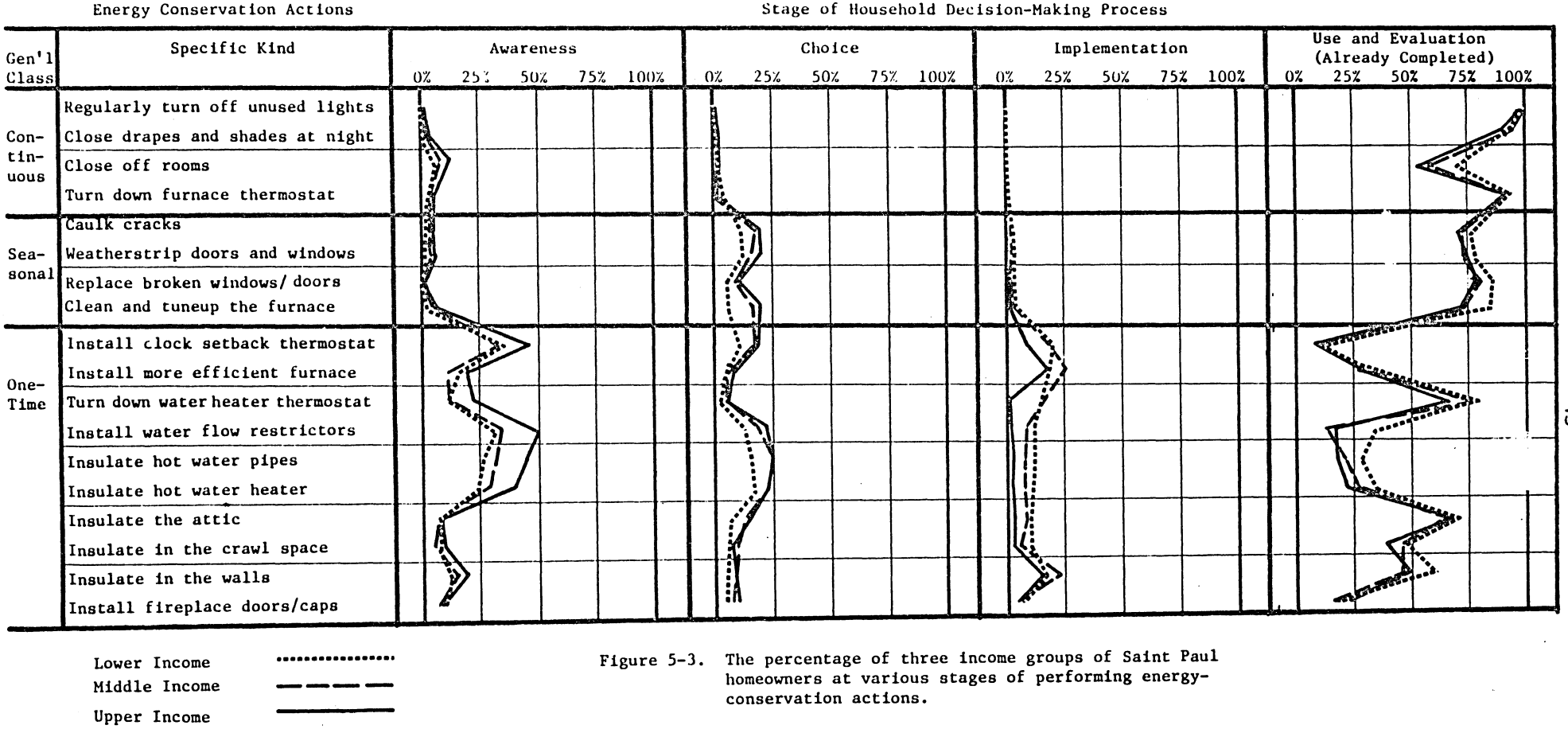

Figure 5-3. The percentage of three income groups of Saint Paul homeowners at various stages of performing energy-conservation actions.

Lower- and medium-income groups have difficulties implementing several one-time energy actions. But these two groups have generally performed more energy-conservation actions than higher income groups.

Plans and Actions of Owners of Three Different Types of Homes

Figure 5-4 shows the percentage of various house types at each stage in the decision making process. It reveals that consumers with larger homes have difficulties performing both seasonal and one-time energy conservation actions at the problem awareness, choice, and implementation stages of decision making. In general, smaller homes have been far more successful in completing energy conservation actions than the larger ones.

Conclusions Relating to Owner Groups

A pattern seems to emerge from the evaluation of homeowner groups. It seems that those groups that can most afford to perform energy conservation actions and can benefit the most from these actions are the least inclined to perform them.

An explanation for this pattern may involve discretionary income for the various homeowner groups. Homeowners with low incomes may have been forced to conserve energy due to their inability to reallocate funds from other areas of their budget. Homeowners with higher incomes may have been able to forego conservation actions because they could allocate discretionary funds for higher energy costs from other areas of their budget.

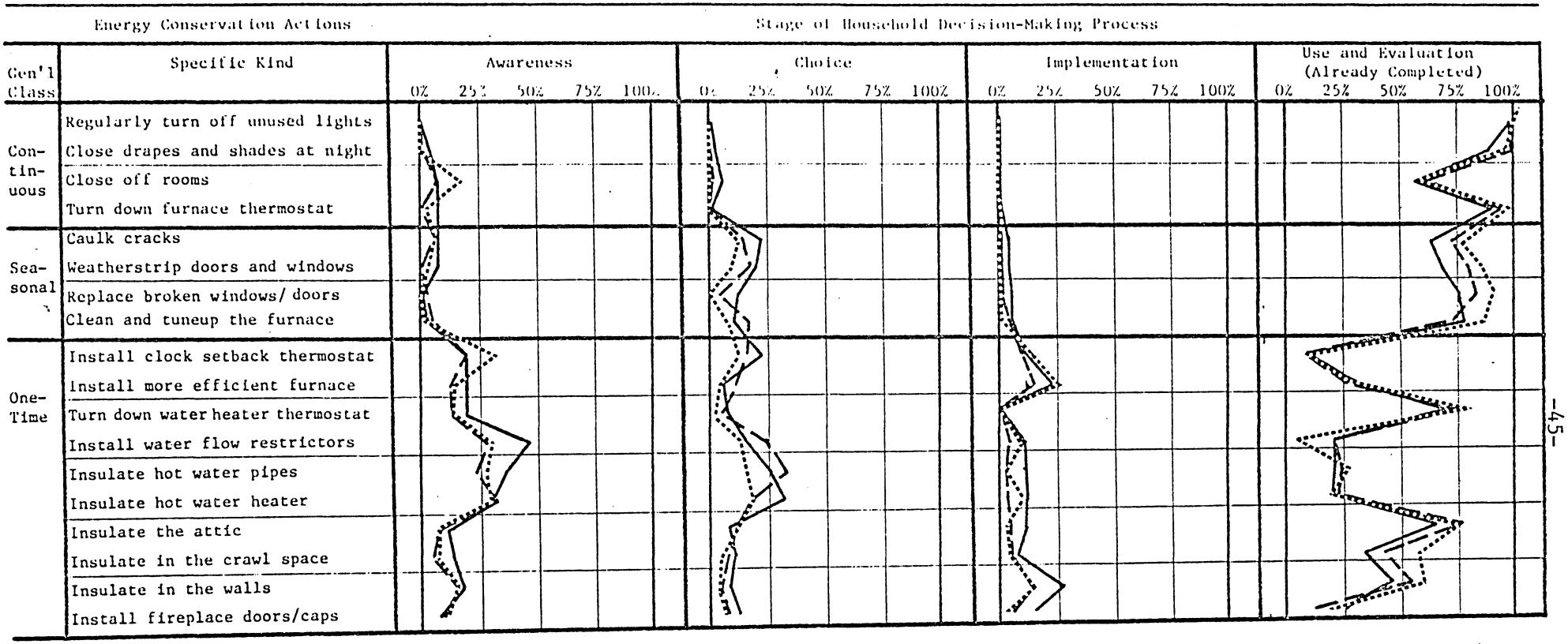

Figure 5-4. The percentage of three groups of Saint Paul homeowners in different kinds of houses that are at various stages of performing energy-conservation actions.

An important conclusion provided by the above segmentation analysis is that different marketing strategies should be directed at different homeowner segments. To help do this the next section provides estimates of potential energy savings by stage in the decision making process and homeowner segment.

6. POTENTIAL ENERGY SAVINGS FROM ACTIONS AT DIFFERENT STAGES OF HOMEOWNERS' DECISIONS

How effective would various one-time actions, seasonal actions, and continuous actions be, if taken by Saint Paul homeowners? In this section the potential energy savings are related to the stages homeowners are at in their decisions about energy.

Estimating Energy Savings

Information Needed

To calculate how much energy savings various homeowner segments would achieve, one needs these kinds of information:

- How many households in Saint Paul are included in each homeowner segment?
- How many Saint Paul households in each of these segments are at each decision-making stage?
- How much money would each Saint Paul household, in each homeowner segment, save if that household took an energy conservation action?

The information was gathered from several sources and then combined. The households in each age and income segment were computed by using the stratified random sample of 3,000 questionnaires from the Saint Paul Energy Mobilization Survey and by multiplying those figures by the total number of single family homes in Saint Paul. The stages of homeowners decision-making were developed using the percentages shown in Figures 5-1, 5-2, and 5-3. The percentage of Saint Paul homes in

three "typical" categories was estimated by Saint Paul Energy Office personnel and the researchers. And the percentage of homeowners owning them was estimated from the stratified random sample of the Saint Paul Energy Mobilization Survey. See the figures below:

	Type of Saint Paul Home		
Homeowner Segment	1 Floor, 2 Bedroom	2 Floor, 3 Bedroom	3 Floor, 4 Bedroom
Under age 60	15%	33%	52%
Age 60 and over	44%	26%	30%
Income under $10,000	42%	21%	37%
Incomes from $10,000 to $20,000	27%	36%	37%
Incomes over $20,000	12%	35%	53%

Estimates of the costs and savings of each energy action in each type of house was provided by Northern States Power, the Minnesota Energy Agency, and the Saint Paul Energy Office (as noted in Section 3). This information is presented in Appendix C.

Calculating the Estimated Energy Savings

How much would be saved by various energy activities, if they were undertaken by various age and income segments of Saint Paul homeowners? This was calculated by multiplying the number of each type of house owned by a segment by the energy savings for that house and then adding the values for all three types of houses. These results are summarized in the tables in Appendix D.

The savings that would occur if an energy action were successfully promoted to a particular segment of households is then computed with the following formula:

$$S_{ij} = P_j \times H \times E_{ij}$$

where S_{ij} = the potential savings available from a specific energy action i taken by household segment j.

P_j = the percent of owner-occupied homes in Saint Paul that comprise a household segment (e.g., incomes under $10,000).

H = the total number of owner-occupied households in Saint Paul.

E_{ij} = the expected savings per household from performing an energy action by that household segment.

The results from this analysis are presented in the tables in Appendix E.

Household Decisions About Energy-Saving Actions

When households are deciding on energy actions, three questions emerge as especially important: (1) What kinds of energy-saving actions could they take? (2) What stage of the decision process are they in? and (3) What is their motivation [12, p. 476] to take the action? Each of these factors will be discussed below, along with implications for action by the City of Saint Paul.

Kinds of Energy-Saving Actions

One-time, seasonal, and continuous energy-saving actions involve dramatically different behaviors to achieve their energy savings. One-time actions (such as installing a more fuel-efficient furnace) may be expensive but require only a single behavior. Continuous actions (such as turning

off unused lights) may be simple and inexpensive but require repeated action. And seasonal actions (such as replacing broken windows or storm doors) lie somewhere in between.

The more often energy-consumers must take action, the more often they must receive "reminder" communications. Otherwise significant energy savings may never be achieved. One-time energy-saving actions, on the other hand, generally require only "one-shot" communications.

Stages in a Household's Decision Process

Households typically move through four stages in their energy decisions (shown earlier in Figure 4-1): (1) problem awareness, (2) choice, (3) implementation, and (4) use and evaluation. To move a household of energy-consumers from the awareness stage to the use (or action) stage takes an immense push. But moving a household from the implementation stage to the use stage is simpler. So Saint Paul could achieve much greater energy savings city-wide by encouraging action among those households already favorably disposed. Creating awareness from scratch is much more expensive and risky.

Motivation to Take Energy-Saving Actions

Money is a much more effective motivator than altruism or patriotism, recent energy research has found. So the faster the "payback period," the more likely a household is to take action [13, p. 7]. (Payback period is the time to recover the initial investment in an energy action; so it is the action's cost divided by its annual savings.) A short payback period, for the purposes of this study is three years or less to recover the cost of the materials. The cost of the labor is excluded because households

can save discretionary income by performing the energy action themselves -- and so tend to evaluate it on direct material costs alone.

Energy Savings by Demographic Group and Kind of Action

Energy savings vary greatly depending on which demographic group is involved. The specific kind of action taken makes an even greater difference. These points are discussed below.

Energy Savings by Age of Head of Household

The age of the head of the household appears to be a relevant segmentation variable for developing energy-conservation plans. As can be seen in Figure 6-1, the under-60 age group is a far better target for energy savings in Saint Paul than the 60-and-over age group. One-time energy savings are about $8,300,000 for the under-60 age group, compared to only $3,400,000 for the older group. The same kind of difference applies to seasonal actions and continuous actions.

Related data also suggest that the stage of decision-making is quite important. Moving decisions on one-time actions (like installing a clock-set back thermostat) from the implementation to the already completed stage would create significant energy savings. But squeezing savings out of seasonal actions would be more difficult -- here many people are stalled in only the choice and awareness stages.

In fact, the potential savings from the one-time actions is the most salient over-all factor here. About $11,700,000, a full 87 percent of the total energy savings possible, comes from them. Seasonal and continuous actions are far behind (see Table 6-1 for the data underlying Figure 6-1).

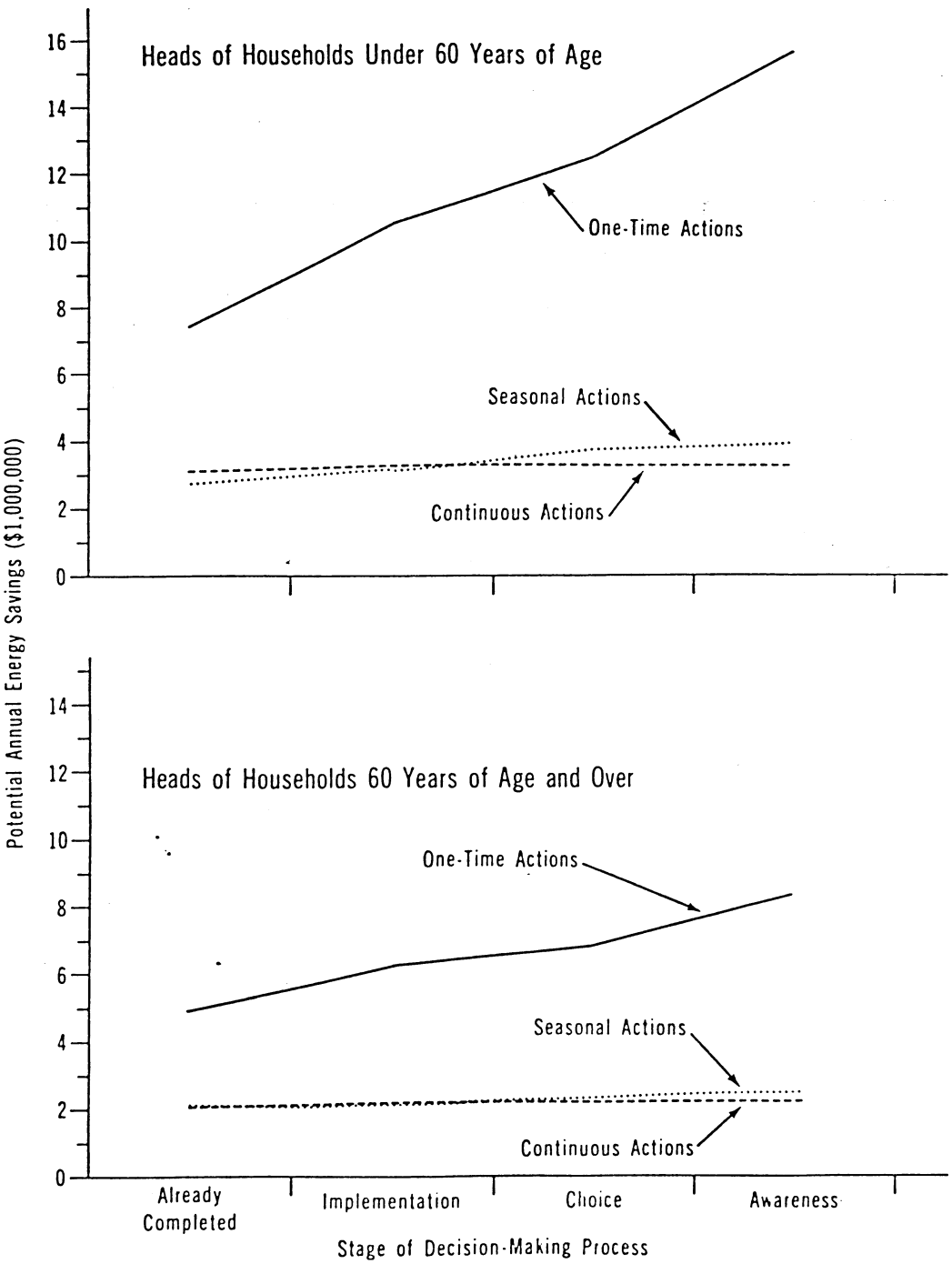

Figure 6-1. Potential annual energy savings in Saint Paul, by age of head of household.

TABLE 6-1

POTENTIAL AND ACTUAL SAVINGS FROM ENERGY-CONSERVATION ACTIONS, BY AGE OF HEAD OF HOUSEHOLD

Kind of Energy-Saving Action	Age of Head of Household	Stage in Household Decision Process			
		Awareness	Choice	Implementation	Use and Evaluation (Already Completed)
Continuous Action	Under 60	$ 186,000	$ 43,000	$ 8,000	$3,147,000
	60 and Over	$ 45,000	$ 16,000	$ 16,000	$2,079,000
Seasonal Action	Under 60	$ 187,000	$ 765,000	$ 98,000	$2,817,000
	60 and Over	$ 45,000	$ 235,000	$ 79,000	$2,083,000
One-Time Action	Under 60	$3,387,000	$1,912,000	$3,052,000	$7,470,000
	60 and Over	$1,524,000	$ 663,000	$1,235,000	$4,988,000

In reading Figure 6-1, note that the horizontal scale, the stages of the decision-making, are in reverse order. The left end of the scale shows actions already completed (use and evaluation), next is implementation, and so on. So the further to the right on the scale in Figure 6-1, the harder it is to achieve that amount of energy saving from Saint Paul households.

Energy Savings by Lower, Middle and Upper Income Households

Income, like age, appears to be a significant segmentation variable in developing community plans for energy conservation. Much more energy could be saved by upper-income groups, as compared to middle- and lower-income households. And, again, the one-time actions offer much more potential for savings than seasonal or continuous actions. Comparisons can be seen in Figure 6-2 and Table 6-2.

Two other important conclusions can be drawn here. First, the idea that lower income groups are already conserving energy -- for financial reasons -- is supported by the data. There is not much more savings potential, even when differences in the relative sizes in population and energy use by types of house compared to higher income groups is taken into account. The ratio of upper income (over $20,000) to lower-income households (under $10,000) is approximately 1.7 to 1. The ratio of upper-income households with large homes compared to the ratio of lower-income households with large homes is approximately 1.4 to 1. So, higher-income households should be expected to have an energy savings potential that is no higher than 1.7 x 1.4 or about 2.38 times larger for lower-income households (since large homes have the greatest savings potential).

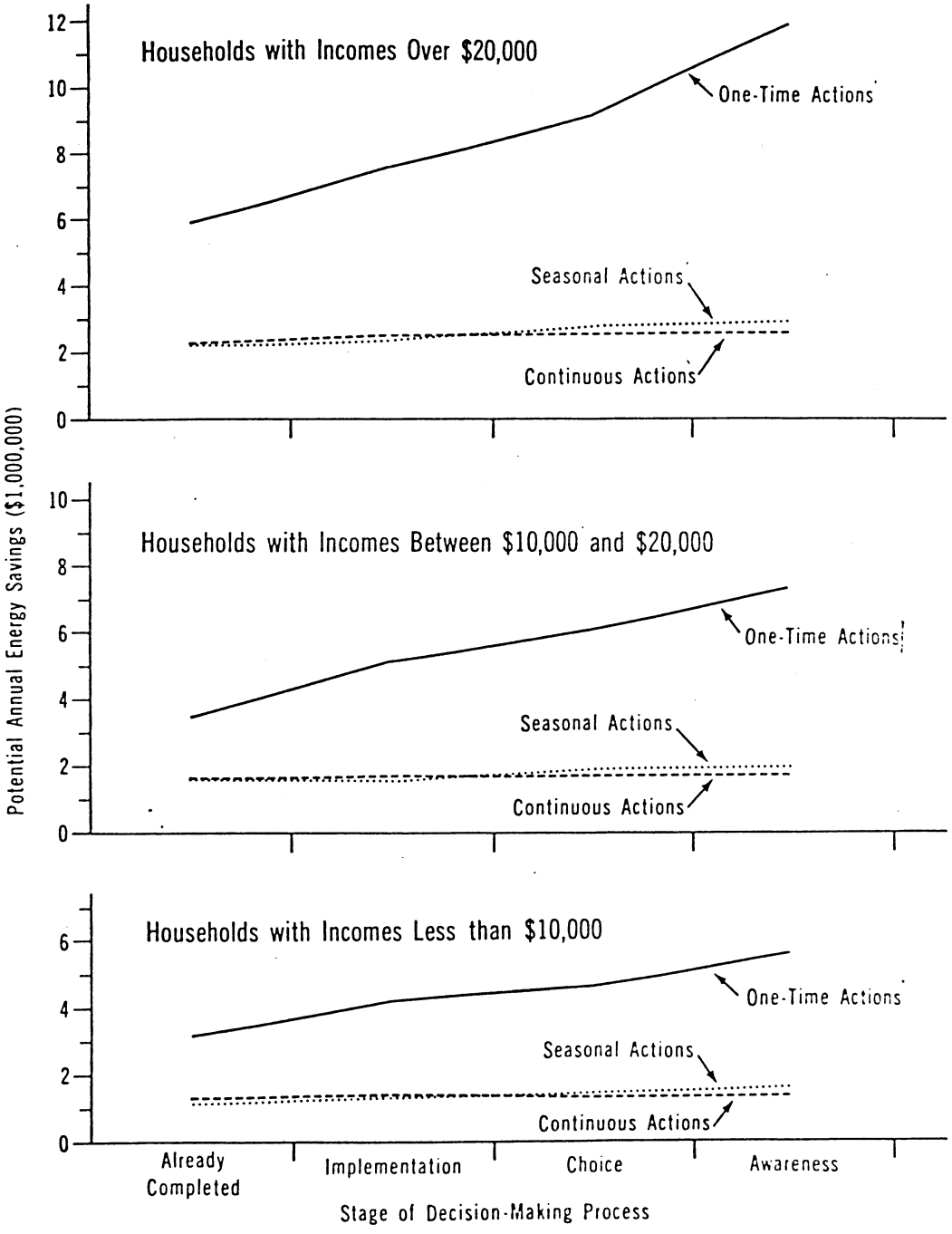

Figure 6-2. Potential annual energy savings in Saint Paul, by income level of households.

TABLE 6-2

POTENTIAL AND ACTUAL SAVINGS FROM ENERGY-CONSERVATION ACTIONS,
BY PRETAX INCOME LEVEL OF HOUSEHOLDS

Kind of Energy-Saving Action	Pretax Income of Head of Household	Stage in Household Decision Process			
		Awareness	Choice	Implementation	Use and Evaluation (Already Completed)
Continuous Action	Over $20,000	$ 179,000	$ 31,000	$ 10,000	$2,339,000
	$10,000-$20,000	$ 84,000	$ 22,000	$ 8,000	$1,610,000
	Under $10,000	$ 55,000	$ 11,000	$ 6,000	$1,291,000
Seasonal Action	Over $20,000	$ 144,000	$ 582,000	$ 22,000	$2,197,000
	$10,000-$20,000	$ 79,000	$ 345,000	$ 62,000	$1,487,000
	Under $10,000	$ 32,000	$ 159,000	$ 70,000	$1,219,000
One-Time Action	Over $20,000	$2,787,000	$1,499,000	$1,733,000	$5,876,000
	$10,000-$20,000	$1,259,000	$ 880,000	$1,627,000	$3,474,000
	Under $10,000	$ 992,000	$ 403,000	$ 998,000	$3,151,000

But the actual ratio of energy-savings potential for these two groups -- comparing total savings potential for the households that have not taken the short payback types of energy actions is $3,739,000/$1,383,000 or approximately 2.7 to 1. So the future potential is much greater for the over $20,000 group for short payback actions.

This same ratio -- and large dollar difference -- should not hold up for long payback types of energy actions since they are less attractive economically to low income groups. This, in fact, is what occurs. Comparing upper income and lower income groups for long payback types of energy actions, the ratio of total savings potential for the households that have not yet taken the actions is $2,279,000/$1,008,000 or approximately 2.26 to 1. So because this ratio is about equal to the 2.38 value cited above, neither group has shown a special inclination to perform long-payback energy actions in the past. So neither group offers a disproportionately large savings potential for long payback actions in the future.

Secondly, we might expect that lower income households, through economic necessity, are more aware of an energy crisis and are farther along in their stages of decision-making. If this is true, the proportion of savings potential for short payback items from lower-income households at early stages compared to later stages should be smaller than the comparable proportion for upper-income households. The ratio for lower-income groups indeed looks like this -- it is about 1.14 to 1. And if upper-income groups are indeed less aware of potential energy savings, their ratio should be far higher than 1.14 to 1. In fact, it is about 1.79 to 1. So the greater potential for energy savings among

households in early stages of their decision making seems to lie with the upper-income households.

Energy Savings by Type of House

Type of house also seems to be a relevant planning factor for Saint Paul. Conclusions here are very similar to those for age and income groups. The potential energy savings from larger homes is far higher than from smaller homes, even though larger homes have already achieved significant savings. And, again, one-time actions offer the greatest energy savings. See Figure 6-3 and Table 6-3.

Energy Savings by Kind of Action

One-time actions -- such as installing a clock-setback thermostat or a fuel-efficient furnace -- clearly create far greater energy savings for Saint Paul than seasonal actions (such as repairing broken storm windows) or continuous actions (such as turning off unneeded lights). Whatever the age of the head of household, the household income, or the type of house, this difference applies. A glance at Figures 6-1, 6-2, and 6-3 and at Tables 6-1, 6-2, and 6-3 shows how much more impressive these one-time actions are. They represent 80 to 90 percent of the total additional energy savings available to the City of Saint Paul.

Key Assumptions of this Analysis

For the analysis in this section, we have assumed:

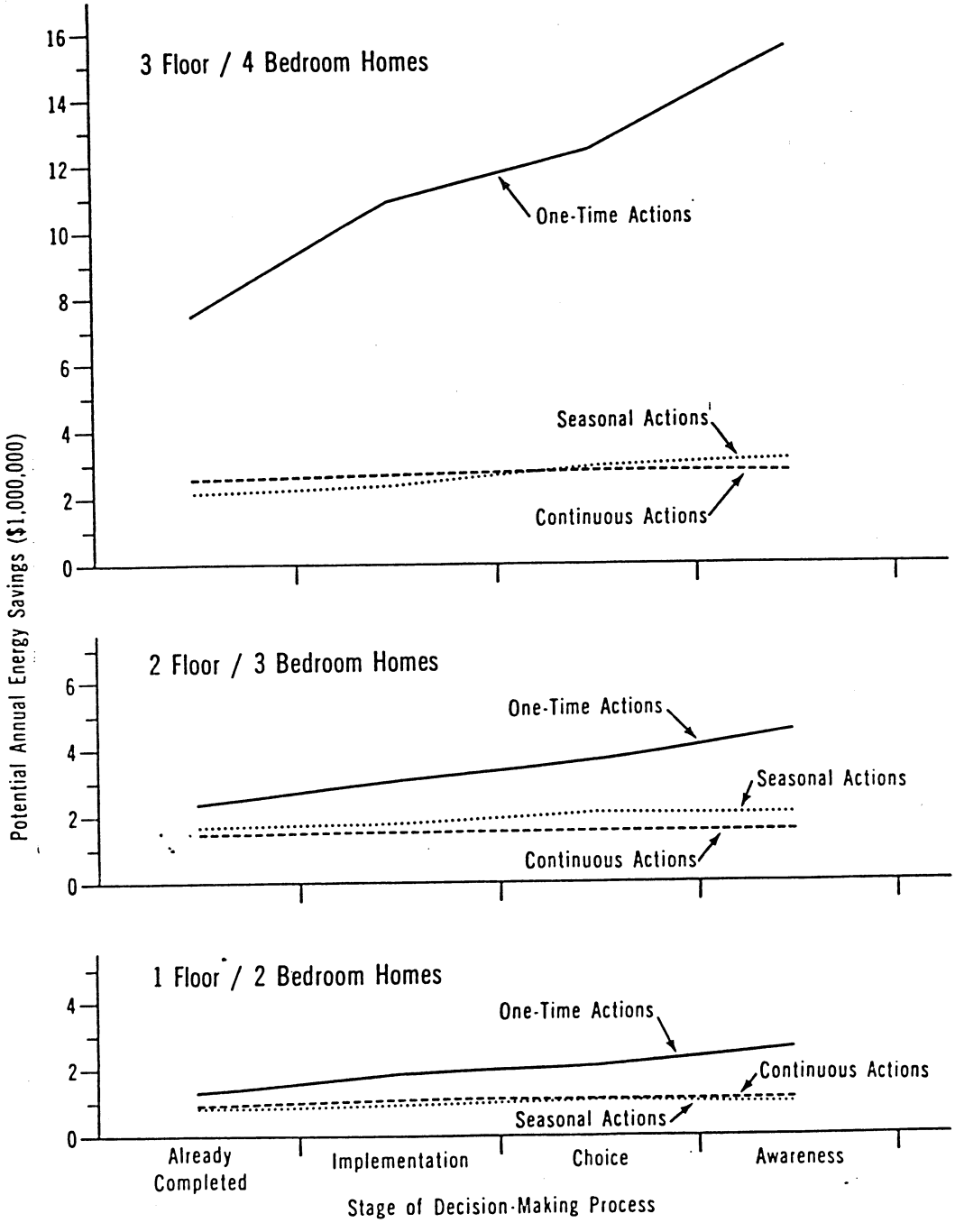

Figure 6-3. Potential annual energy savings in Saint Paul, by type of house in which household is living.

TABLE 6-3

POTENTIAL AND ACTUAL SAVINGS FROM ENERGY CONSERVATION ACTIONS,
BY TYPE OF HOUSE IN WHICH HOUSEHOLD IS LIVING

Kind of Energy-Saving Action	Type of House	Stage in Household Decision Process			
		Awareness	Choice	Implementation	Use and Evaluation (Already Completed)
Continuous Action	1 Floor/2 Bedroom	$ 72,000	$ 0	$ 9,000	$ 993,000
	2 Floor/3 Bedroom	$ 34,000	$ 23,000	$ 0	$1,512,000
	3 Floor/4 Bedroom	$ 193,000	$ 58,000	$ 16,000	$2,521,000
Seasonal Action	1 Floor/2 Bedroom	$ 34,000	$ 102,000	$ 3,000	$ 925,000
	2 Floor/3 Bedroom	$ 70,000	$ 323,000	$ 33,000	$1,650,000
	3 Floor/4 Bedroom	$ 195,000	$ 581,000	$ 131,000	$2,155,000
One-Time Action	1 Floor/2 Bedroom	$ 530,000	$ 241,000	$ 500,000	$1,364,000
	2 Floor/3 Bedroom	$ 974,000	$ 566,000	$ 675,000	$2,349,000
	3 Floor/4 Bedroom	$3,119,000	$1,495,000	$3,487,000	$7,465,000

1. The stratified random sample of households used is representative of all Saint Paul households. This seems reasonable, based on statistical tests of the sample.

2. Answers given in the Saint Paul Energy Mobilization Survey are accurate. Because respondents may want to appear energy-conscious and cooperative, they may tend to overstate their energy-saving actions and plans. The size of the error is unknown.

3. Each of the energy-saving actions identified in the Saint Paul Energy Mobilization Survey can be assigned to one of the four main stages of a household's decision making used in this report (awareness, choice, implementation, use and evaluation). While these stages may not be precise, they are logically consistent: a household that "plans" to take an action seems to be closer to it than one that believes that that action "won't save energy."

4. The energy savings and costs of energy-conservation actions used in the study are reasonably accurate and independent of each other. These data are the best obtainable. Also, while the total savings and costs of performing two or more of the actions may vary from the sum of the individual actions, this difference is not judged significant.

In general, we believe that these assumptions are accurate enough so that more precise data would not change the study's overall results.

Conclusions about Potential Energy Savings

The following conclusions for the City of Saint Paul can be drawn from the analysis in Section 6:

1. Use income as a segmentation variable in energy-conservation plans, since it critically influences energy actions by homeowners.

2. Develop separate energy-conservation programs for lower income and upper-income groups.

3. Emphasize one-time energy actions, especially those offering a short payback period.

4. Direct separate energy-conservation programs or communications to households living in large homes.

5. Use different messages for one-time, seasonal, and continuous actions for energy conservation.

Action recommendations, based on these conclusions, will be used to develop an energy-conservation program for the City of Saint Paul.

See the next section.

7. CONCLUSIONS AND RECOMMENDATIONS

The City of Saint Paul has already mobilized thousands of people to collect energy information. The next step is to turn this information into energy-saving actions, on a limited budget. This section summarizes the guidelines and actions that should help the city to accomplish this goal. And it closes with suggestions for monitoring the progress of energy actions in Saint Paul.

The recommendations included the following four dimensions:

- Whom to direct actions at -- the demographic and housing characteristics of Saint Paul homeowners to whom programs should be directed.
- Where to direct the actions -- the stage of the household decision process most likely to be responsive to Saint Paul's energy-saving programs.
- What kinds of energy actions to promote -- the specific kinds of actions that create the most energy-savings and are most likely to be adopted.
- How to "market" or communicate these ideas for energy savings to households -- how Saint Paul can best stimulate the energy-saving actions.

Where cooperative actions with the State of Minnesota or local utilities seem desirable, these will also be described.

Action Guidelines for the City of Saint Paul

Published research on what motivates households to save energy is quite clear. Only a few will respond to appeals of altruism, patriotism,

or social responsibility. Instead, households act in their own best interests to try to save money, the sooner the better, and with the lowest possible out-of-pocket expenditure.

As a result, the City of Saint Paul should focus its programs on: (1) tangible rewards rather than long-term, intangible ones; (2) rewards to individual households rather than to neighborhoods, communities, or the state; and (3) rewards or incentives for taking the desired action and penalties or disencentives for failing to do so; (4) clear information expressed in the rewards (for example, "insulate walls to R-19" is not generally understandable).

Recommendations. Saint Paul should:

1. Tell households, in simple dollar terms, about the benefits and costs of various energy actions, for the kinds of homes in which they live.

2. Help households take specific energy actions by providing appropriate information, technical assistance, and financial incentives.

The recommendations in the following sections attempt to translate these further into action.

Actions Related to Household and Housing Characteristics

Energy savings accomplished so far are related to the age and income of the head of household and on the type of Saint Paul home. (Details, shown in Figures 6-1, 6-2, and 6-3, were based on data from the Saint Paul Energy Mobilization Survey.) Future energy savings also depend on those variables.

Recommendations: Saint Paul should:

3. Seek energy savings from all households in the city.

4. Focus specific efforts on groups with the greatest potential for energy savings -- households headed by someone under 60 years old; those whose annual incomes exceed $20,000; and those who live in larger homes (3 floors and 4 bedrooms). This will maximize the results achieved from a limited budget.

Actions Related to Stages of a Household's Decision Process

Efforts may be directed at households at all four key stages of decision-making on energy savings: (1) problem awareness, (2) choice, (3) implementation, and (4) use and evaluation. (Tables 4-1, 4-2, and 5-1 identify programs across the country that do so.) But the greatest potential lies in reaching those households in the later stages, where energy-consumers have already taken some action and are predisposed toward more action.

Recommendations: Saint Paul should:

5. Direct programs and messages at households in the "choice" and "implementation" stages. These can include: providing loan, grant, or tax assistance for those unable to take action (for physical or financial reasons); providing lists of approved contractors, lenders, and suppliers; and providing information on the dollar benefits and costs of energy-saving actions.

6. Direct "reminder" advertising at households in the final "use and evaluation" stage. This should focus on continuous activities to promote energy conservation (such as turning down thermostats or turning off lights) and on seasonal activities (such as repairing storm windows).

Actions Related to Kind of Energy-Conservation Activity

Of the three kinds of energy action covered in the Saint Paul Energy Mobilization Survey -- continuous, seasonal, and one-time actions -- one-time actions are by far the most significant (See Figures 6-1, 6-2, and 6-3). They already account for about 25 percent more savings than seasonal and continuous actions combined. And they possess, for households at stages ready to act, five times the potential of the combination of seasonal and continuous actions.

Recommendations: Saint Paul should:

7. Stress the potential energy savings from one-time energy-conservation actions such as installing a clock setback thermostat. (Details are provided below.)

Actions Related to Communicating these Energy-Saving Ideas

Although the City of Saint Paul is not in the business of selling toothpaste or breakfast cereal, it is, in a very real sense, trying to "market" energy-saving actions to its residents. So many strategies for marketing products and services can be applied directly or indirectly to the city's needs. Recommendations in two important marketing areas, communications and personal assistance, are developed below.

Communications

Marketing communication involves the messages to present and the media in which to present them.

Messages. Until further research is done, these messages should focus on how much a household can save in five years by taking specific actions. The net savings can be striking. To see them householders should receive part of Table 7-1, the third that applies to their type of home. The figures assume a 20 percent increase each year in the cost of energy. And they show different savings for households who do the work themselves (the "Materials Only" column) and those who pay to have them done (the "Labor and Materials" column). Table C-1 in Appendix C provides similar information using payback period but without considering future changes in the cost of energy.

Recommendations: Saint Paul should:

8. Arrange to adapt, print, and distribute the striking information on five-year net savings for various energy-conservation actions. Different sheets should be prepared for each of the three types of homes.

9. Especially encourage the following actions by all homeowners. Each represents a savings in five years of at least $100 (with an initial outlay of less than $100, whether the homeowner does the activity or pays to have it done):

   - One-time actions - install clock set-back thermostat
   - Seasonal actions - caulk cracks; weatherstrip doors and windows
   - Continuous actions - close off rooms; turn down furnace thermostat (although it is not as effective as the clock set-back thermostat because households tend to forget to do it consistently).

10. Encourage owners of larger homes to insulate their attics, whether they do it themselves or pay to have it done.

In addition, a number of other actions -- especially one-time actions -- are of great value for those homeowners able to do the work themselves (see Table 7-1).

TABLE 7-1

NET FIVE-YEAR DOLLAR SAVINGS OF VARIOUS ENERGY-CONSERVATION ACTIONS, BY TYPE OF HOME

General Category	Specific Action	1 Floor, 2 Bedroom Home					2 Floor, 3 Bedroom Home					3 Floor, 4 Bedroom Home				
		First-Year Savings ($)	Cost of Materials ($)	Cost of Labor ($)	Net 5-Year Savings[a] Materials Only ($)	Net 5-Year Savings[a] Labor and Materials ($)	First-Year Savings ($)	Cost of Materials ($)	Cost of Labor ($)	Net 5-Year Savings[a] Materials Only ($)	Net 5-Year Savings[a] Labor and Materials ($)	First-Year Savings ($)	Cost of Materials ($)	Cost of Labor ($)	Net 5-Year Savings[a] Materials Only ($)	Net 5-Year Savings[a] Labor and Materials ($)
Continuous	Regularly turn off unused lights	$ 7	$ 0	$ 0	$ 52	$ 52	$ 8	$ 0	$ 0	$ 56	$ 56	$11	$ 0	$ 0	$ 82	$ 82
	Close drapes and shades at night	$ 7	$ 0	$ 0	$ 52	$ 52	$ 7	$ 0	$ 0	$ 52	$ 52	$10	$ 0	$ 0	$ 74	$ 74
	Close off rooms	$19	$ 0	$ 0	$141	$141	$17	$ 0	$ 0	$126	$126	$24	$ 0	$ 0	$179	$179
	Turn down furnace thermostat	$27	$ 0	$ 0	$201	$201	$44	$ 0	$ 0	$327	$327	$86	$ 0	$ 0	$640	$640
Seasonal	Caulk cracks[b]	$27	$ 19	$ 54	$182	$128	$39	$ 19	$ 54	$271	$217	$53	$ 22	$ 72	$372	$300
	Weatherstrip doors and windows[b]	$27	$ 40	$ 40	$161	$121	$39	$ 40	$ 40	$250	$210	$53	$ 50	$ 50	$344	$294
	Replace broken windows/storm doors[b]	$ 5	$ 3	$ 5	$ 34	$ 29	$ 5	$ 3	$ 5	$ 34	$ 29	$ 5	$ 3	$ 5	$ 34	$ 29
	Clean and tuneup the furnace[c]	$11	$ 0	$ 50	$ 55	($195)	$12	$ 0	$ 50	$ 60	($190)	$27	$ 0	$ 50	$135	($115)
One-Time	Install clock set back thermostat	$26	$ 40	$ 40	$153	$113	$30	$ 40	$ 40	$183	$143	$38	$ 40	$ 40	$392	$352
	Install more efficient furnace	$72	$700	$700	($164)	($864)	$81	$700	$700	($ 97)	($797)	$150	$800	$700	$316	($384)
	Turn down water heater thermostat	$ 8	$ 0	$ 0	$ 56	$ 56	$ 8	$ 0	$ 0	$ 56	$ 56	$ 8	$ 0	$ 0	$ 56	$ 56
	Install water flow restrictors	$11	$ 10	$ 10	$ 72	$ 62	$11	$ 10	$ 10	$ 72	$ 62	$11	$ 10	$ 10	$ 72	$ 62
	Insulate hot water pipes	$ 2	$ 2	$ 0	$ 13	$ 13	$ 2	$ 2	$ 0	$ 13	$ 13	$ 2	$ 2	$ 0	$ 13	$ 13
	Insulate hot water heater	$ 3	$ 10	$ 10	$ 12	$ 2	$ 3	$ 10	$ 10	$ 12	$ 2	$ 4	$ 10	$ 10	$ 20	$ 10
	Insulate the attic (6" or more)	$22	$150	$200	$ 14	($186)	$16	$150	$300	($ 31)	($331)	$153	$150	$350	$988	$638
	Insulate in the crawl space	$18	$ 60	$ 60	$ 74	$ 14	$18	$ 60	$ 60	$ 74	$ 14	$18	$ 60	$ 60	$ 74	$ 14
	Insulate in the walls	$45	$130	$730	$205	($1525)	$89	$260	$1460	$402	($1058)	$353	$390	$2190	$2236	$ 46
	Install fireplace doors/caps	$ 8	$100	$100	($ 44)	($144)	$ 8	$100	$100	($ 44)	($144)	$ 8	$100	$100	($ 44)	($144)

[a] Assumes a 20 percent per year increase in energy costs. Then the "Materials Only" column under "Net 5-Year Savings" is the First-Year Savings compounded for four additional years at 20 percent per year minus the "Cost of Materials." The "Labor and Materials" column is similar but the "Cost of Labor" is subtracted as well as "Cost of Materials."

[b] Assumes action is done once and it lasts for five years.

[c] To achieve an energy saving from cleaning and tuning up a furnace, some experts say this activity must be done annually. So "net 5-year savings shown are 5 times the net first-year savings. These are not compounded because the costs are assumed to compound as well.

Source: Appendix C.

Media. Saint Paul should select media that will communicate its energy messages most effectively at least cost. In addition to the messages described in Recommendation 8 above, other messages -- such as lists of approved contractors, lenders, and suppliers -- are also extremely important (Recommendation 6).

Recommendations: Saint Paul should:

11. Use public-service announcements on TV and radio; inside-the-bus posters; neighborhood newspapers; direct-mail inserts in tax statements and utility bills; pamphlets distributed by hardware stores, home-improvement centers, and neighborhood groups (discussed below). Develop a series of advertisements for local newspapers that show energy results for various neighborhood income levels and sizes of home. Install a City Hall energy hot-line to handle both routine and unusual questions from residents.

Collectively, these media should be capable of reaching the entire mix of Saint Paul households -- from young to old, from lower to upper incomes.

Personal Assistance

Saint Paul Neighborhood Associations have started nonprofit "Energy Companies," to help local residents with greater energy conservation. Their direct access to households can help to simplify and personalize difficult energy decisions.

Recomendation: Saint Paul should:

12. Use neighborhood nonprofit Energy Companies to communicate energy-saving ideas to local neighborhood residents. Where necessary, these groups can be augmented by local churches, PTA's, and other public-service groups that reach local residents. In addition, private organizations like hardware stores and home-improvement centers should be used to assist Saint Paul homeowners in buying and installing materials needed for effective energy-saving actions.

Future Information and Research Needs

To measure the effectiveness of its energy programs, the City of Saint Paul needs a continuing program of information collection and research. The following activities should be useful:

- Determining whether the concept of "net five-year dollar savings," is understandable. Comparing this concept with energy-savings information described in terms of "payback period" and "return on investment" to determine which form is most understandable to consumers is especially valuable.

- Verifying and updating the information on the dollar amount of energy savings and costs (Table 7-1).

- Running simple controlled experiments by aiming different messages and programs at different Saint Paul neighborhoods, to test their effectiveness. Measuring the number of energy-consumers who decide to take one-time energy-actions is especially important.

- Verifying the actual energy actions in different types of Saint Paul homes and among households with different demographic characteristics.

With actions like these, the City of Saint Paul can continue its pioneering effort to save a city's energy.

APPENDIXES

APPENDIX A: REFERENCES

1. ACT/ONE Activate Communities Today/Organize Now for Energy, U.S. Department of Energy, Assistant Secretary for Intergovernmental and Institutional Relations, Office of Consumer Affairs, March, 1979.

2. Minnesota State Energy Conservation Plan - 1980, submitted to the Department of Energy on February, 1980 by the Minnesota Energy Agency.

3. Minnesota Energy Conservation Service Plan, Minnesota Energy Agency, June, 1980.

4. "A Model of Public Involvement in Energy Decision Making at the Local Level," testimony by Peter B. Henault, Local Energy Policies, Hearings Before the Subcommittee on Energy and Power of the Committee on Interstate and Foreign Commerce, House of Representatives, Ninety-Fifth Congress, May, June 1978, Serial No. 95-135, pp. 321-332.

5. 1979 Office of Conservation Annual Report, Seattle City Light, 1979.

6. Birdsall, W. D., "Committed to Conservation," Public Power, Volume 38, Number 4, July-August 1980, pp. 18-22.

7. Vumbaco, Joseph A., "Conservation Saves for Minnesota Municipal Utility," Public Power, Volume 36, Number 6, November-December 1978, pp. 79-80.

8. This information was gathered through personal conversations and correspondence with David C. Strafaccia, Secretary and Comptroller, Public Utilities Commission, City of Hibbing, Minnesota, August, 1980.

9. Southworth, Nancy, "Energy Bus Drives Home Conservation," Public Power, Volume 36, Number 4, July-August 1978.

10. Local Government Energy Activities: Volume 1: Summary Analysis of Twelve Cities and Counties, U.S. Department of Energy, July 1979, DOE/PE-0015/1.

11. Local Government Energy Activities: Volume 2: Detailed Analysis of Twelve Cities and Counties, U.S. Department of Energy, July 1979, DOE/PE-0015/2.

12. Kotler, Philip, Marketing Management: Analysis, Planning, and Control, Fourth Edition, Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1980.

13. Gardner, David M.; Cox, James E., Jr.; Wong, John E., A Proposed Model of Consumer Behavior for Study of Energy Consumption and Other Non-Repetitive Purchase Decisions, College of Commerce and Business Administration of the University of Illinois, Faculty Working Paper No. 650, March 6, 1980.

APPENDIX B

SAINT PAUL ENERGY MOBILIZATION SURVEY

Please answer each question or statement by putting a check or "X" mark in the box that matches your answer.

Call 292-6730 for assistance — Llame 292-6730 si Usted necisita ayuda

1. In Minnesota, do you think that shortages of fuels such as natural gas, fuel oil, gasoline and electricity are:

   ☐ a major problem ☐ a minor problem ☐ not a problem at all ☐ there is no shortage ☐ no opinion

2. What do you feel are the major reasons for fuel shortages in the United States? *(you can mark more than one)*

   ☐ there is no shortage ☐ foreign countries ☐ the government ☐ oil companies ☐ utility companies

   ☐ people use too much ☐ running out of raw materials ☐ environmentalists ☐ forces beyond the control of any group ☐ don't know

INFORMATION ABOUT THIS STRUCTURE

3. This building is a:

   ☐ single family house ☐ a building with 2 to 4 dwellings ☐ a building with 5 or more dwellings ☐ business ☐ other

4. How many floors do you heat and use regularly *(include basement)?*

   ☐ 1 floor ☐ 1½ floors or split level ☐ 2 floors ☐ 3 floors ☐ more than 3 floors

5. How many bedrooms do you have?

   ☐ none ☐ 1 ☐ 2 ☐ 3 ☐ 4 or more

6. How many bathrooms do you have?

   ☐ none ☐ 1 ☐ 2 ☐ 3 or more

7. When was your building built?

   ☐ before 1920 ☐ 1920-1945 ☐ 1946-1965 ☐ 1966-1975 ☐ after 1975

8. What kind of main heating system do you have?

   ☐ gravity or forced hot air ☐ hot water or steam *(radiators in the rooms)* ☐ space heaters in the rooms ☐ none

9. What kind of fuel does your main heating system use?

   ☐ natural gas ☐ electricity ☐ fuel oil ☐ wood ☐ coal

10. Do you burn wood in a fireplace, stove or furnace to provide heat?

    ☐ yes ☐ no

11. Do you have air conditioning?

    ☐ no ☐ central air conditioning ☐ 1 room air conditioner ☐ 2 room air conditioners ☐ 3 or more room air conditioners

INFORMATION ABOUT OCCUPANTS

12. How many years have you been at this address?

    ☐ less than 1 year ☐ 1 to 5 years ☐ 6 to 10 years ☐ 11 to 20 years ☐ over 20 years

13. For this dwelling or business are you *(or your family)* the:

    ☐ owner ☐ tenant ☐ other

14. How much building maintenance do you or members of your household do?

    ☐ none ☐ minor repairs ☐ major repairs ☐ hire out work

15. How many people under the age of 20 live in your household?

    ☐ none ☐ 1 ☐ 2 ☐ 3 ☐ 4 or more

16. How many people between the ages of 20 and 29 live in your household?

    ☐ none ☐ 1 ☐ 2 ☐ 3 ☐ 4 or more

17. How many people between the ages of 30 and 59 live in your household?

    ☐ none ☐ 1 ☐ 2 ☐ 3 ☐ 4 or more

18. How many people aged 60 and over live in your household?

    ☐ none ☐ 1 ☐ 2 ☐ 3 ☐ 4 or more

19. Do you pay your own heating bills?

    ☐ yes ☐ no *(included in rent)*

20. Do you pay your own electric bills?

    ☐ yes ☐ no *(included in rent)*

INFORMATION ABOUT TRANSPORTATION

21. How many cars, trucks and vans are used by your household?

    ☐ none ☐ 1 ☐ 2 ☐ 3 ☐ 4 or more

22. Which of the following do members of your household usually do? *(you can mark more than one)*

    ☐ carpool or vanpool to work or school ☐ bus to work or school (not school bus) ☐ walk or bike to work or school ☐ drive alone to work or school ☐ motorcycle to work or school

    ☐ drive for shopping and recreation ☐ taxi for shopping and recreation ☐ bus for shopping and recreation

23. I (we) would use the bus more but: *(you can mark more than one)*

    ☐ it is too crowded ☐ it is too slow ☐ it is too expensive ☐ it doesn't stop near my building or go where I need to go ☐ I have to make too many transfers

    ☐ my work hours can't be changed ☐ I am physically unable to use it ☐ I have to drop off children on my way to work ☐ it doesn't show up ☐ not interested for other reasons

24. I (we) would use a carpool or vanpool more if: *(you can mark more than one)*

    ☐ my employer helped with organizing the pool ☐ someone else helped with organizing the pool ☐ my employer subsidized the cost ☐ I could ride with people from my neighborhood ☐ my hours were the same each day

    ☐ I could change my work hours ☐ I would not use a carpool or vanpool ☐ I already do

INFORMATION ABOUT CONSERVATION

● This is a list of energy conservation activities. Please mark if it has been done or why it hasn't been done. *(please select the one best answer)*

Conservation Activity	Done *(yes)*	Not sure	Plan to do it soon	Landlord should do it	Won't save energy/ not interested	Don't have the time	Don't know how	Don't have enough money	I am physically unable to do this	Doesn't apply
regularly turn off unused lights	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
close drapes and shades at night	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
close off rooms	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
caulk cracks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
weatherstrip doors and windows	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
replace broken windows or storm doors	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
turn down furnace thermostat	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
install a clock setback thermostat	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
clean and "tune up" the furnace	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
install a more efficient furnace	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
turn down water heater thermostat	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
install water flow restrictors	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
insulate hot water pipes	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
insulate hot water heater	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
insulate in the attic *(6" or more)*	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
insulate in the crawl space	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
insulate in the walls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
install fireplace glass doors and/or chimney caps	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

● Which of the following would you be interested in doing or using? *(you can mark more than one)*

having a professional energy audit done ☐ | attend conservation workshops ☐ | solar systems for this building ☐ | wind systems for this building ☐ | wood as a fuel ☐

recycle wastes or cans ☐ | district heating ☐ | none of these ☐

● Are you interested in joining with your neighborhood or business organization to work together to lower your energy costs?

yes ☐ | no ☐

● If you pay your own heat, estimate your fuel bill to heat your house, apartment or business for either the last year *or* for the coldest month.

for last year

less than $100 ☐ | $100 to $500 ☐ | $501 to $1,000 ☐ | $1,001 to $1,500 ☐ | over $1,500 ☐

OR for the coldest month

less than $50 ☐ | $51 to $150 ☐ | $151 to $300 ☐ | over $300 ☐ | not sure ☐

● If you are billed monthly by NSP, are you on the Budget Plan?

yes ☐ | no ☐

● What was your total gross household income in 1979? *(before taxes)*

under $5,000 ☐ | $5,000 to $6,999 ☐ | $7,000 to $9,999 ☐ | $10,000 to $15,999 ☐ | $16,000 to $19,999 ☐

$20,000 to $24,999 ☐ | $25,000 to $34,999 ☐ | $35,000 to $44,999 ☐ | $45,000 and over ☐

● This building is located in the following Saint Paul Neighborhood or Planning District.

Sun Ray Battle Creek Highwood ☐ | Greater East Side ☐ | West Side ☐ | Dayton's Bluff ☐ | Payne-Phalen ☐

North End ☐ | Thomas-Dale-Frogtown-Capitol Heights ☐ | Summit-University ☐ | West Seventh Street ☐ | Como Area ☐

Hamline-Midway ☐ | St Anthony Park ☐ | Merriam Park Lexington-Hamline Snelling-Hamline ☐ | Macalester-Groveland Randolph Heights ☐ | Highland Park ☐

Summit Hill (Crocus Hill) ☐ | Downtown ☐

Thank you for taking the time to complete this survey.

INFORMATION ABOUT BUSINESSES

● For business respondents, how many square feet does your business occupy?

Under 2,000 ☐ | 2,000 to 4,999 ☐ | 5,000 to 9,999 ☐ | 10,000 to 24,999 ☐ | 25,000 and over ☐

● For business respondents, the primary function of this business is:

construction ☐ | manufacturing ☐ | financing real estate ☐ | food and beverage ☐ | retail ☐

wholesale ☐ | transportation ☐ | services ☐

APPENDIX C

TABLE C-1: ESTIMATED SAVINGS AND COSTS OF VARIOUS ENERGY-CONSERVATION ACTIONS, BY TYPE OF HOME

Energy-Conservation Action	1 Floor, 2 Bedroom Home					2 Floor, 3 Bedroom Home					3 Floor, 4 Bedroom Home				
	Annual Savings $	Cost of Materials $	Cost of Labor $	Payback Period (yrs)[a] Materials Only	Payback Period (yrs)[a] Labor and Materials	Annual Savings $	Cost of Materials $	Cost of Labor $	Payback Period (yrs)[a] Materials Only	Payback Period (yrs)[a] Labor and Materials	Annual Savings $	Cost of Materials $	Cost of Labor $	Payback Period (yrs)[a] Materials Only	Payback Period (yrs)[a] Labor and Materials
Regularly turn off unused lights	$7	-	-	I	I	$8	-	-	I	I	$11	-	-	I	I
Close drapes and shades at night	$7	-	-	I	I	$7	-	-	I	I	$10	-	-	I	I
Close off rooms	$19	-	-	I	I	$17	-	-	I	I	$24	-	-	I	I
Caulk cracks	$27	$19	$54	.7	2.7	$39	$19	$54	.5	1.9	$53	$22	$72	.4	1.8
Weatherstrip doors and windows	$27	$40	$40	1.5	3.0	$39	$40	$40	1.0	2.1	$53	$50	$50	.9	1.9
Replace broken windows or storm doors	$5	$3	$5	.6	1.6	$5	$3	$5	.6	1.6	$5	$3	$5	.6	1.6
Turn down furnace thermostat	$39	-	-	I	I	$44	-	-	I	I	$86	-	-	I	I
Install a clock setback thermostat	$26	$40	$40	1.5	3.1	$30	$40	$40	1.3	2.7	$58	$40	$40	.7	1.4
Clean and "tune up" the furnace	$11	-	$50	-	4.5	$12	-	$50	-	4.2	$27	-	$50	-	1.9
Install a more efficient furnace	$72	$700	$700	9.7	19.4	$81	$700	$700	8.6	17.3	$150	$800	$700	5.3	10.0
Turn down water heater thermostat	$8	-	-	I	I	$8	-	-	I	I	$8	-	-	I	I
Install water flow restrictors	$11	$10	$10	.9	1.8	$11	$10	$10	.9	1.8	$11	$10	$10	.9	1.8
Insulate hot water pipes	$2	$2	-	1.0	1.0	$2	$2	-	1.0	1.0	$2	$2	-	1.0	1.0
Insulate hot water heater	$3	$10	$10	3.3	6.7	$3	$10	$10	3.3	6.7	$4	$10	$10	2.5	5.0
Insulate in the attic (6" or more)	$22	$150	$200	6.8	15.9	$16	$150	$300	9.4	28.1	$153	$150	$350	1.0	3.3
Insulate in the crawl space	$18	$60	$60	3.3	6.7	$18	$60	$60	3.3	6.7	$18	$60	$60	3.3	6.7
Insulate in the walls	$45	$130	$730	2.9	19.1	$89	$260	$1460	2.9	19.3	$353	$390	$2190	1.1	7.3
Install fireplace glass doors and/or chimney caps	$8	$100	$100	12.5	25.0	$8	$100	$100	12.5	25.0	$8	$100	$100	12.5	25.0

[a] I = Immediate payback from this action because no out-of-pocket costs are incurred.

Sources: Northern States Power, Minnesota Energy Agency, Saint Paul Energy Agency

APPENDIX D

TABLE D-1
CALCULATIONS OF AVERAGE YEARLY SAVINGS PER HOUSEHOLD
FOR OWNERS UNDER 60

Energy Conservation Action	1 Floor, 2 Bedroom Home			2 Floor, 3 Bedroom Home			3 Floor, 4 Bedroom Home			Weighted Total Savings
	Original Savings	Weight	Weighted Savings	Original Savings	Weight	Weighted Savings	Original Savings	Weight	Weighted Savings	
Regularly turn off unused lights	$ 7	15%	1.05	$ 8	33%	2.64	$11	52%	5.72	9.41
Close drapes and shades at night	$ 7	15%	1.05	$ 7	33%	2.31	$10	52%	5.20	8.56
Close off rooms	$19	15%	2.85	$17	33%	5.61	$24	52%	12.48	20.94
Caulk cracks	$27	15%	4.05	$39	33%	12.87	$53	52%	27.56	44.48
Weatherstrip doors and windows	$27	15%	4.05	$39	33%	12.87	$53	52%	27.56	44.48
Replace broken windows or storm doors	$ 5	15%	.75	$ 5	33%	1.65	$ 5	52%	2.60	5.00
Turn down furnace thermostat	$39	15%	5.85	$44	33%	14.52	$86	52%	44.72	65.09
Install a clock setback thermostat	$26	15%	3.90	$30	33%	9.90	$58	52%	30.16	43.96
Clean and "tune up" the furnace	$11	15%	1.65	$12	33%	3.96	$27	52%	14.04	19.65
Install a more efficient furnace	$72	15%	10.80	$81	33%	26.73	$150	52%	78.00	115.53
Turn down water heater thermostat	$ 8	15%	1.20	$ 8	33%	2.64	$ 8	52%	4.16	8.00
Install water flow restrictors	$11	15%	1.65	$11	33%	3.63	$11	52%	5.72	11.00
Insulate hot water pipes	$ 2	15%	.30	$ 2	33%	.66	$ 2	52%	1.04	2.00
Insulate hot water heater	$ 3	15%	.45	$ 3	33%	.99	$ 4	52%	2.08	3.52
Insulate in the attic (6" or more)	$22	15%	3.30	$16	33%	5.28	$153	52%	79.56	88.14
Insulate in the crawl space	$18	15%	2.70	$18	33%	5.94	$18	52%	9.36	18.00
Insulate in the walls	$45	15%	6.75	$89	33%	29.37	$353	52%	183.56	219.68
Install fireplace glass doors and/or chimney caps	$ 8	15%	1.20	$ 8	33%	2.64	$ 8	52%	4.16	8.00

APPENDIX D

TABLE D-2
CALCULATION OF AVERAGE YEARLY SAVINGS/HOUSEHOLD
FOR OWNERS 60 AND OVER

Energy Conservation Action	1 Floor, 2 Bedroom Home			2 Floor, 3 Bedroom Home			3 Floor, 4 Bedroom Home			Weighted Total Savings
	Original Savings	Weight	Weighted Savings	Original Savings	Weight	Weighted Savings	Original Savings	Weight	Weighted Savings	
Regularly turn off unused lights	$ 7	44%	3.08	$ 7	26%	2.08	$11	30%	3.30	8.46
Close drapes and shades at night	$ 7	44%	3.08	$ 7	26%	1.82	$10	30%	3.00	7.90
Close off rooms	$19	44%	8.36	$17	26%	4.42	$24	30%	7.20	19.98
Caulk cracks	$27	44%	11.88	$39	26%	10.14	$53	30%	15.90	37.92
Weatherstrip doors and windows	$27	44%	11.88	$39	26%	10.14	$53	30%	15.90	37.92
Replace broken windows or storm doors	$ 5	44%	2.20	$ 5	26%	1.30	$ 5	30%	1.50	5.00
Turn down furnace thermostat	$39	44%	17.16	$44	26%	11.44	$86	30%	25.80	54.40
Install a clock setback thermostat	$26	44%	11.44	$30	26%	7.80	$58	30%	17.40	36.64
Clean and "tune up" the furnace	$11	44%	4.84	$12	26%	3.12	$27	30%	8.10	16.06
Install a more efficient furnace	$72	44%	31.68	$81	26%	21.06	$150	30%	45.00	97.74
Turn down water heater thermostat	$ 8	44%	3.52	$ 8	26%	2.08	$ 8	30%	2.40	8.00
Install water flow restrictors	$11	44%	4.84	$11	26%	2.86	$11	30%	3.30	11.00
Insulate hot water pipes	$ 2	44%	.88	$ 2	26%	.52	$ 2	30%	.60	2.00
Insulate hot water heater	$ 3	44%	1.32	$ 3	26%	.78	$ 4	30%	1.20	3.30
Insulate in the attic (6" or more)	$22	44%	9.68	$16	26%	4.16	$153	30%	45.90	59.74
Insulate in the crawl space	$18	44%	7.92	$18	26%	4.68	$18	30%	5.40	18.00
Insulate in the walls	$45	44%	19.80	$89	26%	23.14	$353	30%	105.90	148.84
Install fireplace glass doors and/or chimney caps	$ 8	44%	3.52	$ 8	26%	2.08	$ 8	30%	2.40	8.00

APPENDIX D

TABLE D-3
CALCULATIONS OF AVERAGE YEARLY SAVINGS/HOUSEHOLD
FOR OWNERS WITH INCOMES UNDER $10,000

Energy Conservation Action	1 Floor, 2 Bedroom Home			2 Floor, 3 Bedroom Home			3 Floor, 4 Bedroom Home			Weighted Total Savings
	Original Savings	Weight	Weighted Savings	Original Savings	Weight	Weighted Savings	Original Savings	Weight	Weighted Savings	
Regularly turn off unused lights	$ 7	42%	2.94	$ 8	21%	1.68	$11	37%	4.07	8.69
Close drapes and shades at night	$ 7	42%	2.94	$ 7	21%	1.47	$10	37%	3.70	8.11
Close off rooms	$19	42%	7.98	$17	21%	3.57	$24	37%	8.88	20.43
Caulk cracks	$27	42%	11.34	$39	21%	8.19	$53	37%	19.61	39.14
Weatherstrip doors and windows	$27	42%	11.34	$39	21%	8.19	$53	37%	19.61	39.14
Replace broken windows or storm doors	$ 5	42%	2.10	$ 5	21%	1.05	$ 5	37%	1.85	5.00
Turn down furnace thermostat	$39	42%	16.38	$44	21%	9.24	$86	37%	31.82	57.44
Install a clock setback thermostat	$26	42%	10.92	$30	21%	6.30	$58	37%	21.46	38.68
Clean and "tune up" the furnace	$11	42%	4.62	$12	21%	2.52	$27	37%	9.99	17.13
Install a more efficient furnace	$72	42%	30.24	$81	21%	17.01	$150	37%	55.50	102.75
Turn down water heater thermostat	$ 8	42%	3.36	$ 8	21%	1.68	$ 8	37%	2.96	8.00
Install water flow restrictors	$11	42%	4.62	$11	21%	2.31	$11	37%	4.07	11.00
Insulate hot water pipes	$ 2	42%	.84	$ 2	21%	.42	$ 2	37%	.74	2.00
Insulate hot water heater	$ 3	42%	1.26	$ 3	21%	.63	$ 4	37%	1.48	3.37
Insulate in the attic (6" or more)	$22	42%	9.24	$16	21%	3.36	$153	37%	56.61	69.21
Insulate in the crawl space	$18	42%	7.56	$18	21%	3.78	$18	37%	6.66	18.00
Insulate in the walls	$45	42%	18.90	$89	21%	18.69	$353	37%	130.61	168.20
Install fireplace glass doors and/or chimney caps	$ 8	42%	3.36	$ 8	21%	1.68	$ 8	37%	2.96	8.00

APPENDIX D

TABLE D-4
CALCULATION OF AVERAGE YEARLY SAVINGS/HOUSEHOLD
FOR OWNERS WITH INCOMES BETWEEN $10,000 AND $20,000

Energy Conservation Action	1 Floor, 2 Bedroom Home			2 Floor, 3 Bedroom Home			3 Floor, 4 Bedroom Home			Weighted Total Savings
	Original Savings	Weight	Weighted Savings	Original Savings	Weight	Weighted Savings	Original Savings	Weight	Weighted Savings	
Regularly turn off unused lights	$ 7	27%	1.89	$ 8	36%	2.88	$11	37%	4.07	8.84
Close drapes and shades at night	$ 7	27%	1.89	$ 7	36%	2.52	$10	37%	3.70	8.11
Close off rooms	$19	27%	5.13	$17	36%	6.12	$24	37%	8.88	20.13
Caulk cracks	$27	27%	7.29	$39	36%	14.04	$53	37%	19.61	40.94
Weatherstrip doors and windows	$27	27%	7.29	$39	36%	14.04	$53	37%	19.61	40.94
Replace broken windows or storm doors	$ 5	27%	1.35	$ 5	36%	1.80	$ 5	37%	1.85	5.00
Turn down furnace thermostat	$39	27%	10.53	$44	36%	15.84	$86	37%	31.82	58.19
Install a clock setback thermostat	$26	27%	7.02	$30	36%	10.80	$58	37%	21.46	39.28
Clean and "tune up" the furnace	$11	27%	2.97	$12	36%	4.32	$27	37%	9.99	17.29
Install a more efficient furnace	$72	27%	19.44	$81	36%	29.16	$150	37%	35.50	104.10
Turn down water heater thermostat	$ 8	27%	2.16	$ 8	36%	2.88	$ 8	37%	2.96	8.00
Install water flow restrictors	$11	27%	2.97	$11	36%	3.96	$11	37%	4.07	11.00
Insulate hot water pipes	$ 2	27%	.54	$ 2	36%	.72	$ 2	37%	.74	2.00
Insulate hot water heater	$ 3	27%	.81	$ 3	36%	1.08	$ 4	37%	1.48	3.37
Insulate in the attic (6" or more)	$22	27%	5.94	$16	36%	5.76	$153	37%	56.61	68.31
Insulate in the crawl space	$18	27%	4.86	$18	36%	6.48	$18	37%	6.66	18.00
Insulate in the walls	$45	27%	12.15	$89	36%	32.04	$353	37%	130.61	174.80
Install fireplace glass doors and/or chimney caps	$ 8	27%	2.16	$ 8	36%	2.88	$ 8	37%	2.96	8.00

APPENDIX D

TABLE D-5
CALCULATION OF AVERAGE YEARLY SAVINGS/HOUSEHOLD
FOR OWNERS WITH INCOMES GREATER THAN $20,000

Energy Conservation Action	1 Floor, 2 Bedroom Home			2 Floor, 3 Bedroom Home			3 Floor, 4 Bedroom Home			Weighted Total Savings
	Original Savings	Weight	Weighted Savings	Original Savings	Weight	Weighted Savings	Original Savings	Weight	Weighted Savings	
Regularly turn off unused lights	$ 7	12%	.84	$ 8	35%	2.80	$11	53%	5.83	9.47
Close drapes and shades at night	$ 7	12%	.84	$ 7	35%	2.45	$10	53%	5.30	8.59
Close off rooms	$19	12%	2.28	$17	35%	5.95	$24	53%	12.72	20.95
Caulk cracks	$27	12%	3.24	$39	35%	13.65	$53	53%	28.09	44.98
Weatherstrip doors and windows	$27	12%	3.24	$39	35%	13.65	$53	53%	28.09	44.98
Replace broken windows or storm doors	$ 5	12%	.60	$ 5	35%	1.75	$ 5	53%	2.65	5.00
Turn down furnace thermostat	$39	12%	4.68	$44	35%	15.40	$86	53%	45.58	65.66
Install a clock setback thermostat	$26	12%	3.12	$30	35%	10.50	$58	53%	30.74	44.36
Clean and "tune up" the furnace	$11	12%	1.32	$12	35%	4.20	$27	53%	14.31	19.83
Install a more efficient furnace	$72	12%	8.64	$81	35%	28.35	$150	53%	79.50	116.49
Turn down water heater thermostat	$ 8	12%	.96	$ 8	35%	2.80	$ 8	53%	4.24	8.00
Install water flow restrictors	$11	12%	1.32	$11	35%	3.85	$11	53%	5.83	11.00
Insulate hot water pipes	$ 2	12%	.24	$ 2	35%	.70	$ 2	53%	1.06	2.00
Insulate hot water heater	$ 3	12%	.36	$ 3	35%	1.05	$ 4	53%	2.12	3.53
Insulate in the attic (6" or more)	$22	12%	2.64	$16	35%	5.60	$153	53%	81.09	89.33
Insulate in the crawl space	$18	12%	2.16	$18	35%	6.30	$18	53%	9.54	18.00
Insulate in the walls	$45	12%	5.40	$89	35%	31.15	$353	53%	187.09	223.64
Install fireplace glass doors and/or chimney caps	$ 8	12%	.96	$ 8	35%	2.80	$ 8	53%	4.24	8.00

APPENDIX E

TABLE E-1

POTENTIAL AND ACTUAL SAVINGS FROM ENERGY CONSERVATION ACTIONS
FOR HOUSEHOLDS WITH OWNERS UNDER 60 YEARS OF AGE

Energy Conservation Actions	Average Yearly Savings/ Hshlds	Problem Awareness			Choice			Implementation			Total Potential Savings	Already Saved		
		Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)		Percent Response	No. of Hshlds (1,000)	Actual Savings ($1000)
Continuous Actions														
Regularly turn off unused lights	9.41	1.2%	.4	4	.8%	.3	3	0%	0	0	7	97.8	34.2	322
Close drapes and shades at night	8.56	3.4	1.2	10	1.7	.6	5	0	0	0	15	91.3	31.9	273
Close off rooms	20.94	10.4	3.6	76	2.1	.7	15	.1	.1	1	92	57.8	20.2	423
Turn down furnace thermostat	65.09	4.2	1.5	96	.9	.3	20	.3	.1	7	123	93.6	32.7	2129
				186			43			8	237			3147
Seasonal Actions														
Caulk cracks	44.8	5.0	1.7	78	20.9	.7	325	1.8	.6	28	431	69.4	24.2	1079
Weatherstrip doors and windows	44.8	4.7	1.6	73	19.2	6.7	298	2.3	.8	36	407	72.3	25.3	1124
Replace broken windows or storm doors	5.0	1.4	.5	2	11.2	3.9	20	2.0	.7	4	26	77.4	27.0	135
Clean and tuneup the furnace	19.65	4.9	1.7	34	17.8	6.2	122	4.3	1.5	30	186	69.7	24.4	479
				187			765			98	1050			2817
One-Time Actions														
Install clock set back thermostat	43.96	40.8	14.3	627	17.7	6.2	272	14.8	5.2	227	1126	9.6	3.4	147
Install more efficient furnace	115.53	16.5	5.8	666	7.2	2.5	291	22.9	8.0	924	1881	29.2	10.2	1179
Turn down water heater thermostat	8.00	18.1	6.3	51	4.8	1.7	13	.5	.2	1	65	71.4	24.9	200
Install water flow restrictors	11.00	41.6	14.5	160	18.8	6.6	72	5.9	2.1	23	255	15.6	5.5	60
Insulate hot water pipes	2.00	39.4	18.8	28	25.2	8.8	18	6.6	2.3	5	51	19.3	6.7	13
Insulate hot water heater	3.52	36.0	12.6	44	23.9	8.4	29	6.7	2.3	8	81	23.9	8.4	29
Insulate the attic	88.14	8.0	2.8	246	14.7	5.1	453	7.6	2.7	234	933	64.9	22.7	1999
Insulate in the crawl space	18.00	8.6	3.0	54	9.8	3.4	62	6.3	2.2	40	156	39.7	13.9	250
Insulate in the walls	219.68	18.8	6.6	1,443	8.8	3.1	676	20.5	7.2	1574	3693	46.1	16.1	3539
Install fireplace doors/caps	8.00	6.6	2.3	18	7.2	3.2	26	5.6	2.0	16	60	19.4	6.8	54
				3,337			1,912			3,052	8301			7,470
Total Potential Savings				3,710			2,720			3,158	9588			13,434

APPENDIX E

TABLE E-2

POTENTIAL AND ACTUAL SAVINGS FROM ENERGY CONSERVATION ACTIONS
FOR HOUSEHOLDS WITH OWNERS 60 YEARS OF AGE AND OLDER

Energy Conservation Actions	Average Yearly Savings/ Hshlds	Problem Awareness			Choice			Implementation			Total Potential Savings	Already Saved		
		Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)		Percent Response	No. of Hshlds (1,000)	Actual Savings ($1000)
Continuous Actions														
Regularly turn off unused lights	8.46	.9%	.2	2	.6%	.2	1	0%	0	0	3	98.4%	25.9%	219
Close drapes and shades at night	7.90	2.1	.6	4	.5	.1	1	0	0	0	5	96.4	25.4	201
Close off rooms	19.98	7.0	1.8	37	.3	.7	7	0	0	0	44	67.0	17.7	353
Turn down furnace thermostat	54.40	4.9	1.3	70	.5	.1	7	1.1	.3	16	93	91.1	24.0	1306
				113			16			16	145			2079
Seasonal Actions														
Caulk cracks	37.92	1.8	.5	18	10.1	2.7	101	2.7	.7	27	146	79.5	21.0	795
Weatherstrip doors and windows	37.92	2.0	.5	20	10.6	2.8	106	3.9	1.0	39	165	80.0	21.1	800
Replace broken windows or storm doors	5.00	.2	.1	1	2.6	.7	3	2.1	.6	3	7	88.2	23.2	116
Clean and tuneup the furnace	16.06	1.3	.3	6	6.0	1.5	25	2.4	.6	10	41	87.8	23.1	372
				45			235			79	359			2083
One-Time Actions														
Install clock set back thermostat	36.64	36.6	9.6	353	10.9	2.9	105	15.0	4.0	145	603	9.4	2.5	91
Install more efficient furnace	97.74	15.9	4.2	410	5.5	1.5	142	15.7	4.1	404	956	32.9	8.7	848
Turn down water heater thermostat	8.00	10.6	2.8	22	4.2	1.1	9	.9	.2	2	33	77.0	20.3	162
Install water flow restrictors	11.00	32.1	8.5	93	12.0	3.2	35	10.2	2.7	30	158	12.0	3.2	35
Insulate hot water pipes	2.00	25.5	6.7	13	15.6	4.1	8	10.1	2.7	5	26	27.8	7.3	15
Insulate hot water heater	3.30	23.3	6.1	20	15.6	4.1	14	8.6	2.3	7	41	35.0	9.2	30
Insulate the attic	59.74	7.2	1.9	113	6.6	1.7	104	8.0	2.1	126	343	71.2	18.8	1121
Insulate in the crawl space	18.00	7.5	2.0	36	4.2	1.1	20	6.3	1.7	30	86	50.8	13.4	241
Insulate in the walls	148.84	11.4	3.0	447	5.5	1.5	216	12.0	3.2	471	1134	61.2	16.1	2401
Install fireplace doors/caps	8.00	8.0	2.1	17	4.9	1.3	10	7.1	1.9	15	42	20.9	5.5	44
				1,524			663			1,235	3,422			4,988
Total Potential Savings				1,682			914			1,330	3,926			9,150

APPENDIX E

TABLE E-3

POTENTIAL AND ACTUAL SAVINGS FROM ENERGY CONSERVATION ACTIONS
FOR HOUSEHOLDS WITH INCOMES LESS THAN $10,000

Energy Conservation Actions	Average Yearly Savings/ Hshlds	Problem Awareness			Choice			Implementation			Total Potential Savings	Already Saved		
		Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)		Percent Response	No. of Hshlds (1,000)	Actual Savings ($1000)
Continuous Actions														
Regularly turn off unused lights	8.69	.5%	.1	1	.3%	0	0	0%	0	0	1	98.9	15.2	132
Close drapes and shades at night	8.11	2.4	.4	3	.8	.1	1	0	0	0	4	94.6	14.5	118
Close off rooms	20.43	6.5	1.0	20	1.4	.2	4	0	0	0	24	70.4	10.8	220
Turn down furnace thermostat	57.44	3.5	.5	31	.7	.1	6	.7	.1	6	43	93.3	14.3	821
				55			11			6	72			1291
Seasonal Actions														
Caulk cracks	39.14	2.8	.4	17	11.7	1.9	70	3.6	.6	22	109	76.9	11.8	461
Weatherstrip doors and windows	39.14	1.7	.3	10	11.7	1.8	70	5.1	.8	31	111	78.4	12.0	470
Replace broken windows or storm doors	5.00	.2	.1	1	5.3	.8	4	3.3	.5	3	8	85.6	13.1	66
Clean and tuneup the furnace	17.13	1.5	.2	4	5.9	.9	15	5.2	.8	14	33	84.5	13.0	222
				32			159			70	261			1219
One-Time Actions														
Install clock set back thermostat	38.68	35.2	5.4	208	10.7	1.6	63	19.7	3.0	117	388	10.4	1.6	62
Install more efficient furnaces	102.75	16.0	2.5	252	5.7	.9	90	18.6	2.9	293	635	34.1	5.2	537
Turn down water heater thermostat	8.00	10.7	1.6	13	3.4	.5	4	1.1	.2	1	18	77.4	11.9	95
Install water flow restrictors	11.00	31.2	4.8	53	12.3	1.9	21	13.1	2.0	22	96	12.5	1.9	21
Insulate hot water pipes	2.00	25.7	3.9	8	15.9	2.4	5	13.2	2.0	4	17	28.4	4.4	9
Insulate hot water heater	3.37	23.5	3.6	12	16.5	2.5	9	11.7	1.8	6	27	35.4	5.4	18
Insulate the attic	69.21	6.9	1.1	73	6.6	1.0	70	10.9	1.7	116	259	69.7	10.7	739
Insulate in the crawl space	18.00	7.5	1.1	21	5.7	.9	16	10.1	1.5	28	65	47.6	7.3	131
Insulate in the walls	168.20	13.3	2.0	343	4.6	.7	119	15.6	2.4	402	864	58.8	9.0	1516
Install fireplace doors/caps	8.00	7.3	1.1	9	4.7	.7	6	7.3	1.1	9	24	19.1	2.9	23
				992			403			998	2,393			3,151
Total Potential Savings				1,079			573			1,074	2,726			5,661

APPENDIX E

TABLE E-4

POTENTIAL AND ACTUAL SAVINGS FROM ENERGY CONSERVATION ACTIONS
FOR HOUSEHOLDS WITH INCOMES BETWEEN $10,000 AND $20,000

Energy Conservation Actions	Average Yearly Savings/ Hshlds	Problem Awareness			Choice			Implementation			Total Potential Savings	Already Saved		
		Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)		Percent Response	No. of Hshlds (1,000)	Actual Savings ($1000)
Continuous Actions														
Regularly turn off unused lights	8.84	1.0%	.2	2	.5%	.1	1	0%	0	0	3	98.6%	19.3	171
Close drapes and shades at night	8.11	1.7	.3	3	1.0	.2	2	0	0	0	5	94.9	18.6	151
Close off rooms	20.13	8.2	1.6	32	1.9	.4	8	0	0	0	40	59.2	11.6	234
Turn down furnace thermostat	58.19	4.1	.8	47	1.0	.2	11	.7	.1	8	66	92.3	18.1	1054
				84			22			8	114			1610
Seasonal Actions														
Caulk cracks	40.94	3.5	.7	28	18.8	3.7	151	2.5	.5	20	199	70.8	13.9	569
Weatherstrip doors and windows	40.94	4.4	.9	35	16.3	3.2	131	3.2	.6	26	192	73.8	14.5	593
Replace broken windows or storm doors	5.00	.7	.1	1	8.7	1.7	9	2.5	.5	2	12	78.7	15.6	78
Clean and tuneup the furnace	17.28	4.5	.9	15	16.0	3.1	54	4.0	.8	14	83	72.9	14.3	247
				79			345			62	486			1487
One-Time Actions														
Install clock set back thermostat	39.28	33.0	6.5	254	16.5	3.2	127	18.3	3.6	141	522	10.2	2.0	79
Install more efficient furnace	104.10	10.9	2.1	223	5.9	1.2	120	26.0	5.1	531	874	28.8	5.6	588
Turn down water heater thermostat	8.00	11.8	2.3	19	4.9	1.0	8	.8	.2	1	28	77.6	15.2	122
Install water flow restrictors	11.00	33.2	6.5	72	20.5	4.0	44	9.2	1.8	20	136	13.1	2.6	28
Insulate hot water pipes	2.00	31.3	6.1	12	24.6	4.8	10	8.4	1.6	3	25	20.7	4.1	8
Insulate hot water heater	3.37	29.0	5.7	19	23.4	4.6	15	7.9	1.6	5	39	27.3	5.4	18
Insulate the attic	68.31	7.2	1.4	96	14.1	2.8	189	8.7	1.7	117	402	64.5	12.7	864
Insulate in the crawl space	18.00	6.6	1.3	23	10.4	2.0	37	6.3	1.2	22	82	45.5	8.9	161
Insulate in the walls	174.80	15.5	3.0	531	9.3	1.8	319	22.7	4.5	778	1628	46.1	9.0	1581
Install fireplace doors/caps	8.00	6.5	1.3	10	7.3	1.4	11	5.7	1.1	9	30	16.0	3.1	25
				1,259			880			1,627	3,766			3,474
Total Potential Savings				1,422			1,247			1,697	4,366			6,571

APPENDIX E

TABLE E-5

POTENTIAL AND ACTUAL SAVINGS FROM ENERGY CONSERVATION ACTIONS
FOR HOUSEHOLDS WITH INCOMES GREATER THAN $20,000

Energy Conservation Actions	Average Yearly Savings/ Hshlds	Problem Awareness			Choice			Implementation			Total Potential Savings	Already Saved		
		Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)		Percent Response	No. of Hshlds (1,000)	Actual Savings ($1000)
Continuous Actions														
Regularly turn off unused lights	9.47	1.9%	.5	5	1.4%	.4	3	0%	0	0	8	96.8	25.5	242
Close drapes and shades at night	8.59	4.3	1.1	10	1.7	.4	4	0	0	0	14	90.9	24.0	206
Close off rooms	20.95	12.1	3.2	67	2.2	.6	12	.2	.1	1	80	54.2	14.3	299
Turn down furnace thermostat	65.66	5.6	1.5	97	.7	.2	12	.5	.1	9	118	92.0	24.3	1592
				179			31			10	220			2339
Seasonal Actions														
Caulk cracks	44.98	4.9	1.3	58	20.1	5.3	238	.5	.1	6	302	71.6	18.9	849
Weatherstrip doors and windows	44.98	5.0	1.3	59	19.7	5.2	234	.5	.1	6	299	73.3	19.3	869
Replace broken windows or storm doors	5.00	1.7	.4	2	9.8	2.6	13	.5	.1	1	16	78.9	20.8	104
Clean and tuneup the furnace	19.83	4.8	1.3	25	18.5	4.9	97	1.7	.4	9	131	71.8	18.9	375
				144			582			22	748			2197
One-Time Actions														
Install clock set back thermostat	44.36	46.4	12.2	543	18.4	4.9	215	9.4	2.5	110	868	8.6	2.3	101
Install more efficient furnace	116.49	20.0	5.3	614	7.9	2.1	243	18.4	4.9	565	1422	28.7	7.6	881
Turn down water heater thermostat	8.00	21.9	5.8	46	5.5	1.5	12	.2	.1	1	59	67.1	17.7	142
Install water flow restrictors	11.00	47.2	12.4	137	17.2	4.5	50	2.1	.6	6	193	16.7	4.4	48
Insulate hot water pipes	2.00	43.9	11.6	23	24.9	6.6	13	3.2	.8	2	38	18.3	4.8	10
Insulate hot water heater	3.53	39.6	10.4	37	23.1	6.1	21	3.7	1.0	3	61	22.0	5.8	20
Insulate the attic	89.33	8.7	2.3	205	14.8	3.9	348	4.0	1.1	94	647	66.9	17.6	1575
Insulate in the crawl space	18.00	10.0	2.6	47	8.0	2.1	38	3.1	.8	15	100	38.9	10.3	185
Insulate in the walls	223.64	19.0	5.0	1120	1.1	2.4	537	15.7	4.1	925	2582	48.6	12.8	2865
Install fireplace doors/caps	8.00	7.3	1.9	15	10.3	2.7	22	5.5	1.5	12	49	23.1	6.1	49
				2,787			1,499			1,733	6,019			5,876
Total Potential Savings				3,110			2,112			1,765	6,987			10,412

APPENDIX E

TABLE E-6

POTENTIAL AND ACTUAL SAVINGS FROM ENERGY CONSERVATION ACTIONS
FOR HOUSEHOLDS WITH 1 FLOOR, 2 BEDROOM HOMES BUILT 1946-65

Energy Conservation Actions	Average Yearly Savings/ Hshlds	Problem Awareness			Choice			Implementation			Total Potential Savings	Already Saved		
		Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)		Percent Response	No. of Hshlds (1,000)	Actual Savings ($1000)
Continuous Actions														
Regularly turn off unused lights	7.00	0%	0	0	0%	0	0	0%	0	0	0	100%	15.9	112
Close drapes and shades at night	7.00	0	0	0	0	0	0	0	0	0	0	97.3	15.5	109
Close off rooms	19.00	18.3	2.9	55	0	0	0	0	0	0	55	58.3	9.3	177
Turn down furnace thermostat	39.00	2.8	.4	17	0	0	0	1.4	.2	9	26	95.8	15.3	595
				72			0			9	81			993
Seasonal Actions														
Caulk cracks	27.00	4.5	.7	19	11.9	1.9	51	0	0	0	70	77.6	12.4	334
Weatherstrip doors and windows	27.00	2.9	.5	12	8.8	1.4	38	0	0	0	50	85.3	13.6	367
Replace broken windows or storm doors	5.00	0	0	0	0	0	0	0	0	0	0	90.9	14.5	72
Clean and tuneup the furnace	11.0	1.5	.2	3	7.5	1.2	13	1.5	.2	3	19	86.6	13.8	152
				34			102			3	139			925
One-Time Actions														
Install clock set back thermostat	26.00	31.0	4.9	128	16.7	2.7	69	14.3	2.3	59	256	9.5	1.5	39
Install more efficient furnace	72.00	13.6	2.2	156	4.5	.7	52	25.0	4.0	287	495	27.3	4.4	313
Turn down water heater thermostat	8.00	12.7	2.0	16	1.6	.3	2	0	0	0	18	77.8	12.4	99
Install water flow restrictors	11.00	30.0	4.8	53	12.5	2.0	22	10.0	1.6	18	93	5.0	.8	9
Insulate hot water pipes	2.00	28.2	4.5	9	15.4	2.5	5	2.6	.4	1	15	28.2	4.5	9
Insulate hot water heater	3.00	30.0	4.8	14	17.5	2.8	8	10.0	1.6	5	27	20.0	3.2	10
Insulate the attic	22.00	6.3	1.0	22	10.9	1.7	38	3.1	.5	11	71	76.6	12.2	269
Insulate in the crawl space	18.00	5.7	.9	16	3.8	.6	11	3.8	.6	11	38	58.5	9.3	168
Insulate in the walls	45.00	14.3	2.3	103	3.6	.6	26	14.3	2.3	103	232	58.9	9.4	422
Install fireplace doors/caps	8.00	10.0	1.6	13	6.0	1.0	8	4.0	.6	5	26	20.0	3.2	26
				530			241			500	1,271			1,364
Total Potential Savings				636			343			512	1,491			3,282

APPENDIX E

TABLE E-7

POTENTIAL AND ACTUAL SAVINGS FROM ENERGY CONSERVATION ACTIONS
FOR HOUSEHOLDS WITH 2 FLOORS, 3 BEDROOM HOMES BUILT 1946-1965

Energy Conservation Actions	Average Yearly Savings/ Hshlds	Problem Awareness			Choice			Implementation			Total Potential Savings	Already Saved		
		Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)		Percent Response	No. of Hshlds (1,000)	Actual Savings ($1000)
Continuous Actions														
Regularly turn off unused lights	8.00	0%	0	0	1.2%	.3	2	0%	0	0	2	97.7	22.2	177
Close drapes and shades at night	7.00	1.1	.2	2	0	0	0	0	0	0	2	98.9	22.4	157
Close off rooms	17.00	8.3	1.9	32	2.4	.5	9	0	0	0	41	61.9	14.0	239
Turn down furnace thermostat	44.00	0	0	0	1.2	.3	12	0	0	0	12	94.1	21.3	939
				34			23			0	57			1512
Seasonal Actions														
Caulk cracks	39.00	6.1	1.4	54	14.6	3.3	129	1.2	.3	11	194	73.2	16.6	647
Weatherstrip doors and windows	39.00	0	0	0	16.5	3.7	146	1.2	.3	11	157	80.0	18.1	708
Replace broken windows or storm doors	5.00	2.4	.5	3	3.7	.8	4	1.2	.3	1	8	84.1	19.1	95
Clean and tuneup the furnace	12.00	4.7	1.1	13	16.3	3.7	44	3.5	.8	10	67	73.3	16.6	200
				70			323			33	426			1650
One-Time Actions														
Install clock set back thermostat	30.00	40.0	9.1	272	15.7	3.6	107	10.0	2.3	68	447	8.6	2.0	59
Install more efficient furnace	81.00	12.3	2.8	226	11.0	2.5	202	15.1	3.4	277	705	27.4	6.2	503
Turn down water heater thermostat	8.00	12.5	2.8	23	5.0	1.1	9	0	0	0	32	72.5	16.4	132
Install water flow restrictors	11.00	27.8	6.3	69	23.6	5.4	59	4.2	1.0	10	138	20.8	4.7	52
Insulate hot water pipes	2.00	22.9	5.2	10	32.9	7.5	15	2.9	.7	1	26	24.3	5.5	11
Insulate hot water heater	3.00	31.1	7.1	21	17.6	4.0	12	2.7	.6	2	35	23.0	5.2	16
Insulate the attic	16.00	6.1	1.4	22	11.0	2.5	40	3.7	.8	13	75	76.8	17.4	279
Insulate in the crawl space	18.00	4.0	.9	16	6.7	1.5	27	5.3	1.2	22	65	42.7	9.7	174
Insulate in the walls	89.00	14.9	3.4	301	4.1	.9	83	13.5	3.1	273	657	54.1	12.3	1092
Install fireplace doors/caps	8.00	7.8	1.8	14	6.5	1.5	12	5.2	1.2	9	35	16.9	3.8	31
				974			366			675	2,215			2,349
Total Potential Savings				1,078			912			708	2,698			5,511

APPENDIX E

TABLE E-8

POTENTIAL AND ACTUAL SAVINGS FROM ENERGY CONSERVATION ACTIONS
FOR HOUSEHOLDS WITH 3 FLOOR, 4 BEDROOM HOMES BUILT BEFORE 1945

Energy Conservation Actions	Average Yearly Savings/ Hshlds	Problem Awareness			Choice			Implementation			Total Potential Savings	Already Saved		
		Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)	Percent Response	No. of Hshlds (1000)	Potential Savings ($1000)		Percent Response	No. of Hshlds (1,000)	Actual Savings ($1000)
Continuous Actions														
Regularly turn off unused lights	11.00	.8%	.2	2	.8%	.2	2	0	0	0	4	98.4	22.3	245
Close drapes and shades at night	10.00	4.0	.9	9	3.2	.7	7	0	0	0	16	88.7	20.1	201
Close off rooms	24.00	7.8	1.8	42	6.1	1.4	33	0	0	0	75	57.4	13.0	312
Turn down furnace thermostat	86.00	7.2	1.6	140	.8	.2	16	.8	.2	16	172	90.4	20.5	1763
				193			58			16	267			2521
Seasonal Actions														
Caulk cracks	53.00	7.4	1.7	89	22.1	5.0	265	4.1	.9	49	403	63.9	14.5	768
Weatherstrip doors and windows	53.00	7.1	1.6	85	19.8	4.5	238	4.0	.9	48	371	68.3	15.5	821
Replace broken windows or storm doors	5.00	.8	.2	1	12.5	2.8	14	4.7	1.1	5	20	75.8	17.2	86
Clean and tuneup the furnace	27.00	3.2	.7	20	10.4	2.4	64	4.8	1.1	29	113	78.4	17.8	480
				195			581			131	907			2155
One-Time Actions														
Install clock set back thermostat	58.00	40.2	9.1	529	22.4	5.1	250	11.2	2.5	147	926	8.4	1.9	110
Install more efficient furnace	150.00	19.3	4.4	657	6.1	1.4	208	21.9	5.0	745	1610	30.7	7.0	1044
Turn down water heater thermostat	8.00	19.0	4.3	34	6.9	1.6	13	0	0	0	47	69.0	15.7	125
Install water flow restrictors	11.00	45.7	10.4	114	15.2	3.4	38	6.7	1.5	17	169	21.0	4.8	52
Insulate hot water pipes	2.00	36.0	8.2	16	26.1	5.9	12	11.7	2.7	5	33	20.7	4.7	9
Insulate hot water heater	4.00	30.3	6.9	27	32.1	7.3	29	11.9	2.7	11	67	20.2	4.6	18
Insulate the attic	153.00	9.8	2.2	340	8.1	1.8	281	10.6	2.4	368	989	65.0	14.7	2256
Insulate in the crawl space	18.00	13.0	2.9	53	10.4	2.4	42	7.0	1.6	29	124	33.9	7.7	138
Insulate in the walls	353.00	16.7	3.8	1337	7.5	1.7	600	26.7	6.1	2138	4075	45.8	10.4	3667
Install fireplace doors/caps	8.00	6.6	1.5	12	12.3	2.8	22	14.8	3.4	27	61	25.4	5.8	46
				3,119			1,495			3,487	8,101			7,465
Total Potential Savings				3,507			2,134			3,634	9,275			12,141

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