ECS Evaluation Report

Hagler Bailly Consulting - March 4, 1997

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Volume 2:

Disclaimer

It should be expressly understood that the contents of this document are the work of Hagler Bailly Consulting and its subcontractors, and do not necessarily represent findings, conclusions or policies of the Massachusetts Division of Energy Resources (DOER) or any other agency of the Commonwealth of Massachusetts. Neither DOER nor its staff necessarily endorse the policies, positions or perspectives presented in this report.

Executive Summary

ES.1 Program Overview

History. The Massachusetts Energy Conservation Service (ECS) offers home energy audits and follow-up services to all residents of the state. All gas and electric investor-owned utilities (IOU) and municipal utilities have been mandated to provide the program to their customers since 1980 as per Massachusetts statute, Chapter 465, and Regulations 225 CMR 4.00 and 5.00. The program is jointly administered by the Massachusetts Division of Energy Resources and the Massachusetts Department of Public Utilities. The ECS program was originally established as a result of the federal Residential Conservation Service (RCS), and was enhanced by the state regulation whose requirements exceed those of the federal regulation. In 1990 when the federal RCS regulation sunsetted, the state requirement prevailed, leaving Massachusetts as one of the few states where home energy audits and services are universally provided.

Services. The ECS Program helps homeowners, building owners and tenants conserve energy by providing services to help make their homes or buildings more energy-efficient. The primary element of the program is the 1-4 Unit Program; there is also a smaller Multifamily Building Program (for buildings with 5+ units). The services currently available under the ECS program are:

- In-Home Energy Audits
- Demonstration Materials Installation (hot water tank wrap, weather stripping, etc.)
- Appliance Efficiency Education Service (information on current home appliances)
- Low Cost Measure Work Preparation
- Bulk Purchase Service (mail order or direct purchase)
- Major Work Order Preparation (job specification sheet for contractors)
- Contractor Arranging Service
- Technical Assistance Service (post-audit assistance by phone)
- Post-Installation Inspections

ES.2 Evaluation Overview

This evaluation of the ECS Program was initiated by the Massachusetts Division of Energy Resources (DOER) to determine the need for program changes given the evolution of energy efficiency services in Massachusetts since 1980, and future changes anticipated from utility industry restructuring. The evaluation scope was developed collaboratively with selected members of the ECS Public Advisory Committee and experts from the Massachusetts residential energy efficiency community. The methodology was designed by Hagler Bailly Consulting, Inc. (Hagler Bailly) and reviewed by DOER and representatives of the Public Advisory Committee.

This document represents the final report, which incorporates comments received on the interim draft version (dated December 20, 1996). This draft version was circulated for

review and discussion, and all substantive comments received through February 21, 1996 have been incorporated in this final version.

Objectives. The specific objectives of the evaluation are to answer the following questions:

1. Does ECS achieve energy efficiency actions (installations and/or practices)?
2. Does ECS achieve energy savings/conservation?
3. Does ECS provide energy education?
4. Does ECS achieve other societal benefits?
5. What is the profile of ECS participants and nonparticipants?
6. What is the degree of overlap between ECS and other residential energy programs?
7. What is the status of the technical/educational aspects of the ECS program?
8. What has been and what could be the effectiveness of overall program administration?
9. What is the need for a future evaluation of the Multifamily Building Program?
10. How should the ECS program be changed to best meet the energy efficiency needs of Massachusetts residents throughout the transition to and after the utility restructuring?
11. Does the ECS program presently achieve the goal of energy conservation in the most efficient manner possible? If not, what can be done to facilitate better results?

It should be noted that the focus of this report is the evaluation the FY95 ECS program, and the effectiveness of its coordination during this time period with other residential energy conservation programs (e.g., utility DSM programs, Weatherization Assistance Program). With the exception of these coordination issues, this evaluation does not address evaluation issues specifically related to utility DSM programs or the WAP program.

Methodology. To address the evaluation objectives listed above, Hagler Bailly and its subcontractors (Energy Research Group and Stratford Associates) conducted the following data collection and analysis:

- Needs Assessment Survey -- a telephone survey of the general public residing in Massachusetts, to assess program awareness, energy efficiency needs, preferences for delivery mechanisms and levels of support;
- Participant Survey -- a telephone survey of FY95 participants, to assess program experience and the extent of follow-up actions;
- Stakeholder Interviews -- in-depth interviews with 84 persons representing DOER staff, utility staff, program vendors, field personnel, consumer and energy efficiency advocates, community action agencies, fuel oil alliance groups, the Mass DPU and others;
- Energy Savings Analysis -- combining survey and tracking records, together with engineering data, to estimate the program impact on energy savings; and

- Technical Evaluation of Audit and Education Processes -- field observations of educational component and technical assessment of current validity of ECS measure.

The findings and conclusions presented in this final report are based on Hagler Bailly's interpretation of the results of these evaluation tasks, as well as its extensive experience and professional opinion in conducting and interpreting research data for numerous program evaluations.

ES.3 Evaluation Findings & Implications

The principal findings and implications of this evaluation are shown in Exhibit ES-1.

Exhibit ES-1

Key Findings and Implications from Evaluation Research

Key Findings	Implications
Participant satisfaction with the ECS audit is very high, but the current design does not lead to sufficiently increased actions or energy savings. The program's educational components, while valued by customers and stakeholders, are by themselves insufficient to achieve customer actions.	Need to ensure availability of broader and more targeted array of services (e.g. financing) designed to encourage measure installations.
The legislation and regulation are too rigid in terms of adaptation to customer needs and uneven in terms of piggybacking services. While there remains a significant demand for on-site services, there also exists significant demand for more flexible design and delivery options.	Allow for flexible and modular audits, (which may be shorter than the full audits), as well as "telephone audit" and information services. On-site audits should be permitted, but not required.
The market need for bulk purchased materials no longer exists and is no longer justified. In addition, some of the service components are not widely needed or used (contractor arranging, major work orders, etc.). The fixed cost of maintaining these services is providing value to relatively few recipients.	Eliminate bulk purchase, contractor arranging and major work order components, unless they can be tied to financing.

There is a significant segment of the population that "believes" in fees for services, and has expressed a willingness to pay for these services. However, there is also a segment of the population interested in services only if offered free-of-charge.	Consider implementation of charges for differentiated products & services for different market segments.
The majority of Massachusetts residents are aware of the ECS offer and almost 41% have already used the service. There are segments with remaining needs, however this remaining unserved market will be more costly to reach through the current design.	Focus targeting of future outreach and services.
The administration of the program has grown to include elements of burden and redundancy which are not necessary, and which could be greatly improved without harm to stakeholders (including customers).	Simplify administrative and reporting requirements.
The general population supports the state playing a role in ensuring "unbiased" delivery of energy efficiency services. Stakeholders offered suggestions as to what that role should be (within and outside of a regulated ECS program), now and in the future.	Change state oversight role to encourage/support private sector activities (e.g., market transformation, EEMs, building codes, etc.).

ES.4 Other Issues Affecting the Need for Change

In order to develop meaningful and appropriate recommendations regarding the future of the ECS program, it is necessary to consider the evaluation findings in a broader national context which recognizes the current evolution of energy conservation in the US and expected future changes in energy regulation.

Changing Need for Support Services. Promotion of the ECS program over the past 16 years, together with utility DSM programs and print and broadcast media, have brought about increasing public awareness of energy efficiency, as well as greater availability of some energy efficient products. Even so, there remains significant technical potential and consumer demand for energy efficiency information and services. Thus, new types of specialized services and marketing may be necessary to serve a very different remaining target market today.

Current Product and Service Needs. Changes in consumer needs over the past 16 years, coupled with program usage data, indicate that there is no longer need or interest in some of the ECS services (which are little used), while there is remaining need for other types of extended services and non-in-home services that are not currently offered.

Emerging Nature of Energy Services in Restructured Markets. With the expected advent of utility restructuring and retail competition, there is growing evidence of some private sector interest in the provision of energy audit and efficiency services to residential customers, and some test marketing of those services. Of course, the extent to which such services will eventually be offered to residential customers, the cost of those services, and the level of market demand for them, all remain to be seen. Yet while there is uncertainty over the extent to which market competitors will ultimately provide energy audit and efficiency services to residential customers, there is certainly an important public interest in ensuring that such possibilities are not precluded by existing state programs.

ES.5 Recommendations

The operation of the statewide ECS program is set by existing legislation and regulation. In the short run, changes are constrained to modifications in administrative rules. In the medium-run (1-2 years), changes in legislation and regulation may be instituted to improve the program effectiveness. At that time, changes may also be made to dovetail with industry restructuring and other market changes.

In the long run, the need for continuation of a statewide residential program will depend on the extent to which the energy distributors, energy suppliers, contractors and/or other private sector providers do actually offer the applicable services, and residents utilize them. Since that is not known presently, the prudent approach is for the state to encourage the provision of applicable services by the private sector, while remaining available to fill remaining gaps. If private sector services are widely provided or the remaining need for them disappears, then ultimately there may be no need for a statewide program. Alternatively, there may be remaining need for a specialized program offering limited services, or a targeted program aimed at specific market segments (e.g., poor, elderly, renters). Until that outcome is clear, it will be necessary for legislation to provide for sufficient flexibility such that private competition is not stifled but public interests do not remain unmet.

The recommendations which follow were developed by Hagler Bailly (and discussed in more detail in Chapter 4, Volume I) as steps which can be taken to improve the overall effectiveness of the ECS program. They are broken down into three phases. The Phase I (short-run administrative action) and Phase II (medium-run legislative and regulatory reform) recommendations both build upon the analysis findings regarding current program needs and public demand for various services. The Phase III (program redefinition) recommendations are of a different nature. They represent an extrapolation of recommended program directions to fit possible future changes in energy competition following the advent of utility restructuring and deregulation.

These recommendations represent the views of the consultant team and should not be interpreted to be the final recommendations of DOER. Rather, they are presented here to provide a basis and framework for discussion of the associated program design and policy issues.

Phase 1: Administrative Actions within the Bounds of Current Legislation and Regulation

- The program reporting requirements should be scaled back.
- The on-site audit requirements should be redefined to allow for greater flexibility in the design and delivery of on-site services.
- The Contractor Arranging Service, Bulk Purchase Service, and Major Measure Work Order elements of the program should be eliminated, unless it can be linked to a financing component.
- If determined cost-effective, the Low-Cost Measure Work Order element of the program should be redesigned to be an automated feature of the audit process.
- The telephone intake process should be expanded to provide a more prominent and targeted education/ information element.
- The program marketing effort should redesigned to incorporate active outreach targeted to those segments with higher remaining needs for energy efficiency services, and limited outreach for the remaining markets.
- Consideration should be given to the initiation of a modest fee for audit and/or inspection services.

Phase 2: Legislative & Regulatory Reform

- The currently legislated program focus on education and demonstration of energy conserving measures should be shifted to focus more on "market transformation" objectives.
- The program should be redefined to include a financing mechanism for installation of major energy efficiency measures.
- The measure of program success should be shifted to focus on output performance instead of input effort.
- The program organization and cost structures should be redesigned to facilitate private sector alternatives and market-based on-site services.
- Management and coordination of off-site information services and remaining on-site services (that are not already provided by others) should be provided via a centralized, statewide system.
- Address existing cost-burden inequities through the initiation of charges to participants for enhanced services, and the use of universally-applied but not non-duplicative household energy bill charges.

Phase 3: Program Redefinition

These recommendations represent an interpretation of program direction which could be applicable when there is full retail-level competition for electricity and natural gas.

The Phase 3 Plan provides an "Exit Strategy" for the ECS Program, which lays out conditions under which some or all of the program elements could be eliminated in a deregulated market. The recommended plan is relatively straightforward, and includes the following three elements:

- To the extent that services are not already widely being provided by others on a statewide basis, utilize a central contractor to provide information, audit and other energy efficiency assistance services. The program should focus on filling "gaps" that are not already being met by the marketplace.
- DOER (or its designee) should continue to monitor market availability of specified services, based on pre-determined market transformation and service availability criteria.
- As warranted by future conditions, DOER should eliminate the role of the state in the provision of energy audit, information and/or support services, to the extent that the private sector provides equivalent services to meet customer needs and demands.

Volume 1, Chapter 1 - Introduction

1.1 Description of Program

1.1.1 Background

The Massachusetts Energy Conservation Service (ECS) provides home energy audits and follow-up services to all residents of the state. All gas and electric investor-owned utilities (IOU) and municipal utilities have been mandated to provide the program to their customers since 1980 as per Massachusetts statute, Chapter 465, and Regulations 225 CMR 4.00 and 5.00. The ECS program was originally established as a result of the federal Residential Conservation Service (RCS), but was enhanced by the state regulation whose requirements exceed those of the federal regulation. In 1990 when the federal RCS regulation sunsetted, the state requirement prevailed, leaving Massachusetts as one of the few states where home energy audits and services are universally provided.

The ECS program is jointly administered by the Massachusetts Division of Energy Resources (DOER) and the Massachusetts Department of Public Utilities (DPU). The DOER oversees all operations, guarantees quality, sets the annual goals for each utility, and reviews and approves each utility's annual program plan. The DOER also reviews and approves municipal utility ECS budgets.

As required by statute, a DOER appointed Public Advisory Committee (PAC) meets quarterly to advise DOER on ECS program administration and policy. The PAC is afforded the opportunity to review and comment on state and individual utility plans for implementing the ECS program, provide input on policy decisions affecting the ECS program, and act as a forum for comment on particular issues as they arise. The Committee also advises the Commissioner of the Division of Energy Resources of the effects of ECS policies on various constituent groups. In FY 1995, the Committee consisted of 24 members, each serving a one-year term and representing an interest group which is concerned with the operation of the ECS program.[1]

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[1]Chapter 465 of the Acts of 1980 states that groups represented on the PAC shall include: ECS program operators, home heating suppliers, savings and commercial banks, the residential renewable energy resource industry, energy retrofit contractors, registered professional engineers with retrofit and audit experience, the Massachusetts Community Action Program Directors Association, the realty profession, tenant senior citizen and consumer advocacy groups and the Massachusetts Department of Public Utilities. Prior to the beginning of FY 1995, DOER reached out to recruit PAC nominees from some twelve organizations and, as a result, the PAC gained six new members representing: energy retrofit contractors, the residential renewable energy resource industry, the realty profession, senior citizens; consumer advocacy groups, and a residential engineer with retrofit and audit experience.

The DPU is responsible for reviewing and approving program budgets and surcharges for investor-owned utilities (IOUs) and has established certain regulations concerning informing customers about the availability of the service. The program is funded by an

Energy Conservation Service surcharge which is assessed to IOU residential rate payers monthly in each gas and electric bill. Municipal utilities include ECS program operating expenses within their residential customer rates.

There are 57 gas and/or electric IOU and municipal utilities in the Commonwealth of Massachusetts. Each may either provide the ECS program independently or may join other utilities in a collaborative delivery effort. During the 1995 fiscal year (FY95), there were three collaborative delivery programs, two of which had only municipal utilities. In addition to these, eleven utilities provided the ECS program independently. Most utilities and collaborative programs subcontracted for auditor services, although the largest collaborative and several municipal utilities employed auditors directly.

1.1.2 Qualifying Customers

Every residential customer of an investor-owned or municipal utility in the state qualifies to receive services from the ECS program. The type of dwelling determines which part of the program is delivered:

- one-to-four unit audit and services;
- multifamily building (five-plus units) audit; or
- tenant services.

The multifamily building audit and tenant services (Multifamily Building Program, MFB), in combination, are a small part of the ECS services delivered statewide. In fact, municipal utilities are not required to offer these parts of the ECS program. While touching on these MFB services, this evaluation primarily focuses on the one-to-four unit audit and services.

1.1.3 ECS Program Services

When it was first offered, the ECS program consisted of only an audit and demonstration material installations (DMI). Participants were left with a customized report of energy improvement recommendations, as well as some demonstrated measure installations, but the program offered little additional assistance to encourage further measure installations.

Over the years, the program has been expanded to include a variety of follow-on assistance services - *equivalent services* - designed to assist homeowners and tenants with implementing the recommendations, such as the bulk purchase service, major measure and low-cost measure work order preparation services, contractor arranging services, and post-installation inspection services.

In addition to these enhancements within the ECS program, beginning in 1990 some utilities began to "piggyback" Demand-Side Management (DSM) program services[2] with the ECS audit visit. These piggybacked DSM measures include domestic hot water (DHW) measures, compact fluorescent lamps (CFLs), as well as cost-effective DSM measures. These DSM services further enhanced the value of participation for ECS

customers by: a) capturing lost opportunities, b) reducing duplication of effort, and c) allowing $30 of ECS to go toward the cost of other demonstration measures. The delivery of piggybacked DSM measures allowed utilities to deliver (in some cases) DSM measures that would otherwise not have passed the utility cost-effectiveness test if delivered as stand-alone services.

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[2] "Piggybacked" DSM program services are defined here as situations where two or more energy efficiency programs are delivered at the same time, thereby sharing (and saving on) program costs.

During its sixteen-year history, the ECS program has been coordinated with several other types of energy assistance programs. The two primary coordination efforts have been the Weatherization Assistance Program (WAP) and the Home Energy Assistance Team (HEAT) Loan Program. In the former, modest ESC resources supplement WAP resources when an eligible WAP client is serviced through the WAP program. During the two waves of the HEAT Loan Program, an ECS audit indicating a recommendation(s) for the applied-for improvement(s) was a requirement for loan approval. During FY95, the WAP coordination continued while the HEAT coordination ended with the defunding of the HEAT program in 1992.

1.1.4 Program Awareness and Request

Every utility is required by regulation to devote one bill-insert per year to informing customers of the availability of the ECS program.[3] Customers also become aware of audit availability through general publicity/marketing, word-of-mouth, calling their utility to ask questions, and other methods. In most cases, a customer who is interested in the program contacts the utility via telephone or a postage-paid card (attached to the bill insert) and requests the service. An appointment is made for an auditor to come to their home.

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[3] IOUs are required by DPU regulation to notify customers annually. Municipals are required to do this by DOER regulation.

1.1.5 Energy Audit

The ECS audit is fuel-blind, meaning that all end-uses are examined regardless of the fuel used. Whether or not a customer's electric utility or their gas utility provides the audit, all electric, gas, oil, and other (if used) systems are covered. As delivered during FY95, fuel-switching could not be recommended in the 1-4 program component, but could be considered in the multi family component.

A trained, utility-certified ECS energy auditor makes a survey of the customer's home and identifies areas where energy conservation improvements can be made. Specifically,

during the audit, the building's heating and DHW systems, shell insulation and appliances are examined.

The program is designed for the resident to accompany the auditor in the examination of the building so that explanations and education occurs during the course of the visit. The customer is provided with a written report which describes the efficiency of the building and lists measures which should be taken for improvements, based on order of priority . If appropriate, the auditor writes a work order for low-cost or major improvements and leaves it with the customer. The auditor also explains and leaves materials about other *equivalent services* available to assist the resident to make the changes. A folder with the audit report and descriptions of all follow-up equivalent services is left with the customer. Toll-free phone numbers are given to customers for technical assistance, bulk purchase orders, contractor arranging services, post installation inspection, and any other assistance which they may need after the visit.

1.1.6 Equivalent Services

Demonstration of Materials Installation - During the ECS visit, the auditor installs several energy saving items. The purpose of the DMI is to show the resident "how to" and to get them started. While different in each dwelling, typical installation items include: a water heater wrap and pipe insulation, a CFL, weatherstripping of one demonstration window, a door sweep, a low-flow showerhead, and a sink aerator.

Low-Cost Work Order - During the ECS visit, the auditor may prepare a low cost measure job specification sheet detailing work to be done in the customer's home or building (e.g., caulking, weatherstripping). These low-cost measure work orders are designed to assist customers in do-it-yourself applications. In addition, as requested, the auditor may complete a bulk purchase (see below) order form for the customer with amounts, sizes, and other specifications customized to their home and energy need.

Bulk Purchase Service - This "after-visit" service provides energy saving materials at or below market prices for do-it-yourself projects. In addition to providing telephone- and mail-order, the service offers DOER-approved materials, including caulking, weatherstripping, clock thermostats, energy saving light bulbs, etc.

Work Order Preparation - During the ECS visit, depending on the need of a particular dwelling, the auditor will prepare a job specification sheet for home energy improvements. Examples of projects are attic insulation, window retrofit, and new heating system. Work orders for large projects can be used by the customer to solicit bids from contractors either through the ECS contractor arranging service component (see below) or on their own.

Technical Assistance Service - This "after-visit" service involves telephone assistance from qualified, experience audit staff who will answer questions concerning heating, hot water systems, insulation, space conditioning, lighting, and appliances. In

addition, municipal utilities provide complete information regarding hiring contractors, materials, and proper installation of materials.

Contractor Arranging Service (CAS) - This service matches customers who need a contractor to implement their energy improvements with contractors who have been pre-approved by the ECS program. The participating contractors have agreed to perform work at reasonable prices and within a specified period of time and to warranty installed measures. Customers are matched with contractors on a rotating basis or customers solicit bids on their own from the CAS contractor list. Independent municipal utility programs are not required to offer CAS.

Post-Installation Inspection (PII) - An inspection of energy improvements by a trained inspector is available in conjunction with the Contractor Arranging Service or for customers who have made improvements themselves or hired a contractor on their own. The inspector indicates if work or materials are not up to ECS standards. Customers who have participated in the CAS are not obligated to make their last payment until the work is approved by the inspector. This service reviews only the energy-worthiness of work; it does not replace required code and safety inspections, where needed. Independent municipal utility programs are also not required to offer this service.

Appliance Efficiency Education Service (AEES) - Customers can receive site specific, energy efficiency education and information about the appliances in their home. The customer will learn which appliances in their home use the most energy and how to use them more efficiently. Customers will also obtain information on the estimated cost to run some common household appliances and information on how and why to purchase energy efficient appliances.

1.2 Evaluation Goals

As discussed above, ECS has been delivering energy conservation services to Massachusetts utility customers since 1980 and, since the mid-1980s, additional energy conservation services have become available to Massachusetts residents through ECS and other utility sponsored programs delivered separately and also through coordination with ECS. Hagler Bailly Consulting, Inc. (Hagler Bailly) was selected to complete the ECS evaluation and determine whether the Energy Conservation Service is or can be:

- an efficient mode of delivery for residential conservation services;
- efficiently coordinated with other Massachusetts residential energy conservation programs;
- technically/educationally state of the art; and
- efficiently administered.

The specific objectives of the evaluation are to answer the following questions:

1. Does ECS achieve energy efficiency actions (installations and/or practices)?
2. Does ECS achieve energy savings/conservation?
3. Does ECS provide energy education?
4. Does ECS achieve other societal benefits?
5. What are the household, participation, and energy efficiency measure adoption characteristics of those served by the ECS program between July 1, 1994 and June 30, 1995?
6. What is the degree and nature of the potential coordination and/or overlap between ECS and other residential energy conservation programs, including Demand Side Management (DSM) programs, the Weatherization Assistance Program (WAP), and a potential Home Energy Rating Service (HERS)?
7. What is the status of the technical/educational aspects of the ECS program?
8. What has been/could be the effectiveness and efficiency of overall ECS program administration?
9. What is the need for DOER to conduct a future evaluation of the ECS Multifamily Building Program?
10. How should the ECS program be changed to best meet the energy efficiency needs of Massachusetts residents throughout the transition to and after the restructuring of the gas and electric utilities?
11. Does the ECS program as presently operated (as documented in answers to questions 1-9), achieve the goal of energy conservation and energy actions in the most efficient manner possible? If not, what can be done to facilitate better results?

The answers to these questions have been formulated based on research and analysis completed by Hagler Bailly and its subcontractors, Energy Resource Group (ERG) and Stratford Associates, as part of this evaluation project. Specific components of this research are described below in Section 1.3.

It should be noted that the focus of this report is the evaluation the FY95 ECS program, and the effectiveness of its coordination during this time period with other residential energy conservation programs (e.g., utility DSM programs, Weatherization Assistance Program). With the exception of these coordination issues, this evaluation does not address evaluation issues specifically related to utility DSM programs or the WAP program.

1.3 Evaluation Methodology

A total of eleven tasks were implemented to address the overall evaluation goals and specific research questions discussed above. These tasks were developed by DOER with participation by an appointed Evaluation Advisory Group, consisting of representatives from a cross-section of utilities, vendors and the DPU. The ECS Public Advisory Committee also reviewed and commented on the tasks. These eleven evaluation tasks utilized information collected and analyzed via the following principal evaluation activities:

- **Needs Assessment Survey.** A telephone survey of the general public residing in Massachusetts, to assess ECS program awareness, interest in/need for energy efficiency services, preferences for selected design and delivery options, opinions about the role of utilities, state government, and other in delivering these services, and preferences for energy efficiency program funding mechanisms.
- **Participant Survey.** A telephone survey of FY95 participants, to assess satisfaction with program and services received, extent of measure installations, and influence of ECS and other services on measure installation decisions.
- **Stakeholder Interviews.** In-depth interviews with 84 persons representing DOER staff, utility staff, program vendors, field personnel, consumer and energy efficiency advocates, community action agencies, fuel oil alliance groups, and the DPU.
- **Energy Savings Analysis.** Use of participant survey and tracking records, together with engineering data, to estimate the program's energy savings impacts.
- **Assessment of Technical and Educational Aspects of ECS Audit.** Evaluation of current validity of required ECS measures in light of the "state-of-the-art" and assessment of ECS educational procedures via field observations and educational training curriculum review.

The findings and conclusions presented in this final report are based on Hagler Bailly's interpretation of the results of these evaluation tasks, as well as its extensive experience and professional opinion in conducting and interpreting research data for numerous program evaluations.

1.4 Organization of This Report[4]

This report consists of two volumes. Volume I, contains an Executive Summary and a concise yet complete summary of the evaluation findings and recommendations. Volume II includes the detailed evaluation findings, conclusions, and recommendations.

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[4] This document represents the final report, which incorporates comments received on the interim draft version (dated December 20, 1996). This draft version was circulated for review and discussion, and all substantive comments received through March 3, 1997 have been incorporated in this final version.

As the first chapter in Volume I, this chapter has presented background on the history and principal design elements of the ECS Program, as well as an overview of the goals of and approach to this evaluation. The remaining chapters of this Volume contain Hagler Bailly's synthesis of evaluation findings (Chapter 2), implications of these findings in

developing recommendations (Chapter 3), and our recommendations for future directions (Chapter 4).

Volume II is organized as follows:

- **Chapter 1: Introduction** - presents background on the history and principal design elements of the ECS Program, and an overview of the goals of and approach to this evaluation.
- **Chapter 2: Stakeholder Interviews** - presents an overview of the sample design and data collection process, as well as specific findings regarding stakeholder views on program objectives, program operations, the audit process, program administration, and visions for the future.
- **Chapter 3: ECS Participant Survey** - presents an overview of the sample design and data collection process, as well as specific findings regarding the participant profile, satisfaction with audit process and ECS equivalent services, adoption (and barriers to adoption) of recommended measures, demonstration measures, and DSM "piggyback" measures.
- **Chapter 4: Needs Assessment Survey** - contains an overview of the sample design and data collection process, as well as a profile of Massachusetts residents, an assessment of their awareness of/participation in ECS/DSM programs, their perceptions regarding the energy efficiency of their home and its major components, their interest in energy efficiency services, and their willingness-to-pay for these services.
- **Chapter 5: Technical Assessment of ECS Audits** - contains a critical assessment of audit methods and identifies opportunities for improvement.
- **Chapter 6: ECS Audit Education** - presents an analysis of the effectiveness of the educational component of the ECS Audit.
- **Chapter 7: Impact Analysis and Results** - contains an overview of the analysis and results of the impact analysis completed for measures implemented through ECS and non-ECS services during FY95.

Volume 1, Chapter 2 - Evaluation Findings

This chapter presents a detailed synthesis of the evaluation findings as they relate to each of the principal evaluation objectives and tasks described in Chapter 1. The findings are based on Hagler Bailly's interpretation of the results of this evaluation, as well as its extensive experience and professional opinion in conducting and interpreting research data for numerous program evaluations.

2.1 Does ECS Achieve Energy Efficiency Actions?

As discussed in Chapter 1, one of the principal goals of this evaluation was to determine whether ECS is responsible for encouraging the adoption of energy efficiency actions among its participants. In order to assess this objective, Hagler Bailly identified energy-saving actions implemented by fiscal year 1995 (FY95) ECS participants through a telephone survey. Responses from this survey were analyzed to ascertain the sole or contributory role that the ECS program played in encouraging participants to take direct actions to improve the energy efficiency of their homes.

The results from this evaluation suggest that modest levels of energy efficiency actions have been achieved through the provision of ECS and related services. Of the measures recommended to participants through the ECS audit, 16% were implemented according to the survey results. In addition, a significant number of direct install and demonstration measures were received by participants during this time frame. On average, each participant received about four direct install measures (4,000 measures were provided to 948 participants included in the survey sample). In addition, about half (54%) of the ECS participants surveyed that they had purchased "do-it-yourself" energy saving materials after receiving the ECS services. Therefore, it can be concluded that, as a result of ECS, a modest level of participants appear to have taken significant energy efficiency actions.

In addition, ECS and related service appears to have influenced a large portion of these measures installations. That is, regardless of the type of service used by participants to install energy saving measures (e.g., ECS work orders, DSM piggyback, other DSM/WAP services, ECS bulk purchase services, etc.), most of the measures that were installed would not have been implemented had it not been for the provision of ECS and related services (including utility DSM and WAP services).

Nevertheless, barriers to measure implementation support the conclusion that there is a need for more targeted, specialized services in order to bring about increased adoption of energy saving measures. For example, participants who did not implement audit recommendations cited the following three main reasons: cost (28%), (perceived) lack of need (23%), not a priority (14%), and rental property barriers (10%). In order to overcome the cost barrier, as well as the non-priority and rental property barriers, more targeted and specialized services would need to be offered. The barrier regarding participants' (perceived) lack of need indicates that the educational elements of ECS may

not have been sufficient to overcome some participants' beliefs regarding the appropriateness of measure recommendations for their homes.

2.2 Does ECS Achieve Energy Savings?

This evaluation also assessed the extent to which ECS has achieved energy savings. A rather limited impact analysis was completed to address this issue. This analysis utilized participants' self-reported information regarding actions they have taken to save energy in their homes, utility data regarding the provision of direct install measures, and (again) participants' self-reports regarding the relative *influence* of the program on their decisions to take specific actions.

While the energy savings *potential* from ECS audit recommendations and direct installation services is great, realization of these energy savings benefits is limited due to: (1) a generally modest level of overall measure adoption, and (2) a predominance of moderate- to low- energy saving measures among the pool of measures that were actually installed in participants' homes (e.g., DMI measures and DSM piggyback measures).

2.3 Does ECS Provide Energy Education?

The third objective of this evaluation was to determine the extent to which ECS has provided energy education to its participants. To be considered effective, programs designed to provide energy education should encourage customers to take specific actions to improve the energy efficiency of their homes. In addition, energy education, if effective, should also "leave behind" information and knowledge that can be used in future energy-related decision making. Finally, the effectiveness of ECS educational services should be assessed in light of its overall contribution to the "success of the program" - as measured through customer satisfaction.

With respect to the first factor, "Does ECS education lead to participant action?," the results of this evaluation suggest that the answer is "Modest levels." As discussed above in Section 2.1, the provision of ECS and related services has encouraged modest levels of participant action. While few of the audit recommendations were implemented (16%), each participant received a number of direct install measures and more than half went on to purchase additional energy saving materials on their own. In addition, when measures have been installed, participants report the provision of the audit and educational services was very influential in their decision to install these measures. Nevertheless, because the energy savings realized from these participant actions is limited to rather low- to moderate- energy savings measures (as discussed in Section 2.2), the significance of these findings is reduced considerably.

Further, this finding is supported through additional analysis of the survey data. That is, elsewhere in the survey, participants were asked a number of general questions regarding whether or not they have taken specific "energy efficiency actions" and, if so, whether or not their participation in the program has influenced their decision to take these actions.

A fair number of participants (over 30%) reported in this section of the survey that they do not take certain "energy efficiency actions" (e.g., get regular tune-ups on their heating system, repair leaky faucets, etc.), despite the fact that ECS should have educated them on the importance of these measures. While others reported that they have taken certain actions (e.g., set back space heating thermostat at night or when leaving home), these participants tended to regard themselves as having been relatively "proactive" when it came to taking these actions. As a result, their actions cannot be attributed to something they learned through their participation in ECS.

The answer to the second question, "Does ECS 'leave behind' information and knowledge participants can use to make future decisions?," is "Probably." Based on the results of the survey, participants have generally reported (at least their perceptions that) the ECS educational service has significantly contributed to both (a) their current knowledge of what needs to be done to save energy in their homes, and (b) their capabilities for carrying these actions out in the future.

At first glance, these results may appear in conflict with findings presented above (i.e., about the specific actions participants have taken, or not taken). That is, the findings above suggest that (a) some participants view themselves as generally proactive, and (b) others report taking little specific action. However, overall, participants have also indicated that the education provided through ECS has reinforced or strengthened their current awareness and knowledge of what needs to be done. This should be regarded as a likely indicator of success for the ECS educational component in that it has successfully "left behind" (at least the perception of) knowledge and information that participants can use in future energy-related decision making.

Finally, the answer to the last question, "Has ECS education significantly contributed to customer satisfaction?," is also "Yes." The results from the survey indicate that the provision of educational services through ECS has had a significant effect on customer satisfaction ratings for the program overall. For example, when participants were asked to indicate what they liked most about ECS, the educational aspects were among the most commonly reported "likes." Specifically, many participants (31%) were impressed with the level of "useful knowledge" provided through ECS, that (presumably) will be available to participants for future decisions. In addition, 11% were pleased with the comprehensiveness of the audit and 10% were particularly impressed with the measure demonstrations. These findings further demonstrate the "success" of the ECS educational components.

2.4 Does ECS Provide Other Benefits?

This evaluation was also designed to answer the question, "Does ECS provide benefits, other than energy savings, to society and its participants?." This issue was discussed during the stakeholder interviews and participant surveys

Findings from the stakeholder interviews indicate that ECS, over the years, has provided a number of "societal" benefits. For example, some stakeholders felts that ECS has

served as a "training pool" or incubator for developing and maintaining energy expertise in the state.

In addition, other stakeholders felt that ECS has provided societal benefits in the sense that it has attempted to **develop and maintain a "baseline" level of energy efficiency awareness and knowledge among the general population.**

In addition, benefits - other than energy savings - were explored with ECS participants. Specifically, FY95 participants were asked during the survey whether or not they had received any (other) benefits, such as increased comfort, reduced energy bills, "personal satisfaction" with helping to conserve energy and improve the environment, etc. Participants' "perceptions" regarding the benefits they have realized through their participation in the program have been used to assess the effectiveness of ECS in providing these other benefits.

Generally, ECS has provided participants with a high level of "personal satisfaction" with respect to helping conserve energy (89%) and improve the environment (88%). In addition, many felt that they had benefited in terms of increased comfort (71%) and lower energy bills (64%) in the winter season. However, these results should be interpreted with caution. Given the relatively limited level of measure implementation and realized energy savings (as discussed in Sections 2.1 and 2.2), it is unclear whether the participant population is likely to have actually experienced the full magnitude of these benefits.

2.5 What is the Profile of ECS Participants and Nonparticipants?

The underlying objective of this task was to develop a database that captures important classification information for a representative sample of ECS participants and nonparticipants. This database is intended to be useful for program planning and updating purposes, and for targeting future services. Exhibit 2-1 presents a summary of selected information that is contained in this database. As shown:

- Awareness of ECS is generally high among nonparticipants (62%).
- Only a small portion of the general participant population report receiving more than one audit (11%).
- Participation in utility DSM and other energy conservation programs is generally higher among ECS participants than nonparticipants (25% v. 9%).
- Customers who use oil for space heating are more frequently represented among nonparticipants than participants (50% v. 36%), as are customers who use oil for water heating (34% v. 21%).
- Participants are more likely to reside in 1-4 unit housing, as compared to nonparticipants (92% v. 88%). Similarly, participants are more likely to own their homes, as compared to nonparticipants (84% v. 68%).

Exhibit 2-1
Selected Profile of Participants and Nonparticipants

Database Item:	FY95 Participant Survey (n=948)	Needs Assessment Survey	
		Participants (1980-mid-1996) (n=244)	Non-Participants (n=352)
Awareness of ECS Audit Program	100%	100%	62%
Participation in ECS Audit Program	100%	100%	0%
Multiple Participation in ECS Audit Program	[1]	11%	0%
Participation in Other Programs [2]	25%	12%	9%
Space Heating Fuel Type	Gas 56% Oil 36% Electric 5% Other 3%	Gas 44% Oil 39% Electric 10% Other 6%	Gas 35% Oil 50% Electric 11% Other 2%
Water Heating Fuel Type	Gas 59% Oil 21% Electric 15% Other 5%	Gas 51% Oil 23% Electric 25% Other 1%	Gas 44% Oil 34% Electric 17% Other 6%
Dwelling Type	[3]	SF (1-4) 92% MF (5+) 8%	SF (1-4) 88% MF (5+) 12%
Owner v. Renter	Owner 88% Renter 11%	Owner 84% Renter 16%	Owner 68% Renter 32%
Years in Massachusetts	[1]	39	33
Years in Current Residence	<5 48% 6-10 19% 11-20 13% Over 20 20%	<5 30% 6-10 21% 11-20 22% Over 20 26%	<5 45% 6-10 16% 11-20 16% Over 20 23%
Dwelling Age	45	53	48
Annual Household Income [4]	$51,000	$56,000	$54,000

Source: Hagler Bailly telephone surveys: (1) FY95 ECS participant survey, and (2) needs assessment survey of MA residents. The distinction between participants and nonparticipants among the general population was made through the needs assessment survey. Respondents' answers not verified based on actual ECS participation data.
Notes:
[1] Question not asked in FY95 participant survey.
[2] Participation in other programs (e.g., utility DSM programs, WAP, etc.) was determined based on responses to survey questions. Respondents' answers were not verified based on actual utility DSM/WAP participation records.
[3] Only single family (1-4) residents included in FY95 participant survey.
[4] Annual household income was recorded in ranges, and the mid-point of each range was used to calculate the average annual household income level presented in this Exhibit.

- There is some evidence that participants tend to (a) be longer term residents of Massachusetts, (b) live in their current homes for longer periods of time, and (c) live in older homes. However, recent ECS participants (FY95) appear to have somewhat more recently moved into their relatively newer homes.

2.6 How Well is ECS Coordinated with Other Residential Energy Conservation Programs in the State?

To address this question, Hagler Bailly examined the coordination and overlap of the ECS, DSM, and WAP programs through interviews with various stakeholders (e.g., utility staff, vendors, and other providers) and customers.

Generally, investor-owned gas and electric utilities were satisfied with coordination between ECS and their DSM programs. However, a few representatives from gas utilities pointed out that this was not always the case, and that the desire to improve this level of coordination led to their decision to act as their own ECS provider.

ECS program vendors were somewhat split with respect to their comments on coordination issues. Representatives of one vendor remarked that they coordinate with DOER and other entities (e.g., WAP, other utilities) very well. However, another vendor commented that coordination between DOER, utilities, other entities (e.g., WAP) is somewhat difficult because of the difference in systems and structures within each group. This vendor commented that there is no incentive for anyone to make it work any better - in this vendor's opinion, there is a tremendous internal inertia to meet "your" goal. As such, developing an appropriate and effective reward system for improving coordination among key players under these circumstances is a challenge.

In addition, one vendor pointed out coordination problems between gas and electric companies, where one vendor provides services to customers under contract to the gas utility, yet another vendor provides services to customers under contract to the

electric utility. More importantly than the coordination bottlenecks that this arrangement presents, there is duplication of effort because there are two vendors providing legitimate service to the same customers. Some representatives from community action agency shared this concern and recommended modifications to the administration and implementation of ECS, DSM and WAP programs to make them more "seamless."

Nevertheless, from the participants' perspective, efforts to coordinate the provision of these various services (e.g., ECS, DSM, WAP) have been fairly transparent. Generally, participants were satisfied with the quality of information and level of service provided. Few specific comments regarding the delivery of poorly coordinated services were received.

However, at least in one sense, ECS does not appear to have been particularly effective in promoting these other services. For example, when multiple services were available to a participant, one might expect that ECS would have been regarded as the participants' "one source" of information for all of these programs. Yet, the survey results suggest that this may not be the case. That is, participants were more likely to hear about the other DSM/WAP programs available to them from their utilities (i.e., bill inserts, media promotion) and/or word of mouth advertising, than they were to hear about them from their ECS auditor.

2.7 How Adequate are the Technical and Educational Components of ECS?

2.7.1 Technical Assessment: Are ECS Measures Technically State-of-the-Art?

To answer this question, a technical review of the required ECS program measures (both residential 1-4 and multifamily) was conducted to determine whether they are currently valid and technically state-of-the-art. Drawing upon available technology literature from the Electric Power Research Institute (EPRI), Department of Energy (DOE), National Laboratories and other sources, as well as ERG's energy conservation technology expertise and its knowledge of other residential conservation programs in Massachusetts, each measure was assessed in terms of its validity given current state-of-the-art.

As an additional means of assessing the current validity and status of required ECS measures, a detailed matrix was prepared rating the relative energy savings potential of each measure (negligible, minimal, moderate, significant), market barriers to installation (cost, replacement versus retrofit situations), and its status as a conservation measure (not current, standard, progressive). This matrix also provides, for information purposes only, some examples of new or emerging technologies within the measure categories.

For the most part, the required measures were found to be standard, tried and true energy efficient technologies and therefore, would remain ECS program measures under the existing program design. A few measures were categorized as standard, but having limited applicability. A few were identified to be "not current" or out-of-date

given current marketplace conditions and some were categorized as "progressive," or advanced.

While the current list of required ECS measures is generally regarded as technically valid, some modifications to existing measures, as well as additional measures, should be considered. These findings are summarized below:

- Consider adding/modifying the current required ECS measure list:
    - require clearer definitions/specifications for replacement heating system
    - (1-4, and MF);
    - require a more thorough assessment of the multiple options and possible configurations for replacement water heating (1-4 and MF);
    - consider adding blower door testing for leak detection and air sealing measures (1-4);
    - consider adding high-efficiency appliances, such as refrigerators and washing machines (1-4 and MF);
    - consider adding CFLs for high-usage lighting (1-4); and
    - consider adding swimming pool covers and heat recovery ventilation (MF).
- Potential future measures to be considered for addition to the ECS measure list:
    - Lighting products, such as smaller compact fluorescent lamps, dimmable compact fluorescent lamps, and compact fluorescent lamp fixtures;
    - Windows, including double-paned, low-e, argon-filled windows with foam-filled vinyl frames, windows with electrochromic glazing, and "superwidows";
    - "Super Batts" insulation, which has higher R-value fiberglass insulation for walls and ceiling joists;
    - Controls, including newer programmable thermostats for baseboard heating systems and electric water heaters; and unified temperature and indoor air quality control;
    - "Aerosol Duct Sealer," a new process that pressurizes ducts and sprays in an aerosol sealer; and
    - High efficiency appliances, such as "Super Efficient Refrigerator" (SERP) and horizontal axis washing machines.
- Further evaluate the need to update and increase standardization and consistency across audit tools by:
    - reviewing the above recommendations for changes to the list of required ECS measures with each ECS vendor to gain consensus on current validity for both residential 1-4 and multifamily applications;
    - updating the required ECS measure list based on the results of these meetings;
    - formally comparing each vendor's energy saving algorithms, assumptions and/or measure specifications to evaluate the need to update and increase standardization; and

- in light of the findings from the above activities, revisit the need to modify the current procedures used to evaluate proposed program changes and/or enhancements to audit tools.

2.7.2 Educational Assessment: How Effective is the ECS Approach to Education?

The current ECS audit process was reviewed to determine whether the educational procedures and approaches are adequately achieving the educational objectives of the Program. This involved two tasks: (1) accompanying ECS energy auditors in the field while performing the audits to observe the procedures being implemented, and (2) reviewing educational training curricula.

In the first task, educational criteria were developed to rate auditor performance in several categories relative to measures, energy saving practices, installation demonstration and equivalent services. The auditors were then ranked relative to their educational approaches. **The results from this assessment indicate that all auditors were highly ranked, and there was no evident significant differentiation between program vendors.** The auditors observed did an excellent job of educating program participants about energy conservation and motivating participants to install applicable measures. They were found to be very knowledgeable and had strong educational and motivational skills. As a result, no recommendations for approach improvement have been made based on these observations..

In the second task, training program curricula of three of the program vendors were reviewed - Mass-Save, Inc., Conservation Services Group, and DMC. **All three curricula contain training sessions on customer education and motivation. However, approaches vary.** The Mass-Save program offers a comprehensive academic approach, the CSG program offers more of a "hands'-on" approach. The DMC approach differed from the Mass-Save and CSG curricula, in that sessions on educational and motivational techniques were discussed at the beginning of the training program, and reinforced during both the technical training modules and the field training.

It would appear that, despite these findings related to the performance of auditors in delivering educational services, and the adequacy of the training provided to these staff, the educational elements of ECS have only been partially effective. The modest levels of energy efficiency action and realized energy savings that are attributable to the program indicate that education, in and of itself, may not be a sufficient motivation for participants to act. As discussed above in Section 2.1, barriers to measure installation, as reported by participants who did not install specific audit recommendations, include such factors as measure costs, non-priority, and rental property barriers. These findings suggest the need for more targeted and specialized services, in addition to education and information services, to encourage greater measure adoption rates.

However, as mentioned above in Section 2.1, some participants reported that audit recommendations were not implemented because of a (perceived) "lack of need." This findings suggests that, for some participants, ECS education has not been effective in

overcoming participants' misperceptions regarding the appropriateness of specific energy efficiency measures for their homes.

2.8 How Effective and Efficient is the Overall ECS Program Administration?

During the interviews with stakeholders, many administrative and operational aspects of the ECS program were discussed, including topics and subtopics related to planning, review and approval; marketing and promotion; and program delivery.

2.8.1 Program Goals

Issues relating to the effectiveness of the program's goals, as well as the goal-setting process, were discussed with the stakeholders through the interview process. DOER is responsible for setting the goals for the program year, reviewing and approving each provider's implementation plan on an annual basis, and monitoring during the course of the year (and at year-end) whether these plans are met. Summarized below are the principal findings from various stakeholders regarding the program's goals and the goal-setting process:

- Many of the **DOER staff** interviewed during this evaluation agreed that the program goals should not simply be a "count" of the number of audits completed. In this sense, these DOER staff are suggesting a *performance-based program design* that provides for better follow-up once audits are completed. Ultimately, this suggestion reflects desire to change the way "success" is measured for this program (i.e., goals). **These DOER staff would like to see the program changed to incorporate a mechanism that ties performance measurement to the extent of energy savings resulting from an audit.** Providers could be required to submit proposals that would specifically indicate how they would obtain and measure energy savings.
- Most **gas utility** representatives who had experience with the goal-setting process indicated that, while there were problems in the past, they now work in a cooperative manner with DOER to find common ground when finalizing their goals. **These gas utility representatives were split, however, with regard to their opinions about how "seriously" the goal-setting process is taken.** For example, a few characterized the process as "frivolous," in that goals are set by either increasing or holding constant achievement levels from the previous year, and "meaningless," because there are no penalties for failing to meet goals and no rewards for achieving them. Others, however, take meeting their goals very seriously. Yet, these representatives questioned the cost-effectiveness issues as well as the customer service issue if, in fact, audits are being "sold" (via telemarketing) to customers who may not really want them or need them in an effort to meet goals.
- **Electric utility** representatives had little to say about program goals, or the goal setting process in particular, other than a few mentioning that **goals are typically set too high and should be reduced to more realistic and attainable levels.**

- **Most representatives from municipal utilities feel that program goals have become inappropriate, especially for their service territories.** These representatives were concerned that their markets have been "saturated" and that, at this point, they are primarily providing multiple audits and audits to people who want them for the "wrong" reason. For example, when someone calls with a high bill complaint, they are all too quickly sent an auditor, when that might not be the best response for that customer.
- **Generally, representatives from vendor management regard the goal setting process as adequate and the targets established by DOER as "fair." However, many objected to the general concept of "goals" at this point in the program's life cycle.** When the program began, utilities tended to be somewhat "unenthusiastic," and therefore, goals made sense. Now, utilities have provided ECS audits to their customers for many years, and realize that customers value the service, so goals may not be necessary.

  In addition (as mentioned above under the discussion of the effectiveness of program coordination, Section 2.6), at least one vendor indicated that the goals issue negatively effects their ability to coordinate different programs. As stated above, the internal "inertia" that exists to meet "your goal" presents challenges to improving coordination among vendors and providers.

- Representatives from the **DPU** reported that, within the context of quality program operations, there is too much emphasis placed on simply getting the audits completed. **These representatives feel the correct emphasis should be on quality services, rather than quantity.**
- **One of the energy efficiency advocates suggested that new regulations should state program goals in terms of market transformation,** and as well bring in this concept as the underlying objective and intent of the program.

2.8.2 Utility Implementation Plan (UIP)

Stakeholders were also asked about the Utility Implementation Plan (UIP) process. The UIP is a comprehensive document that must be submitted annually by all providers. The UIP contains detailed descriptions of each step of each aspect of the ECS program as planned for implementation by the provider. **Generally, criticisms of this document were offered by nearly every category of stakeholder interviewed, with the harshest of which coming from the gas utility representatives (who, generally, act as their own providers and are, therefore, ultimately responsible for submitting this document).** Among all stakeholders, the UIP was regarded negatively for three primary reasons: (1) it's size, (2) it's value, and (3) it's effect of innovation and creativity. Most agree that the UIP is too large and resources (time and money) required to prepare it could be better spent on other aspects of the program delivery. Similarly, many feel that it has little value in that only "creeping changes," i.e., changes from the prior year's UIP, are included. And, perhaps most importantly, some feel that the UIP process stifles creativity and serves as somewhat of a disincentive to legitimate program improvements.

For example, putting a new item in the package requires a great deal of work and takes a long time - so much so that some may not even attempt it.

2.8.3 Budget Review and Approval

As a formal role in ECS, the DPU is required by legislation to review and approve all the budgets submitted by investor-owned utility providers in a process that includes hearings and full discovery. Few stakeholders offered comments on this aspect of the program. For example, **some DPU staff felt that their role is somewhat hampered because they are not required, via legislation, to review utility ECS plans, but are required to review their associated budgets.** As such, they feel somewhat "between a rock and a hard place" because they may not always have the information they require to make decisions regarding budget approvals.

The DOER staff interviewed regard the budget review and approval process as fairly "onerous," however, it is currently required by the statute. Utility representatives, also recognizing that the hearing format is legislated, agreed that the process is somewhat tedious and, at times, adversarial. Some investor-owned utility representatives feel that the process should be streamlined to resemble the less formal process used for DSM budgets (which, they add, involve significantly more money).

2.8.4 Role of DOER as Program Administrator

The role of DOER as ECS program administrator was specifically discussed with each of the stakeholders interviewed through this evaluation. As the state government's energy policy arm, DOER is responsible for formulating and implementing state energy policies, including the ECS program. With respect to ECS, DOER staff administer the program, i.e., they ensure that the legislative and regulatory requirements of the program are being met by providers and utilities. As mentioned above, while not directly involved in day-to-day program operations, DOER sets goals for the program, reviews and approves each provider's implementation plan on an annual basis, and monitors whether these plans are being met.

Generally, there were mixed opinions among the stakeholders with respect to the role of DOER as ECS program administrator. Summarized below are some of the more noteworthy findings from each group:

- Most of the **DOER** staff interviewed feel that there are some **real and perceived problems** associated with their role as program administrator. However, they also noted that current legislation and/or regulations require a high level of reporting and oversight.
- **Investor-owned gas and electric utility representatives had mixed opinions of DOER staff's performance as the program administrator.** Several said that there was "way too much administration for a simple program," but nearly as many said that DOER's work in this area was not problematic.

- **Most municipal utility representatives who had opinions about DOER's administration of the program were not satisfied with their performance.** One said that they "overzealously review minutiae" and that, "each year, the requirements get more prescriptive and burdensome."
- **Among vendors, there was a general split in opinions regarding the overall effectiveness of ECS program administration.** While staff of one of the vendor firms feel that DOER oversight is at the right level, staff of the other vendors did not agree. This latter group felt ECS program administration was quite ineffectual, with specific references to communications bottlenecks, and overly burdensome and inappropriate regulations and reporting requirements.
- Generally, representatives from the **DPU staff interviewed regarded DOER's role as program administrator as adequate.**
- **Energy efficiency advocates offered few opinions of DOER's role as administrator of the program,** although one representative from this group pointed out that DOER may be unfairly criticized for their role in enforcing the statute.

2.8.5 Role of Public Advisory Committee (PAC)

As required by statute, a DOER appointed Public Advisory Committee (PAC) meets quarterly to advise DOER on ECS program administration and policy. The PAC is afforded the opportunity to review and comment on state and individual utility plans for implementing the ECS program, provide input on policy decisions affecting the ECS program, and act as a forum for comment on particular issues as they arise. The Committee also advises the Commissioner of the Division of Energy Resources of the effects of ECS policies on various constituent groups.

The legislation requires that diverse groups should be represented on the PAC, including ECS program operators, home heating suppliers, savings and commercial banks, the residential renewable energy resource industry, energy retrofit contractors, registered professional engineers with retrofit and audit experience, the Massachusetts Community Action Program Directors Association, the realty profession, tenant senior citizen and consumer advocacy groups and the Massachusetts Department of Public Utilities. Prior to the beginning of FY95, DOER reached out to recruit PAC nominees from some twelve organizations and, as a result, the PAC gained six new members representing: energy retrofit contractors, the residential renewable energy resource industry, the realty profession, senior citizens, consumer advocacy groups, and a residential engineer with retrofit and audit experience.

During the stakeholder interview discussions, the role of the PAC was specifically addressed with a number of groups. For example, most **investor-owned gas and electric utility** representatives regarded the meetings with the PAC as a **useful forum** for the sharing of information and ideas. However, some remarked that **"public" is not really being represented** in this forum due to the predominance of providers and "bureaucrats" typically in attendance at these meetings.

2.8.6 Program Funding

Issues related to program funding were brought up by several of the stakeholders interviewed. Most often, these issues involved the inequities (or, at least, perceptions of inequities) involved in the way the current program is funded. For example, **investor-owned gas and electric utilities** protested the **inequity of having oil companies relieved of the burden of sharing in the financing of the ECS program.** In addition, one **gas utility** representative and one **DPU** representative shared opinions that the **residential ECS program should not be supported by commercial customers,** who are also paying a surcharge that is used to fund the program. Finally, although not specifically related to these two themes, some of the representatives from the **low income advocates** group recommended that, regardless of how program funds are collected, **the *allocation* of such funds should continue to be fuel blind.**

2.8.7 Promotion and Marketing

The stakeholder interviews also addressed a number of issues relating to the effectiveness of program promotional and marketing efforts. **Generally, both utilities and vendors regard the current program's marketing and promotional efforts as adequate. Many cited a recent positive change in the regulations concerning the distribution of program announcements (bill inserts) offering the ECS program.** Previous regulations had required that they be distributed during the first three months of the year. This caused significant backlogs which was generally disruptive to operations. Most utility staff mentioned that they were please that they are now allowed to announce the program over 12 months. Almost all vendors agreed that the change in the program's mail-out schedule has improved the effectiveness of this delivery channel. For example, this change has helped them maintain the workforce and better manage program backlog prior to and during the peak heating season.

Vendors also commented that, in some parts of the state, program marketing efforts have been so effective that there is a constant pattern of over-subscription. In these areas, vendors felt this marketing vehicle was indeed effective in getting the message out to all potential participants - including low-income customers and tenants. Some of the electric utility representatives, however, felt new marketing strategies may be required. These representatives indicated that, because the program has been marketed the same way for years, new strategies may be needed to continue to attract customers with future programs. (No specific suggestions were offered for new marketing strategies.)

2.8.8 Customer Requests, Screening, and Scheduling

ECS customer request, screening and scheduling processes were was **generally regarded as adequate** by all of the stakeholders who had experience with these aspects of the program. However, there were some **concerns raised about the extent of repeat or duplicate customers who are receiving ECS audit services.**

2.8.9 Quality Control

ECS involves a reporting requirement that addresses quality control issues. Specifically, DOER requires ECS utility providers to periodically report on their activities to quality control the vendors and auditors delivering the ECS service. The quarterly reports provide detailed information on the review of individual auditor performance review and programmatic services, and report on plans for training activities.

A few representatives from **investor-owned gas and electric utilities expressed an interest in learning what DOER does with the information it collects through this process.** At least one of these representatives (from a gas utility) suggested that this process is somewhat misdirected. That is, instead of looking at what benefits the customer is (not) receiving, the quality control process focuses on whether the provider is meeting the requirements of their UIP.

In addition, **a few vendors questioned the appropriateness of DOER's quality control efforts.** For example, one vendor representative felt that DOER's level of oversight with respect to its quality control requirements was "inappropriate" for a small vendor with only a handful of auditors. Another vendor indicated that DOER's role in this process was inappropriate (quality control requirements should be imposed by the utilities, not the DOER).

2.9 What is the Need for Future Evaluation of the Multifamily Building Program?

In order to address the issue of whether or not their is a need to conduct a future evaluation of the Multifamily Building Program (MFB), stakeholders were asked about their general reactions to the program. There were only few stakeholders with specific interests and/or involvement in MFB, and a summary of the interview findings is presented below:

- While at least one group of stakeholders regard **the MFB program as a very good service for commercial customers who manage and/or own multifamily buildings, this group also feels that it may not be addressing the needs of tenants - which was its original intent.** In addition, if continued in its current form, "participants" should be required to pay a significant portion of the cost of the program, because, as indicated by one of the individuals interviewed, "many large property management companies in Boston are saving thousands of dollars and investing nothing because of this program." In this sense, these staff noted that the MFB program has evolved into a "commercial giveaway" - albeit a very well-managed, quality one.
- Another group of interested/involved stakeholders felt that **MFB is a technically-sound and well-run, albeit costly to implement and potentially reaching saturation levels (especially among larger building complexes).** Opportunities for smaller buildings still exist, according to this individual, although it is more difficult to attract representatives from this group into the program (due, at least in part, to the limited resources available from/to smaller building owners). Future programs should provide comprehensive services to the low-middle income

sector. In this way, the program would work more closely with these customers, and put them in touch with the resources they need to move toward measure implementation.

- Another group of stakeholders offered additional observations and insight with respect to the MFB program:
    - **There may be increased interest in the MFB program in the coming years**, due to the recent "slow down" of utility DSM programs serving multifamily properties.
    - **Large complexes seem to be the most likely to implement MFB recommendations** and, because more money is a stake with the improvements and the expected savings, there is a perception that larger multifamily complexes are more likely to implement the recommendations without financing.
    - **Building managers and owners, the beneficiaries of program services, should be required to pay the full cost of the audit.** Previously when there was a fee for the audits, the program still reached goals. At that time, the fee was $25-$100 while the audit cost was about $200-$300.
    - A **new release of the audit software should be developed** to incorporate some of the latest HVAC and water heating controls.

Based on this feedback, it may be necessary to consider the need for modifying the MFB program objectives and funding mechanisms. If the current program is intended to serve tenants, it is unclear how well their needs are being met while, according to stakeholders, it is somewhat unlikely that tenants receive any direct benefits. In fact, most of the benefits accrue to the building owner and, as such, if the program is to continue its objectives should be modified. The recommendation, therefore, is to assess the underlying objectives of this program and, in light of these objectives, modify design and delivery elements accordingly and consider modifications to the program funding mechanism to eliminate inequities.

2.10 What is the Current Assessment of ECS and How Should it be Changed to Better Meet the Changing Needs of Massachusetts Residents?

This section addresses the final two objectives of this evaluation, namely:

- Does the ECS program as presently operated achieve the goal of energy conservation and energy actions in the most efficient manner possible? If not, what can be done to facilitate better results?
- How should the ECS program be changed to best meet the energy efficiency needs of Massachusetts residents throughout the transition to and after the restructuring of the gas and electric utilities?

Two principal data sources were used to address these important questions. First, the stakeholder interviews (discussed in part above) were used to gather industry opinions regarding the current need for ECS today, whether short-term changes might bring about more efficient and effective delivery, and suggestions for modifying the program's

objectives, design, delivery, and administrative/regulatory elements to best meet the changing needs of Massachusetts residents in the future.

Second, a needs assessment survey of 597 Massachusetts residents was conducted to:

- Identify the type and extent of current need among the general residential population for energy efficiency services;
- Assess interest among the general population in various service design and delivery options that might best meet these needs; and
- Determine preferences for service providers, as well as required roles for both the state and utilities.

The results of this evaluation indicate general support, among stakeholders and the general population, for the provision of some form of energy efficiency service to Massachusetts residents. However, most stakeholders agreed that ECS, in its current form, does not adequately meet the energy efficiency needs of residential customers, both today and in the future. Many options for change - for the short, medium, and long term - were suggested during the stakeholder interview process. This following sections present some of the relevant findings from stakeholders, supported as appropriate with the results of the ECS participant and needs assessment surveys.

2.10.1 Program Goals and Performance Measurement

Several stakeholders offered suggestions for updating the program's performance measurement criteria. The extent to which any of these suggestions should be implemented in the short-term, versus the medium and/or long-term, however, was debated. For example, as discussed above under Section 2.8, **the DOER staff interviewed suggested a *performance-based program design* which would incorporate a "mechanism" for tieing performance measurement to the extent of energy savings resulting from audits.** No specific suggestions were offered by the DOER staff interviewed, however, regarding the specific method for implementing this change, other than to suggest that providers could be required to submit proposals that would specifically indicate how they would obtain and measure energy savings.

Another possible means through which to tie performance measurement objectives into the program design, as suggested by a few of the ECS energy auditors interviewed, would be to **link an auditor's base compensation on the amount of energy savings recommended/ realized (as opposed to the number of audits completed).**

Finally, several of the representatives from investor-owned gas and electric utilities suggested that **the program's performance should be "held up" to the standards of cost-effectiveness that are used to evaluate their DSM programs.**

However, performance-based program designs, such as those where goals are tied to realized energy savings, are particularly challenging to implement. A number of factors, including (1) the cost involved in direct impact measurement, (2) the

uncertainties surrounding the appropriate attribution of program "influence," and (3) the staggered nature with which participants tend to implement measures, all combine to illustrate the many challenges associated with performance-based designs that are tied to energy savings objectives. It is not clear how, given the current program administration (or even vastly streamlined forms of program administration) ECS would accomplish these objectives without placing significant administrative and reporting burdens on DOER, utilities, and vendors.

Moreover, without significant change to the current design to bring about increased rates of measure installation and/or behavioral modifications among the participant population, it does not seem realistic to consider such potentially costly measurement objectives in light of the current program's performance in this regard. (Although direct impact measurement was not attempted through this evaluation, the estimates of energy savings that were attributed to ECS as a result of the impact analysis are modest.)

2.10.2 Marketing Emphasis

Stakeholders shared some of the general opinions regarding segments of the market that may have been under served by the current ECS program. While there was widespread (but not universal) agreement that the low-income sector may be under served by ECS, other potentially missed segments included: the elderly population, the moderate income (or "working poor" sector, tenants, non-English speaking segments, oil heat customers, and small "mom & pop" businesses). In addition, it should be noted that most of the utility representatives felt that all segments of the residential population are being adequately served through the current program. In fact, some stakeholders (mostly investor-owned electric and municipal utility representatives) felt that certain segments were "over-served" (i.e., implying that multiple audits are being provided to these segments and/or some segments may have already been saturated with the program's services). While this may be a widely held belief among the utility stakeholders, the results of the needs assessment survey indicate that only 11% of the participants through October 1996 received more than one audit (based on customer self-reported data), and some of these participants were believed to have been "legitimate" repeat participants (i.e., they received their first audit several years ago and then returned to participate in the program again, more recently).

The principal objectives of the needs assessment survey were to:

- assess the extent to which there is remaining need for and interest in energy efficiency services among residents of the state, and
- identify specific segments of the population that would be appropriate targets for the current and future ECS services.

The results of the segmentation analysis completed as part of this survey effort suggest that future programs should incorporate more targeted marketing efforts to attract participation from two distinct segments of the residential population.

The first group was identified as "those with the greatest need and interest in assistance" for improving the energy efficiency of their homes. We have named this group **"Help Wanted (and Needed),"** and it is generally concluded that this group may represent an **appropriate target for the current program.** While this group represents, overall, 37% of the general population, certain characteristics of this group may preclude cost-effective delivery of the current package of ECS services to this group (see discussion below).

The second group was categorized as those who may or may not have the "greatest need," but have otherwise shown significant interest in assistance to help them improve the energy efficiency of their homes. This group could be targeted with **new, specialized services** that can address their somewhat different needs in the most cost-effective manner. The characterization of this group, as well as a discussion of the services they are most interested in, is presented below in Section 2.10.3, Design Options.

This section identifies important characteristics of the first target group, "Help Wanted (and Needed). Exhibit 2-2 compares these characteristics to the general population.

As shown:

- **Housing Stock/Ownership:** While still predominantly single family homeowners, there is a higher than average percentage of **single family renters and multifamily renters** in the target segment.

Exhibit 2-2

Selected Characteristics of the "Help Wanted (and Needed)" Target Group

	Target Group: "Help Wanted (and Needed)" (n=209)	**General Population (n=597)**
Housing Stock/Ownership:		
SF Owners		
SF Renters	56%	72%

MF Owners	30%	18%
MF Renters	4%	3%
	10%	7%
Average Number of Years of Residency in:		
Current home	11	14
Massachusetts	32	36
Average Age of Home:	55	50
Space Heating Fuel Type:		
Oil	44%	46%
Gas	39%	39%
Electric	12%	11%
Other	5%	4%
Average Annual Per Capita Household Income [1]:		
<$11,000	25%	20%
$11,000 to < $18,000	23%	24%
$18,000 to < $30,000	29%	31%
$30,000 +	23%	25%
Average Annual Household Income:	$54,000	$55,000

[1] "Per capita" income was derived from responses to two questions in the needs assessment survey: (1) number of household occupants, and (2) annual household income in 1995 before taxes and after deductions. Annual household income was recorded in ranges, and the mid-point of each range was used to calculate the average annual household income level and

the average per capita income level.

- **Length of Residency and Age of Home:** While this group would not be characterized as "new to the state," their **residency in Massachusetts is somewhat shorter** than the total population, as is **occupancy in their current residence.** Additionally, their homes are somewhat older than that reported by the total population.
- **Space Heating Fuel Type:** Generally, the space heating fuel characteristics of this group do not differ significantly from the general population. However, when one looks only at **Massachusetts residents who use electricity for space heating, nearly half are represented in this group**. This finding is statistically significant at the 90% confidence level, and may suggest that efforts to target the "Help Wanted (and Needed)" segment with future programs may result in serving a significant portion of the electric heat market. However, since the electric heat market is so small in comparison to other fuel markets, special design considerations to focus on the specific needs of electric heating customers may not be appropriate.
- **Household Income.** While the average household income of members of the target group (as reported by respondents) does not significantly differ from the average income among the general population, there is one notable difference when comparing per capita income. That is, **households reporting less than $11,000/year in per capita income** are somewhat more likely to be represented in this group as compared to the general population. Again, this may suggest that efforts to target the "Help Wanted (and Needed)" segment with future programs may result in greater participation from low-income households. While the low-income sector represents a larger portion of the total target segment (as did the electric heat sector), it is not clear whether the current package of ECS services could be cost-effectively targeted to low-income residents because of the lack of financial assistance available to participants to encourage measure installations.

2.10.3 Design and Delivery Options as Discussed with Stakeholders and Customers

Both the stakeholder interviews and needs assessment survey results addressed a number of important issues relating the development of new service design and delivery options. Presented first is a summary of the key findings from the stakeholder interviews, followed by a discussion of the needs assessment survey results, which lends support and additional insight to the stakeholder findings.

Stakeholders offered a host of other changes they would like to see in future programs. However, most agreed that there were certain aspects of the current design that should remain. For example, **the program's education, information and customer service elements should continue to be included in the program.** In addition, the **option of obtaining custom "benefit/cost analysis" of energy efficiency options** via on-site visits as well as the personal, customer services (e.g., "hand-holding," questions & answers, etc.) provided through these on-site audits, should still be offered.

As mentioned earlier in Section 2.4, one stakeholder from an investor-owned gas utility mentioned that these types of programs are **important to improving the "baseline" awareness** of the importance of energy efficiency among the general population and, should the extent of DSM programs available to residents be reduced, an "ECS-like" program would be the only service left for residential customers. In addition, many non-utility stakeholders viewed the continuation of an ECS-like service as one of the **only means to deliver "unbiased" energy efficiency education** to customers.

Overwhelmingly, however, stakeholders agreed that if the ECS program is to remain a viable option, it will need to be designed with greater flexibility in audit delivery, incorporate new specialized services, and place more emphasis on measure installations - as summarized below:

- **Flexible Design and Audit Delivery.** Stakeholders felt that the audit process should be modified to be more flexible. Suggestions of specific changes that would make the program more "flexible" were infrequently offered, except from one group of stakeholders who advocated a **more flexible menu** of service offerings, such as full audits, partial audits, and information services, as well as **delivery options** including "self-audits" and general information dissemination to "do-it-yourselfers" via such avenues as the Internet, brochures, and an 800 customer service number. The general intent among all stakeholders was to make the audit process more focused more on customer needs.
- **New Specialized Services.** Several stakeholders remarked that there is currently a rather limited remaining demand for energy audits, as provided through ECS. Instead, **many stakeholders offered suggestions for new, specialized services that could simultaneously address wider and more targeted customer needs,** as well as having the flexibility of being updated to reflect changing market conditions. Some of the ideas offered in this regard include:
    - provide additional services for the oil heat customer (i.e., inspection services for oil space heating equipment)
    - "bundled" services, which incorporate education and information services as part of other utility service offerings (e.g., energy efficiency services offered as part of "new connections" package,
    - provide tax credits for homeowners making energy efficiency improvements
    - incorporate "market transformation" services to introduce new technologies (such as geothermal heat pumps, solar hot water heaters, etc.)
    - vehicle for joint/regional initiatives or pilots
    - allow recommendations for fuel-switching
- **Emphasis on Measure Installations.** While few stakeholders offered specific recommendations, **many advocated an increased emphasis on measure installations. Adding a financing component** was seen by many as a means to this end (see bullet below). In addition, some stakeholders supported program design and delivery changes that would incorporate "follow-up" with participants to encourage measure installations (although, again, few specific recommendations regarding the nature of these follow-up activities were offered).

- **Add Financing Component.** In the short-term, there was widespread (nearly unanimous) support for **incorporating some linkage to (or formal addition of) financing options to the ECS program** to encourage the installation of energy efficiency measures. Financing options should be provided at low-interest or no-interest to qualified customers. Several stakeholders offered specific suggestions of how financing options could be best incorporated into the program:
    - Team up with heating system dealers, who already offer financing packages, to encourage special packages or bundled services for high efficiency installations
    - The state should encourage an "energy efficiency loan pool" within the financial sector and/or issue bonds to develop funds to be used to finance energy efficiency improvements
    - Make financing available to certain income-qualified residents by freeing up money through reductions in (a) administrative requirements (and associated costs) and (b) the number of audits completed each year
    - Institute private-sector financing program, similar to the HEAT loan program, that would provide:
        - audits, work orders, contractor arranging, and contractor supervision
        - monthly loan payments (principal only) that are lower than or equal to energy savings
        - program funding to cover interest on loans
        - charge fee for initial audit (which can be applied to installation cost) to attract truly motivated participants
- **Incorporate Fees for Service.** While there was some disagreement among the stakeholders regarding requiring "fees for service" within the current ECS program, overall **most agreed that these fees should be implemented in the short-term.** Those in agreement cited that fees for service would improve the current "cost equity" of the program, encourage perceptions among the population that ECS services have "value," and enhance the "credibility" of the program among potential participants. While few disagreed that fees for services should be incorporated, those stakeholders who did not support this program change cited their belief that such fees would negatively impact participation levels and program costs (e.g., administration of small fees would be too costly to implement).

  Generally, stakeholders in support of fees for service advocated a small ($10-$30) fee for on-site services, as well as competitive market fees for certain add-on services (e.g., "handy-man" services to complete DMI installations). In addition, many advocated fee waivers for certain segments (i.e., low-income) and the possibility of applying the amount of the fee paid toward the cost of actual measure installations.

As summarized above, stakeholders offered a host of suggestions for modifying ECS to allow for a more flexible audit delivery in which new, specialized services and greater emphasis on measure installations would be provided. The needs assessment survey was

designed to address the extent of customer interest in some of these targeted and specialized service options, as well as a number of related issues. These results are presented in the following sections, and organized as follows:

- General beliefs regarding "fees for service" and "willingness to pay"
- Likelihood of using selected energy efficiency services
- Preferences for energy efficiency service delivery methods
- Perceptions regarding selected energy efficiency needs
- Awareness of specific actions needed to improve energy efficiency
- Barriers to energy efficiency measure installations

Perceptions Regarding "Fees for Service" and "Willingness to Pay"

During the needs assessment survey, residents were asked about their general beliefs regarding whether or not residents who use energy efficiency services (i.e., provided through state and/or utility programs such as ECS, DSM, etc.) should pay fees for these services. **From the analysis of this data, it can be concluded that a significant portion of the general population believes in the concept of "fees for service."** While many (40%) feel that residents using the services should not have to pay fees for these services, a slightly greater percentage (42%) indicated their belief that residents using these services should pay a fee covering at least part of the cost of these services. Another 18% advocate a policy were residents using these services pay fees that covers the full cost.

There was little difference in these findings across participants and nonparticipants, other than to note that a somewhat greater portion of nonparticipants (as compared to participants) feel that residents using these services should pay fees covering the full cost (21% v. 14%). Although each group does not significantly differ from the average (18%), this may indicate two things: (1) some nonparticipants, who are unlikely to take part in future programs offering energy efficiency services, may feel more strongly that those who do use these services should pay the full cost through fees, and/or (2) participants, who have previous experience using similar services, may be somewhat reluctant to pay the full cost via fees for the services they may recall receiving through prior programs.

In addition, there is some indication of "willingness to pay" for ECS audit services among the general population. That is, about 35% of the general population would be willing to pay at least $30 for audit services, such as those provided through ECS. About one quarter (25%) would pay $30 and another 10% would pay up to $60. Overall, the percentage is somewhat higher for residents who reported that they had already participated in ECS, as compared to nonparticipants. That is, about half (52%) of previous participants would have been willing to pay at least $30 for the services they received, whereas only 22% of nonparticipants are currently willing to pay at least $30 to participate. These findings are summarized below in Exhibit 2-3.

These findings clearly indicate that (a) a significant portion of the general population would be willing to pay something to receive ECS services, and (b) some previous participants have placed a "dollar value" on the services they received.

Specifically, 38% would have paid $30, and another 14% would have paid $60. It should be noted that, due to limitations on the survey interview length, only three choices were given to survey respondents with respect to their willingness to pay: $0, $30, and $60. It is possible, therefore, that some of the respondents who indicated that they would participate in ECS if offered for free might have been willing to pay something in between $0 and $30, further increasing the significance of these findings.

Exhibit 2-3

Willingness to Pay for ECS Audit Services

	Overall	Participants	Nonparticipants
Not interested in participating, even if free	27%	0%	47%
Participate only if free[1]	38%	48%[2]	31%
Willing to pay $30 to participate	25%	38%	15%
Willing to pay $60 to participate	10%	14%	7%
Base	565	236	329

[1] Due to limitations on the survey interview length, only three choices were given to survey respondents with respect to their willingness to pay: $0, $30, and $60. It is possible, therefore, that some of the respondents who indicated that they would participate in ECS if offered for free might have been willing to pay something in between $0 and $30.

[2] Some of these participants may have, in fact, paid to participate in ECS when fees for service were included in the program in prior years.

The findings regarding residents' general beliefs on "fees for service" are slightly inconsistent with (although not significantly) the findings presented above in Exhibit 2-3 regarding the extent to which residents (who are interested in participating in programs such as ECS) are willing to pay fees for services received. For example, of the 565 respondents included in Exhibit 2-3 (above), 73% would be willing to participate in ECS. Of these 412 respondents, about 52% would be willing to participate in ECS only if offered free-of-charge, and 48% would be willing to pay a small fee ($30-60). However, as reported above, about 60% of the general population feel that, in general, "fees for service" are appropriate.

Therefore, it may be concluded that residents' general beliefs about fees for service may not truly reflect their willingness to pay for services (when they are interested in taking advantage of them). However, these two findings are not significantly different from one another to over-ride the general conclusion that there appears to be (a) a significant belief in fees for services among the general population, and (b) a significant willingness to pay for such services among the portion of the population who is willing to use these services.

Interest in Various Energy Efficiency Services

The survey also addressed the level of interest in various energy efficiency services across the general population, as well as within specific segments. Specifically, all respondents were asked about their likelihood of using the following variety of energy efficiency services:

- Information about how to buy and install energy saving measures and equipment
- Assistance in finding and contracting with reliable companies who install energy saving measures and equipment
- Financing assistance for improving the energy efficiency of the home
- Mortgages that provide favorable terms for homes that are more energy efficient
- Customized energy analysis of the home

Exhibit 2-4 presents the results of these questions. As shown, **generally respondents indicated that they were most likely to use the "how to" information service and the customized audit service. A significant portion also indicated that they were likely to use the contractor arranging, financing, and favorable mortgage services.** However, a greater percentage were unlikely, as opposed to likely, to use these services.

Exhibit 2-4

Interest in Various Energy Efficiency Service Offerings

Likelihood of Using Energy Efficiency Services	Percent of Population Reporting:				
	Very Likely	Somewhat Likely	Neither Likely nor Unlikely	Somewhat Unlikely	Not at all Likely
"How to" information	25%	29%	7%	10%	29%
Contractor assistance	16%	26%	6%	14%	38%

Financing assistance	22%	19%	6%	11%	42%
Energy efficient mortgages	26%	19%	6%	7%	42%
Customized audits	27%	28%	6%	8%	30%

For nearly all service types, there was little difference between the level of interest reported by specific segments of the population and the overall level of interest reported by the general population as a whole. Summarized below, by service type, is a discussion addressing differences in specific segments of the population:

- **Information Services** - Most segments of the population were just as interested as the general population as a whole in information services. A few findings regarding the segments of the population who were <u>least likely</u> to be interested in information services may shed some light on appropriate targeting approaches (findings that are significant are marked with an "*"): electric heat, multifamily renters, multifamily home owners, lower-income households (*), and current nonparticipants (*).
- **Installation Assistance Services** - In addition, most segments of the population felt about the same as the general population as a whole with respect to their interest in installation services. However, certain segments were more interested than others (significance noted as "*"):
    - <u>most interested</u>: other heating fuels (e.g., propane, wood), moderate-to-high per capita income group(*), and previous ECS participants(*)
    - <u>least interested</u>: oil heat(*), electric heat, multifamily renters, multifamily owners, moderate-to-low per capita income(*), and current nonparticipants(*)
- **Financing Assistance Services** - Generally, segments of the population who were interested in financing assistance services did not differ from the average resident. There were two segments who were significantly different, however, in that they were the least likely to be interested in financing assistance services: single family renters(*), and high per capita income households(*). In addition, customers who are most interested in financing options also represent customers who (at least perceive) to have the greatest need for and interest in making energy efficiency improvements. And, those who are <u>not</u> interested in financing options are also likely to (at least perceive themselves to) have virtually no need for energy efficiency improvements and/or no interest in making energy efficiency improvements. **Therefore, it can be concluded from the results of the survey that, if appropriately targeted, financial assistance services may be effective in encouraging energy efficiency improvements among segments of the population who have the greatest need <u>and</u> the greatest likelihood of "taking action."**

- **Energy Efficient Mortgages**. There was only one distinct segment that was significantly different from the general population with respect to their interest in energy efficient mortgages - residents who are currently renting single family homes.
- **Customized Energy Audits.** Generally, few specific segments of the population differed from the average resident with respect to their interest in customized energy audits. However, certain segments were more interested than others (significance noted as "*"):
    - most interested: gas heat(*), single family renters, and moderate per capita income(*).
    - least interested: electric heat, multifamily owners, and high per capita income(*).

Preferences for Service Delivery Methods

The needs assessment survey also addressed preferences for delivery methods that could be used to offer the various energy efficiency services previously described (e.g., "how to" information, installation/financial assistance, customized audits). Specifically, respondents were asked to "assume" that these services were made available to Massachusetts residents, and to indicate which delivery methods they would be likely to make use of. The specific delivery methods included in this question series included: 1-800 telephone number, in-home delivery, computer access, libraries, retail stores, radio/television programming, and videos.

Exhibit 2-5 presents the results. As shown, **residents appear to favor delivery of energy efficiency services through retail outlets, in-home delivery mechanisms, 1-800 telephone numbers, and general mass media programming.**

Exhibit 2-5

Preferences for Various Delivery Options

Energy Efficiency Service Delivery Methods:	Percent of Population Reporting Delivery Preference:
Retail stores	69%
In-home delivery	68%
1-800 telephone number	63%

Radio/TV programming	61%
Libraries	46%
Videos	44%
Computer access	38%

Specific segments of the population who had preferences for delivery methods that were significantly different (at the 95% confidence level) than the general population as a whole are summarized below (with significance noted as "*"):

- **Retail Stores.** Only one segment differed significantly from the general population with respect to their interest in delivery of energy efficiency services through retail locations. Previous ECS participants(*) were more likely to report their preference for this delivery method as compared to the average resident.
- **In-Home Delivery**. Few trends were noted across different segments of the population, except that single family renters(*) preferred this delivery method much more frequently than the average resident.
- **1-800 Telephone Number.** A wide variety of segments preferred this delivery method more frequently than the average resident. These include (significance noted as "*"): electric heat, multifamily renters, single family owners(*), low per capita income(*), and previous ECS participants(*).
- **Radio/Television Programming.** There was a clear and significant trend across household per capita income levels in that as income levels increased, interest in this delivery method decreased. Residents using oil heat were least likely to report this as a preferred delivery method, whereas residents using "other" fuels (e.g., propane, wood, etc.) were most likely to prefer this method. Previous ECS participants(*) preferred this option more frequently than the average resident.
- **Libraries.** There was similar trend across household per capita income levels with respect to interest in this delivery method. As household income levels(*) increase, interest in this option decreases. Although not significant, electric heat customers preferred this option less than the average resident, and customers using "other" fuels (e.g., propane, wood) preferred this option the most.
- **Videos.** Again, as household incomes(*) increase, interest in video delivery options decreases. Single family renters(*) were also more likely to prefer these methods as compared to the average resident, as were customers using "other" fuels.
- **Computer Access.** The trend in income reverses for this delivery method. That is, as household per capita income levels(*) increase, interest in this method increases. In addition, gas heating customers(*) prefer this method more often than the average resident.

Energy Efficiency Service Design Considerations

The needs assessment survey addressed residents' perceptions regarding the energy efficiency of their home and major end-uses. In addition, their awareness of specific actions they could take to improve the energy efficiency of their home was also explored. Exhibit 2-6 presents a summary of the key findings from these survey questions. As shown, **for some measures there seems to be a rather low perception of "need" (e.g., energy efficient heating systems). For others, the need for improvement is more evident, yet "awareness" of specific actions to take is relatively limited.**

Exhibit 2-6

Perceptions Regarding Energy Efficiency Needs

and Awareness of Specific Actions Needed

	No Perceived Need for Energy Efficiency Improvement:	**Perceived Need, Yet Unaware of Specific Actions Needed**	**Perceived Need and Aware of Specific Actions Needed**
Attic insulation	39%	42%	19%
Energy efficient windows	49%	36%	15%
Energy efficient heating system	66%	29%	5%
Energy efficient lighting	52%	31%	17%
Base: 597 respondents (General Population)			

The needs assessment survey also addressed what "barriers" are facing residents who are aware of the specific actions they should take to improve the energy efficiency of their homes, but have yet to take them. The top three barriers to installing measures (among the segment of the population that has identified specific actions they can take) are: **(1) cost** (37% of 423); **(2) not a priority** (22%); and **(3) landlord/rental barriers** (13%).

Taking into account perceived needs, awareness, and barriers, three distinct segments of the population have been defined according to the level of service(s) with which each segment might be most appropriately targeted:

- **Specialized Implementation Services**

    - This group contains residents who perceive to have a need for energy efficiency improvements, are aware of the specific actions they need to take, yet have not taken any specific action to-date. There might be three types of specialized implementation services offered to this group:
        - *financial assistance services:* residents who report "cost" as a major barrier to measure adoption
        - *installation assistance services:* residents who report "non-priority" as a major barrier to measure adoption
        - *rental property assistance services:* residents who report "rental property" barriers to measure adoption
- **Limited Education and Implementation Services**
    - This group consists of residents who perceive to have a need for energy efficiency improvements, but are not aware of the specific actions they need to take. This group might be targeted with limited education and implementation services to increase awareness. As awareness is increased, some within this group might be best targeted with the specialized services described above (depending on the barriers they face once they are made aware of what their options are).
- **Limited Outreach and Information Services**
    - The remaining group consists of residents who do not perceive to have a need for energy efficiency improvements. Since it is unlikely, that in all cases, residents "perceptions" regarding energy efficiency needs are accurate, it is unclear what should be done to address this remaining (yet undetermined need). It is possible that limited outreach and information services might be the most cost-effective means through which to address this segment. As the outreach and information services begin to address their "real" (as opposed to perceived) needs, the other services described above (as appropriate) could be more effectively targeted to address the remaining awareness issues and barriers.

2.10.4 Preference for Program Providers/Administrators

Preferences for specific agents of program delivery, as well as the role of the state and other entities in the provision of energy efficiency services was also explored during the stakeholder interviews and needs assessment survey.

Among stakeholders, there were mixed opinions regarding who should deliver energy efficiency services in light of the current transitional regulatory environment. Most of the **DOER** staff interviewed feel that their role should be less "hands-on" and an independently-run third-party (instead of utilities) should deliver a more flexible menu of services. Some representatives from **investor-owned gas utilities** felt that utilities should continue to be responsible for providing an ECS program - however, they also advocate a program that is more flexible and less regulated. While most of the representatives from **investor-owned electric utilities** feel that, if the program continues, it should continue to be provided by utilities, one representative did advocate delivery via a "third party." Again, these representatives were in agreement that,

if continued, the program should provide more, flexible and customized services. Only some of the **municipal utility representatives** advocated delivery by third parties.

While none of the representatives from **vendor** management offered opinions about delivery agents, representatives from **community action agencies** felt that their agencies are the most qualified and most appropriate (as opposed to the current vendor organizations and utilities) delivery agents because of their special ties to low income groups, who they feel should be the target for future programs.

Representatives from **energy efficiency advocate** groups felt that delivery agents for future programs should be selected based on the direction that future programs take. Those advocating more of "market transformation" approach, suggested that DOER's role would be to bring players around a problem issue that everyone wants to solve, but no one can solve alone, and to ensure that certain niches get filled. Others in this group who advocated increased linkage with efforts to improve energy efficiency in the new construction market (e.g., HERS and EEMs) felt that the state should be involved in some way to make this happen, but they were not clear on how exactly this could occur.

Generally, **there was widespread agreement among stakeholders that future programs should involve delivery by an independent, "third party" organization (i.e., not the state and not utilities).** Within the context of program delivery, one group of stakeholders specifically recommended that oversight from a "public agency" should still be provided. However, many stakeholders held opinions regarding (other) roles that the state should have with respect to the delivery of energy efficiency services to the residential sector.

All of the stakeholders would like to see the administrative and regulatory requirements of ECS change - many advocating a reduced role for the state in terms of its current oversight of the program. Some felt the DOER's role should be less "hands on," while others felt their role should be limited to the provision of information services only (e.g., via telephone and/or publications).

In addition, stakeholders offered a number of other "roles" that would be best fulfilled at the state level. These included:

- **Building Codes**. While a few groups of stakeholders were intrigued by the concept of HERS, most felt that it would be inappropriate to incorporate this type of program into a program like ECS. Instead, some advocated that the state should become more involved in "tightening" residential building codes to improve energy efficiency in new construction market. These more stringent building codes could be instituted via a "HERs-like" test and/or model energy codes.

- **Market Transformation.** One group of stakeholders felt the underlying goals of ECS should be revised to incorporate market transformation objectives and, in this regard, the role of the state would be to develop and administer research and development programs, as well as regional campaigns to introduce new and emerging technologies.

- **Energy Efficient Mortgages.** Most felt the appropriate role for the state with respect to Energy Efficient Mortgages (EEMs) would be to encourage and support efforts in the market place (e.g., private sector, financial industry). Most did not advocate the bundling of EEM programs with residential audit/information services.

Preferences for specific delivery agents, as well as roles for the state and other entities, were also explored through the needs assessment survey. Specifically, three issues were discussed: (1) preferences for delivery agents, (2) whether or not the state should be involved in ensuring that energy efficiency information and services are available to Massachusetts residents, and (3) whether or not utilities should be required to provide energy audits to Massachusetts residents.

Keeping in mind the somewhat leading nature of these questions, as well as the limited knowledge among the general population of potential delivery agents in the "future" (i.e., post-restructuring), the results of these questions are summarized below:

- **Preferences for Providers.** When specifically asked "who" they thought should be the provider of these energy efficiency services, **over half (55%) indicated that utilities or their representatives should provide these types of services.** Another 20% reported that independent energy service companies (ESCOs) should provide these services, and 19% felt state agencies should provide these services. Finally, 11% indicated that fuel oil companies should provide these services, and 3% said other entities (e.g., landlords/property owners, the federal government, manufacturers, etc.) should be involved in providing these services. (Respondents were allowed to provide more than one response and, as a result, these percentages add to more than 100%.)

A few segments of the population differed from the average with respect to their preferences for providers:

- **Utility and Representatives.** The following segments felt the most strongly that utilities and their representatives should provide these services (significant noted as "*"): gas heat(*), "other" heating fuels, multifamily owners, and moderate-to-high income(*). Respondents using oil heat(*) and low-income households(*) were the least likely to prefer utilities/representatives as delivery agents.
- **State.** Only the highest income category(*) differed significantly from the average with respect to their interest in state-provided services; this group had a greater preference than the average. Other (insignificant) trends include: electric heat customers and multifamily renters preferring state oversight more likely than the average resident, and those using "other" fuels to heat their homes preferring state oversight less frequently than the average.
- **ESCOs.** As household income levels rise, interest in services delivered by ESCOs increased significantly. Although not significant, respondents heating their homes with electricity and "other" fuels were more likely than the average respondent to prefer ESCO-delivered services. Finally, gas heating customers(*) were least likely to prefer ESCO-delivered services.

- **Oil Companies.** While very few preferred services delivered by oil companies overall, gas heating customers(*) were the least likely to report this preference (7%), whereas oil heating customers(*) and electric heating customers(*) were more likely (12% and 14%, respectively).

- **Role for State.** Again, when specifically asked, **exactly three quarters of all residents (75%) reported that they felt the state government should be involved in some way to ensure that energy efficiency information and services are made available to Massachusetts residents.** There were no significant differences across different segments of the population with respect to their interest in state oversight.

- **Role for Utilities.** Similarly, when specifically asked, **78% indicated that gas and electric utilities should be required to provide energy audits to Massachusetts residents.** The following segments felt less strongly than the average resident that utilities should be required to provide energy audits: single family home owners(*), higher income households(*), and current nonparticipants(*).

2.10.5 Program Funding Mechanisms and Related Issues

Among the stakeholders, there were a number of suggestions regarding modifications to the current mechanisms used to fund the ECS program. Most of these suggestions were offered as inappropriate for the short-term but necessary to improve future programs in the medium-term. **There was some agreement that (at least perceived) inequities be eliminated via modifications to the program funding mechanisms.** For example, oil companies should be required to share the burden of financing/funding the program (although specific recommendations for modifications to the existing mechanism to achieve this goal were not offered by any stakeholder). In addition, a few stakeholders advocated the elimination of non-residential surcharges currently used to fund ECS. Also, investor-owned electric utility representatives advocated a change such that customers who do not use or otherwise value the service do not have to pay for it via surcharges.

The representatives from DOER staff and municipal utilities who were interviewed agreed that the current mechanism used to secure funding for the program from municipals should be modified. While the DOER staff interviewed offered no specific recommendations for modifications to the current mechanism, municipal representatives advocated that the requirement they contribute should remain, and that their level of contribution should be based on a percentage of residential revenues, not total revenues.

Findings from the needs assessment survey shed some light on the views of Massachusetts residents with respect to program funding mechanisms (Exhibit 2-7). **When initially asked, a significant portion of the population (52%) reported that they are opposed to the "concept" of monthly surcharges on electric and gas bills to cover any portion of energy efficiency program cost.** However, the remaining 48% are not opposed to this concept. In fact, 23% of the general population feel surcharges covering part of the costs are appropriate and another 23% are supportive of surcharges

which cover the full costs. (Previous participants are only slightly more likely to advocate surcharges of any kind as compared to nonparticipants.)

Exhibit 2-7

Opinions on Program Funding Mechanisms

	Overall	Participants	Nonparticipants
Opinions on the "Concept" of Monthly Surcharges:			
Surcharges on electric & gas bills to cover **full costs**	23%	23%	24%
Surcharges on electric & gas bills to cover **partial costs**	25%	30%	21%
No surcharges	52%	47%	55%
Base	566	231	335
"Willingness to Pay" by Surcharge Amount [1]:			
$0.00	23%	20%	26%
Greater than $0, but less than $0.20/month [2]	5%	6%	4%
$0.20/month	17%	20%	14%
$1.00/month	23%	22%	24%
$2.00/month	33%	33%	33%
Average "Dollar Value" of Monthly Surcharge	*$0.91*	*$0.91*	*$0.92*
Base	568	231	337
[1] The base for this data is all respondents, regardless of their opinions on the "concept" of surcharges. [2] Due to limitations in the survey length, respondents were given			

only three choices with respect to the amount they would be willing to pay (i.e., $0.20, $1.00, and $2.00 per month). To compute the average across the population, those respondents indicated they would be willing to pay something (i.e., greater than $0.00 but less than $0.20) were assumed to be willing to pay at least $0.01. Therefore, the average amount of the surcharge respondents would be willing to pay could be slightly higher than $0.91, but not less.

It should be noted that, although about half of the general population indicated through the survey that they do not advocate surcharges, 67% of these residents reported elsewhere in the survey that they feel the state should be involved in ensuring that energy efficiency information and services are made available to all Massachusetts residents. **Therefore, while these residents support the state's role in the program, they do not support the current funding mechanism.**

In addition, some of these respondents (despite the fact that they reported being opposed to surcharges) indicated that they would be "willing to pay" through surcharge mechanisms. At first glance this appears somewhat inconsistent. However, it is likely that these respondents may have reacted negatively - at least initially - to the "concept" of being charged. But then, when asked if they would be willing to pay $0.20, $1.00, or $2.00 per month, these respondents were less opposed to the specific surcharge amounts discussed during the survey.

Therefore, it can be concluded that a much smaller proportion of the general population (i.e., 24%, as opposed to the 52% reported above) is likely to be (a) opposed to the "concept" of monthly surcharges and (b) not willing to contribute any amount of money (regardless of how small) via monthly surcharges.

Again, looking across the general population, the average surcharge respondents would be willing to pay is $0.91/month. This average takes into account the issues discussed above (i.e., some respondents do not support the "concept" of charges, but indicated they would be willing to pay some small amount). However, this average does not take into account the limitations in the survey interview length, which resulted in respondents being given only three choices with respect to the amount they would be willing to pay (i.e., $0.20, $1.00, and $2.00 per month). To compute the average, those respondents who indicated they would be willing to pay something (i.e., greater than $0.00 but less than $0.20) were assumed to be willing to pay at least $0.01. **Therefore, the average amount of the surcharge respondents would be willing to pay could be slightly higher than $0.91, but not less.**

2.10.6 Administrative and Regulatory Issues

Finally, issues related to the administration and regulation associated with ECS were discussed with each group of stakeholders. On these issues, **there was universal agreement that the administrative and regulatory requirements of the program**

should be changed. Generally, the current procedures were regarded by all stakeholders as constraining, unnecessary, and costly. Several groups of stakeholders felt that the current requirements discourage creativity and innovation, others reported that prescriptive regulations were unnecessary given the level of experience among providers/vendors who have offered similar services for years, and others indicated that the current requirements are too costly (and the money could be better spent elsewhere in the program).

2.11 What are the Implications of the Evaluation Findings for Future Modifications to ECS?

Further synthesis of the evaluation findings presented above provides certain implications for making modifications to ECS. The principal findings and implications of this evaluation are presented in Exhibit 2-8.

Exhibit 2-8

Key Findings and Implications from Evaluation Research

Key Findings	Implications
Participant satisfaction with the ECS audit is very high, but the current design does not lead to sufficiently increased actions or energy savings. The program's educational components, while valued by customers and stakeholders, are by themselves insufficient to achieve customer actions.	Need to ensure availability of broader and more targeted array of services (e.g. financing) designed to encourage measure installations.
The legislation and regulation are too rigid in terms of adaptation to customer needs and uneven in terms of piggybacking services. While there remains a significant demand for on-site services, there also exists significant demand for more flexible design and delivery options.	Allow for flexible and modular audits, (which may be shorter than the full audits), as well as "telephone audit" and information services. On-site audits should be permitted, but not required.
The market need for bulk	Eliminate bulk purchase,

purchased materials no longer exists and is no longer justified. In addition, some of the service components are not widely needed or used (contractor arranging, major work orders, etc.). The fixed cost of maintaining these services is providing value to relatively few recipients.	contractor arranging and major work order components, unless they can be tied to financing.
There is a significant segment of the population that "believes" in fees for services, and has expressed a willingness to pay for these services. However, there is also a segment of the population interested in services only if offered free-of-charge.	Consider implementation of charges for differentiated products & services for different market segments.
The majority of Massachusetts residents are aware of the ECS offer and almost 41% have already used the service. There are segments with remaining needs, however this remaining unserved market will be more costly to reach through the current design.	Focus targeting of future outreach and services.
The administration of the program has grown to include elements of burden and redundancy which are not necessary, and which could be greatly improved without harm to stakeholders (including customers).	Simplify administrative and reporting requirements.
The general population supports the state playing a role in ensuring "unbiased" delivery of energy efficiency services. Stakeholders offered suggestions as to what that role should be (within and outside	Change state oversight role to encourage/support private sector activities (e.g., market transformation, EEMs, building codes, etc.).

of a regulated ECS program), now and in the future.	

Volume 1, Chapter 3 - Issues to Consider for Developing Recommendations

3.1 Approach

In order to develop meaningful and appropriate recommendations regarding the future of the Energy Conservation Services (ECS) program, it is necessary to consider the facts uncovered by this study in a broader national context which encompasses past changes in energy conservation, current trends in utility programs and expected future changes in energy regulation. Together, all of these considerations provide a basis for addressing two broad questions:

- How are program objectives and needs *today* different from what they were in the past - when the program was started?
- How do we expect program objectives and needs *in the future* to be different from what they are today?

To answer these questions, we examine program objectives and needs - past, present and future. The remainder of this chapter is organized into seven parts:

- Changing Program Objectives
- Needs for Energy Efficiency Support Services
- Product and Service Needs Today
- Changing Roles of Utilities and States in Energy Audit Programs
- Emerging Nature of Energy Programs in Deregulated Markets
- Product and Service Needs for the Future
- Organizational Options for Delivery of Services

3.2 Changing Program Objectives

The Massachusetts ECS Program grew out of the State's response to the National Energy Conservation Policy Act of 1978, initiated in response to the oil embargo at that time. The federal legislation called for every state to establish a Residential Conservation Services (RCS) program, which offered energy audits and information to promote conservation of energy use. The Massachusetts program was then mandated by state law (Ch. 465, Acts of 1980). Its original motivation was an economic response to the oil embargo, as spelled out in the legislation:

"It is hereby declared that as a result of world petroleum shortages, rising petroleum prices, and excessive reliance on imported petroleum products by the commonwealth, that there now exists high levels of inflation and petroleum supply instability in the commonwealth, conditions that are inhibiting its economic growth and the prosperity of its citizens. Therefore, it is found that it is in the public interest of the commonwealth to promote the prosperity and general welfare of its citizens to establish the Massachusetts residential conservation service and to require all electric and gas utilities to offer on-site

energy conservation and renewable energy resource services to their customers, thereby encouraging citizens to take steps to immediately improve the energy efficiency of all residential buildings in the commonwealth." (Acts 1980, ch. 465, Sec. 2)

Much has changed in the past 16 years. The concern in 1980 about price instability and reliance on oil from unfriendly parties remains a strategic concern, but is a less prominent public concern today. However, there is remaining public policy interest in energy efficiency today, but it is motivated more by environmental interests in reducing hydrocarbon emissions from power plants as well as regional economic concerns (including housing affordability). Thus, while the motivations have changed, there is still a remaining state interest in ensuring that: (1) the public is aware of the value of energy efficiency and options available to address it, and (2) those options are indeed readily available and economically viable.

3.3 Changing Needs for Energy Efficiency Support Services

Promotion of the ECS program over the past 16 years, together with utility DSM programs and print and broadcast media, have brought about a relatively high level of public awareness of energy efficiency. Indeed, the "Needs Assessment" survey (discussed in Ch. 2) confirms that as of 1996, 78% of the household respondents are aware of the availability of the audit program. The survey and ECS program records also both confirm that about 41% of the households in Massachusetts have in fact previously had an ECS energy audit.

For the ECS program, as currently designed, the remaining target segment of the population is comprised of those state residents who are either unaware of the availability of energy services or who are aware but still have a high level of remaining need for energy efficiency improvements. For that segment, there is perceived to be a remaining need for energy information, energy audits or related assistance. However, this group has a profile of specific housing characteristics that differs from the overall population - its members are more likely to be renters and to be living in older buildings and/or multi-unit buildings. The current ECS program is not particularly well set up to serve the needs of these remaining households, though. Thus, new types of specialized services and marketing may be necessary to serve the remaining market, by better addressing the differing needs, motivations and capabilities of landlords, renters and those with modest incomes.

Massachusetts residents, in general, have a need for a variety of energy efficiency services. Taking into account perceived needs, awareness, and barriers, three distinct segments of the population have been defined according to the level of service(s) with which each segment might be most appropriately targeted:

- **Specialized Implementation Services**. This group contains residents who perceive to have a need for energy efficiency improvements, are aware of the

specific actions they need to take, yet have not taken any specific action to-date. There are differing types of specialized implementation services that could be offered to this group, based on their specific barriers (e.g., financial assistance services, installation assistance barriers, and rental property barriers).

- **Limited Education and Implementation Services**. This group consists of residents who perceive to have a need for energy efficiency improvements, but are not aware of the specific actions they need to take. This group might be targeted with limited education and implementation services to increase awareness. As awareness is increased, some within this group might be best targeted with the specialized services described above (depending on the barriers they face once they are made aware of what their options are).
- **Limited Outreach and Information Services**. The remaining group consists of residents who do not perceive to have a need for energy efficiency improvements. Since it is unlikely, that in all cases, residents "perceptions" regarding energy efficiency needs are accurate, it is unclear what should be done to address this remaining (yet undetermined need). It is possible that limited outreach and information services might be the most cost-effective means through which to address this segment. As the outreach and information services begin to address their "real" (as opposed to perceived) needs, the other services described above (as appropriate) could be more effectively targeted to address the remaining awareness issues and barriers.

3.4 Product and Service Needs Today

When the ECS program was started in 1980, customer awareness of energy efficiency issues was low, many retail stores did not stock products for energy efficiency and hot water conservation, and contractors to install some of the conservation materials and high efficiency equipment were not always easy to identify. There have been significant changes in those situations over the past 16 years. The surveys of ECS program users and non-users, as well as interviews with program stakeholders (summarized in Ch.2), all confirm that program needs today are different from those first identified when the program was initiated. Specifically:

- **There is no longer significant need for some of the ECS services, especially absent a companion financing option.** This includes the bulk purchase, contractor arranging and major work order segments of the program. Current use of those services is too low to justify their continuation. Moreover, there are additional options available today to meet the needs that those services were designed to address. In earlier times, there was perceived to be more of a need for individual consumer help to identify where to purchase materials, identify contractors and ensure appropriate installation of appropriate energy conservation materials. Today, major home improvement retailers and hardware stores prominently feature energy-saving materials and the yellow pages in most areas prominently list contractors who advertise installation of insulation and energy efficiency equipment. Thus, as markets have transformed, the need to promote these services has diminished.

- **There is remaining need for some other energy information and assistance services, but in different forms than originally offered.** When the program was first designed, few homeowners even knew what energy audits were. Today, most residents of Massachusetts have some awareness of energy efficiency options and know of the availability of energy audits. There is now significant remaining demand for more specialized information and more flexible forms of energy services, as well as a need for better addressing the needs of rental housing residents.

3.5 Changing Roles of Utilities and States in Energy Audit Programs

The interviews of Massachusetts utility representatives (discussed in Ch.2) indicated that some, but not all, of the utilities in the state have an interest in seeing that there is some continued offering of energy audit services to their customers. Those that did have an interest cited various reasons including image building, promoting general customer satisfaction, addressing high bill complaints, and piggybacking with marketing of additional products and services. Of course, the extent to which these utilities would actually continue to offer energy audits on their own (without an ECS program) is unknown. However, the experiences of other states may offer some insight.

All of the states complied to some extent with the National Energy Conservation Policy Act of 1978, and most offered active audit programs under the Residential Conservation Services (RCS) umbrella throughout the 1980s. However, once the federal law mandating RCS programs in the United States expired in 1989, many states dropped their own statewide residential conservation programs. Those states whose legislatures continued funding for their programs into the 1990s have recently dropped them too. New York's (HIECA) program ended in June 1996; Rhode Island's RCS (RISE) program ends in December 1996; the District of Columbia program ended in June 1995, and Oregon's program ended in October 1995. The Massachusetts program appears to be one of the few remaining statewide RCS program.

It is notable that the ending of statewide RCS programs in other states has not universally signaled the end of energy audit programs. When statewide oversight and program coordination were dropped, most utilities were permitted to design their own residential programs under less restrictive guidelines. In many (but not all) cases, individual utilities offered their own audit programs. Some of these residential energy audit programs were offered by utilities as part of broader offerings of energy efficiency programs, as required by state regulators. Other residential energy audit programs were initiated solely by the utility without a requirement by regulators. Most of them were fuel-specific -- depending on whether the sponsoring utility was an electric only, gas only, or combined gas-electric provider. (Examples from other states are shown in Exhibit 3-1; these examples are based on information from Hagler Bailly interviews of utility, regulatory, and/or state energy office staff. The list is not intended to be exhaustive.)

In general, we see that some utilities have voluntarily offered residential energy audit services once statewide requirements have dropped. However, the utility services are not

always as complete or universally available as the former statewide programs, and are not always free of charge to users. Nevertheless, these actions do appear to reinforce the finding that some utilities (and also some service contractors) have shown an interest in continuing to offer energy audit services even when not required to do so.

Exhibit 3-1
Summary of State Energy Audit Programs

State	Current Status
Alabama	No statewide residential energy conservation program. Not many residential audits are done. Never really followed the mandate to begin with.
Arizona	Residential Conservation Services program was stopped in 1989, and has not been provided since. Some utilities continue to provide energy audits in response to customer requests and high bill complaints.
California	No statewide program. PG&E offers on-site audits at the customer's request, but also offers phone- and direct-mail delivered audits and information services as part of a regulated DSM program.
Colorado	No statewide program. Utilities offer audits only for customers with high bill complaints.
Connecticut	ConnSave Program had provided energy audits performed by outside contractor, but has since ended. However, audit programs are still offered by individual utilities. ($65 per audit.) Programs are small.
Delaware	No statewide energy audit program. No program offered by Delmarva Power.
District of Columbia	Mandate for a residential conservation program continued until 1995. Since then weatherization and audit services have been provided upon customer request by not-for-profit and government contractors.
Georgia	No statewide program. However, Georgia Power voluntarily began offering energy audits under a new stand alone program in 1992.
Illinois	The statewide program expired once the federal mandate ended in 1989. No program offered by Central Illinois Public Service.
Indiana	The statewide program ended, but PSI started its own, voluntary audit program in 1992 (CAP program).
Maryland	No statewide program. However, an informal program is continued voluntarily by individual utilities.
Michigan	Statewide program ended. However, Consumers Power and other utilities still offer low-income (CAP) programs and gas efficiency audits.

Nevada	Statewide program ended. However, Nevada Power does offer a residential audit program (completing about 3,500/year), which is a voluntary program not associated with the state.
New York	Statewide HIECA program mandated residential energy audits from 1977 until ending in June 1996. Utilities continue to provide some energy audits in response to customer requests or high bill complaints.
N. Dakota	No statewide program.
Oregon	Bonneville Power Administration's "Weatherwise," a residential weatherization program included audits until ended in 1995. Utilities are starting to run their own audit programs without BPA funding.
Pennsylvania	No statewide program. PP&L now offers "do-it-yourself" audits, and a bill disaggregation/information program, and recently designed a new audit program.
Rhode Island	Statewide RCS program ends December 1996. However, the program's delivery contractor (RISE) has announced continuation of free audits with an expanded set of services including installation contracting.
Tennessee	No statewide program. Memphis Light offers its own residential audit program.
Vermont	No statewide program. Audit activities vary by utility; some are very active, while others do not offer any programs (with the exception of low-income weatherization programs).
Washington	Audit programs are offered by most utilities; State does provide funding for CAP agencies; however, there is no statewide policy for auditing homes.

3.6 Emerging Nature of Energy Programs in Deregulated Markets

The Commonwealth of Massachusetts is moving towards deregulation of major portions of the electric and natural gas industries. Following an initiative of the Federal Energy Regulatory Commission (FERC), the Massachusetts Dept. of Public Utilities (DPU) has indicated its intention to move to restructure electricity and natural gas markets in the state by January 1998. Already, there are existing pilot programs in the state whereby some electricity and gas customers can choose from amongst a set of different energy providers.

It is commonly expected that under future deregulation, the distribution of gas and electricity to homes will continue to be offered by the companies now providing those services (or their successors), which will continue to be operated as regulated distribution companies serving defined service areas. However, the sale of natural gas or electricity, which will flow through distributors to the homes, will be deregulated and open to broad competition amongst retail energy suppliers. Those suppliers will be able to operate nationally, without restriction to specific service areas.

The nature of new roles and responsibilities for the regulated and deregulated companies have yet to be set. However, there is wide expectation that:

- *The distribution companies* will remain subject to regulatory requirements, which may require them to provide specific services to customers in their service areas. These could include energy audit or other energy efficiency services. Even if not required to do so, these companies will still be free to voluntarily offer assistance services to their customers.
- *The energy suppliers* will be free to offer customers "bundled" products and services, which could include energy audits and/or other energy efficiency services together in a package price with energy sales.

No one can foretell with certainty whether or not deregulation will occur exactly in the form that is commonly expected today. Even if it does occur as expected, no one can then foretell with certainty whether or not residential customers would be provided with energy services by the voluntary actions of distribution companies or energy suppliers if there were no regulatory requirements to do so.

However, there are some early indications that at least some energy services could be provided to at least some residential customers under deregulation. These indications include the following:

- *Pilot tests of retail energy competition to residential customers*, such as the New Hampshire Pilot, have shown that several of the competing energy suppliers are test marketing bundled energy services to customers, together with the electricity sales. Those offerings are including a variety of energy efficiency materials and support services,[1] although they tend to be highly limited in scope.

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[1] For example, inclusion of weather sealing materials, energy credits and other services available to customers of energy suppliers featuring "green marketing" in the New Hampshire Pilot.

- *Some large firms which are gearing up to be national energy suppliers* have announced in their advertising and marketing materials that they intend to offer comprehensive services to their customers, however, the general outcome of these initiatives is uncertain. At least one firm aims to provide energy audits and energy related services in a deregulated environment to a wide audience. Utilicorp United's EnergyOne program is gearing up to become a national "brand" of energy solutions, providing both the product and the energy services that go along with it.

  The EnergyOne concept is based on the assumption that in the future, energy suppliers will be competing for customers. Therefore, they will need to

distinguish themselves from their competitors through superior customer service offerings and performance. EnergyOne is an attempt to give brand recognition to energy supply. Utilicorp hopes to be present in all markets across the nation and be able to serve any customer, regardless of location, similar to the service provided by a long distance phone company, for example.

Right now, Utilicorp provides appliance repair, home security, and carbon monoxide monitoring to the residential market. Other new products and efficiency services are being developed, in order to provide one-stop shopping for all homeowner energy needs, with a single bill covering a multitude of services (See Utilicorp's EnergyOne web page: http://www.energyone.com).

Another firm, Entergy System and Service, Inc. (SASI), a Memphis-based company that provides energy-efficient equipment and services to commercial business and institutions, is setting its sights on the emerging energy services market. The company is a deregulated subsidiary of Entergy Corporation, the leading electricity supplier in the southern middle region of the country. In May, Entergy SASI changed its name to Entergy Integrated Solutions, Inc., to reflect a new emphasis on integrated services, though it does not provide residential services yet.

- *Combination of energy audit services with installation contracting* are arising. Several large firms which currently provide (or have previously provided) utility-sponsored residential audit services also show some indications that they will likely remain in the market once utility sponsorship has receded. For example, RISE, Inc., announced it will offer free energy audits as well as equipment sales and installation as part of an expanded package of services to Rhode Island residents, to fill a gap created by the ending of that state's RCS program after 1996.

  Kemper Management Services has also expanded its current menu of services for residential customers beyond what was traditionally provided via utility/regulated service offerings. Kemper now offers all of the following in the private market sector:

  - One stop needs assessment
  - Project implementation using weatherization technologies
  - Subcontractor arranging
  - Piggyback programs with other utility and non-utility sponsors
  - Comprehensive program reporting
  - Quality assurance
  - Customer education.

  In Massachusetts, Fleet Bank and Conservation Services Group is offering a Comfort Crafted program, which combines home energy analysis, a home energy improvement loan, and contractor installation and inspection services. Eligible

homeowners can obtain up to $15,000 in funding for insulation, heating and cooling equipment repair and replacement, window and door replacements, efficient lighting, ventilation, asbestos and lead abatement, radon mitigation, and other efficiency improvements.

Some other large national firms (Honeywell/DMC, Xenergy, A&C Enercom and others) are taking a wait-and-see approach to offering residential services, still offering audits in conjunction with utility-sponsored programs, but indicating that they will likely offer more bundled services in the future. These services could include the provision of audits on the condition that the customer contracts at the outset to purchase any services or appliances recommended in the audit. A number of firms now providing audit services have not been involved in implementation in the past. One possible direction the market could go would be for audit firms to team with implementation firms in order to make the provision of combined services profitable.

- *Distribution companies* will continue to have an economic self-interest in providing services that promote quality of life, population and economic growth of their service areas, and avoidance of additional investments in new distribution facilities. In that respect, some of the services now offered by utilities to their customers may be expected to continue. However, distribution companies will also have an economic interest in increasing throughput under the emerging rate structure.

  An example of a current, yet transitional solution is taking place in Massachusetts. Bay State Gas and Fannie Mae have teamed up to offer financing for home energy efficiency improvements using Bay State's participating contractors. The program offers favorable financing terms for heating system, insulation and window efficiency measures, up to a limit of $10,000 worth of improvements, including installation costs. Home energy analysis, contractor arranging, and post-installation inspection are also program components.

  Another example involves the Wisconsin Energy Conservation Corporation, in cooperation with the State of Wisconsin, the Energy Center of Wisconsin, and Madison Gas and Electric Company. Through this cooperative effort, the pilot Home Performance Program is being tested. For a fee of $49.95, a professional auditor will inspect the home, install hot water saving measures worth up to $10, and provide a home energy rating on a promotional basis. The regular price for a complete home rating package is $199.95. See Exhibit 3-2 for a complete list of service options available.

The interest in energy audits and related energy services amongst energy distributors, energy suppliers and energy service companies is not necessarily altruistic. Over time, customers have become more educated about the potential long-term cost savings associated with investing in energy conservation and efficiency. A small but growing number of companies are now offering to finance the up-front costs of energy efficiency

improvements in businesses and homes through a stream of monthly payments that are more than offset by the expected savings in monthly energy bills. The financing can be profitable to the companies offering the service, which can also save customers money. The financing can cover costs of energy audits as well as equipment purchases, contractor installations and even maintenance.

Altogether, these points indicate that there is indeed some private sector interest in the provision of energy audit and efficiency services to residential customers, and some test marketing of those services and customer willingness to pay for them. The extent to which such services will eventually be offered to residential customers, the cost of those services, and the level of market demand for them, all remain to be seen.

Yet while there is uncertainty over the extent to which market competitors will ultimately provide energy audit and efficiency services to residential customers, there is certainly an important public interest in ensuring that such possibilities are not precluded by existing state programs. It would be undesirable if some national energy suppliers offered the option of bundled energy services to residential customers in every state except Massachusetts, because of the nature of its existing statewide program. Of course, that future possibility can be eliminated if there is appropriate redesign of the statewide program features and pricing by that time. (This issue is discussed further in the following section.)

Exhibit 3-2
Wisconsin Home Performance Program Service Offerings

Home Performance Products and Services	Home Improvement Assessment	Home Improvement Rating Package	Complete Home Assessment	Complete Home Rating Package
Walk-through inspection of home's energy uses and equipment	✓	✓	✓	✓
Blower door diagnostic test to identify hidden air leaks	✓	✓	✓	✓
Recommendations for comfort and energy efficiency improvements	✓	✓	✓	✓

Up to $10 of hot water saving measures installed at no extra charge	✓	✓	✓	✓
Demonstration of energy-saving compact fluorescent bulbs and lamps	✓	✓	✓	✓
Demonstration of programmable thermostat	✓	✓	✓	✓
Demonstration of home carbon monoxide detector	✓	✓	✓	✓
Carbon monoxide safety testing			✓	✓
Lead paint safety testing			✓	✓
Microwave radiation safety testing			✓	✓
In-depth computerized energy analysis of home		✓		✓
Certificate documenting home's computer-generated energy rating		✓		✓
Eligibility to apply for special home improvement discounts from the state		✓		✓

Easy process for financing improvements through a first mortgage		✓		✓
Packet of home comfort, safety, and energy tips and information	✓	✓	✓	✓
Information on financing available for comfort and efficiency installations	✓	✓	✓	✓
Option for contractor arranging and bid review services	✓	✓	✓	✓
Pricing	$49.95	$174.95	$79.95	$199.95
The first 50 homeowners to take advantage of Home Performance will receive a rating package for the price of an assessment package.				

3.7 Product and Service Needs for the Future

The nature of needs for changes to the ECS program differ, depending on the time frame.

- *In the short run (i.e., within one year), the operation of a statewide ECS program will remain set by existing legislation.* However, some administrative rules and minor regulations affecting specific program features can still be modified within the coming year, in order to increase cost effectiveness. Some little-used services can be dropped, some allowance for more flexible audits can be added and some of the more onerous reporting requirements streamlined.
- *In the medium run (i.e., one to two years), the operation of a statewide ECS program can be redefined by updating the 1980 legislation and altering regulations to reflect the current situation and anticipated future needs.*
    - The original legislation's objectives need to be updated. In addition, the legislation's focus on inspection services and installation of demonstration materials needs to be replaced by a set of information services and on-site services that is more adapted to changes in technologies, markets, population awareness and capabilities for pursuing energy efficiency.
    - Program delivery mechanisms and pricing can also be rationally redefined. Current state oversight functions and reporting requirements, which are

widely considered onerous, are imposed as a necessary step to keep track of a variety of separate providers who are supposed to be delivering a uniform state-defined service. The oversight functions and reporting requirements can be streamlined through appropriate introduction of other forms of service delivery. Specifically, more customized and creative services to residents can be offered through a less rigid plan which encourages rather than prevents individual utilities from test offering their own forms of energy audit, information and efficiency services in preparation for full deregulation. Remaining needs of state residents and some common statewide needs (e.g., information/referral clearinghouse and backup provision of services not otherwise offered by utilities) may also be more simply met by the use of a single state contractor.

- *In the long run, deregulation of retail energy markets is expected to occur*. It is in the interest of the Commonwealth of Massachusetts that emerging private sector markets for energy audits, energy information services and energy efficiency improvements be encouraged rather than discouraged. To do so, it is necessary that:
    - The nature of energy audit and support services should not be predefined by regulations in ways that constrain and limit utilities (and other private sector providers) from offering more creative, flexible and cost-effective services or service delivery methods.
    - The pricing of energy audit and support services by state-mandated programs should not undercut the pricing of services that would otherwise be offered by utilities and other private sector providers to willing customers in open markets. (Current surveys, as discussed in Chapter 2, indicate some level of customer willingness to pay for audit and enhanced information services.)
    - The offering of energy information, audit and support services by the state should focus on ensuring the provision of services which are in the public interest but which are not adequately provided by the private sector under deregulation.

In the long run, the need for continuation of a statewide residential program will depend on the extent to which the energy distributors, energy suppliers, contractors and/or other private sector providers do actually offer the applicable services, and residents utilize them. Since that is not known presently, the prudent approach is for the state to encourage the provision of applicable services by the private sector, while remaining available to fulfill remaining gaps. If private sector services are widely provided or the remaining need for them disappears, then ultimately there may be no need for a statewide program. Alternatively, there may be remaining need for a specialized program offering limited services, or a targeted program aimed at specific market segments (e.g., poor, elderly, renters). Until that outcome is clear, it will be necessary for legislation to provide for sufficient flexibility such that private competition is not stifled but public interests do not remain unmet.

3.8 Organizational Options for Delivery of Services

As the nature of public needs for energy services continues to evolve, and as the prospect of utility restructuring moves closer to reality, it is important to also examine the options available for delivery of energy services in the future. While there can be an infinite number of possible alternative arrangements, it is useful to consider the range of options and their tradeoffs in terms of some prototypical examples.

The current ECS program design mandates a single type of energy audit service, which is then delivered by a variety of utility providers and contractors. This is represented in Exhibit 3-3 as "Organizational Form A." The advantage of this form is that it preserves the autonomy of utilities to provide services to customers in their own service areas. The disadvantage is that (in its current format) it requires a significant element of state oversight (and associated reporting requirements), not only to monitor actions and outcomes, but also to maintain control over the nature of the service offered and the form of its delivery by the various different providers and contractors.

Exhibit 3-3
Program Organizational Models

Organizational Form	**Provider of Services**	**Type of Services**
A: MP/ST	**M**ultiple **P**roviders	**S**ingle **T**ype
B: MP/DT	**M**ultiple **P**roviders	**D**iverse **T**ypes
C: SP/ST	**C**entral **P**rovider	**S**ingle **T**ype
D: CP/DT	**C**entral **P**rovider (non-exclusive)	**D**iverse **T**ypes

It is quite possible that in the future, there will be increasing interest among some utilities (and possibly also non-traditional energy suppliers and contractors) in offering a more diverse range of bundled energy services to their customers. Energy deregulation and competition may be expected to increase that interest. Insofar as more diverse range of energy services is permitted to occur, the program could move towards what is referred to in Exhibit 3-3 as "Organizational Form B." The advantage of this form is that it permits greater latitude amongst utilities (and other parties) in providing different types of services. As such, it could potentially reduce or eliminate the need for state oversight of program quality and consistency. However, there would be remaining needs for some state monitoring to ensure that residents are still being adequately served.

A third organizational form is that of a fully centralized program, administered on behalf of the state by a single contractor. That corresponds to "Organizational Form C" in Exhibit 3-3. This arrangement minimizes administrative overhead costs and reporting

requirements (since it is much easier to monitor the performance of a single contractor than it is to monitor the performance of a wide assortment of different companies that are all supposed to be delivering the same service). A centralized organization could make sense for situations where the state offers a needed service that the individual utilities are not willing to offer, and/or the nature of the service naturally lends itself to a centralized delivery mechanism (e.g., a telephone "information hotline" or a computerized information "web site").

A fourth organizational form is a hybrid, in which multiple providers are encouraged to provide diverse types of services (as in "Form B"), but there is also a central contractor to provide a minimum set of services (as in "Form C") to meet remaining unmet needs. This arrangement, referred to as "Organizational Form D," could provide a guaranteed minimum set of services while maintaining latitude for utilities (and other parties) to provide different types of services. However, it would also introduce needs for a more complex set of procedures for program cost allocation.

The need for the alternative organizational forms of service delivery will depend on many factors, including the extent to which new types of energy education and audit services are to be introduced by market players in a deregulated future. At this juncture, it is important to think openly and strategically about possibilities for the future and to allow for the possibility of alternative organizational arrangements to be introduced as program needs, and market environments change.

Volume 1, Chapter 4 - Recommendations: Future Program Directions

4.1 Approach

Hagler Bailly's recommendations for ECS future directions focus on program definition and program delivery - i.e., "What changes should be made to Massachusetts' statewide residential energy conservation services program?" The nature of the recommendations are an outcome of the study findings (discussed in Chapter 2) and the analysis of emerging issues (discussed in Chapter 3). The recommended timing for these actions is also a result of practical considerations about time required for legislative and regulatory changes, as well as longer term considerations concerning the expected nature of utility deregulation (as discussed in Chapter 3).

While the future of utility restructuring and its impacts can not be fully known, it is anticipated that there will be a continuing need for energy efficiency services by consumers, and that some market-based energy products and services (provided by energy distribution utilities, their service affiliates, other energy service companies and/or competitive energy suppliers) will address some of that need. However, no one knows exactly where the future dividing line, at which market-based services will leave off and publicly supported services will have to pick up, will be.

Accordingly, the following Hagler Bailly recommendations lay out suggested changes in the program objectives, services, organization and delivery mechanisms in terms of three very different types of actions occurring over three different time periods:

- **Phase 1: Administrative Actions within the Bounds of Current Legislation and Regulation** - refinement of current services and operations in order to improve program effectiveness and better address current market conditions;
- **Phase 2: Legislative & Regulatory Reform** - more fundamental changes to the organizational structure of the program and its service delivery, in order to better meet new needs associated with the advent of retail competition in energy markets as well as other market changes;
- **Phase 3: Redefinition and Exit Strategy** - procedures for re-targeting, redefining and (if appropriate) eventually eliminating the state role in providing energy information and audit assistance to residents, after full retail competition is in place.

After discussing the program needs and recommended actions associated with each of these three phases, their implications for project funding are then addressed.

4.2 Phase 1: Short-Term Modifications

4.2.1 Legislative and Regulatory Constraints

The Phase 1 recommendations focus on achieving program improvements, as identified in Chapter 2, within the bounds of existing state statute and existing regulations. Specifically, any changes to be made within 1997 must be made within the current planning cycle and within the bounds of the existing regulation and legislation (Ch.465, Acts of 1980, "Establishing the Massachusetts Residential Conservation Services Program.") Key aspects of that legislation include the following:

- **On-Site Audits:** All electric and gas utilities are required to offer a program which includes "on-site energy conservation and renewable energy resource services" to their customers.
- **Demonstration Activities:** The utilities are required to have their on-site audits include "demonstration of the performance or of the installation of no-cost or low-cost energy conservation measures, state measures, energy conservation practices and other appropriate program requirements during energy audits."
- **Publicity:** The utilities are required to "publicize the program through mailed program announcements and paid radio and newspaper advertising."
- **Limited Fee:** "The charge to a customer for the audit of a single family dwelling shall not exceed twenty dollars" (as of 1980), a limit which can be raised in accordance with the consumer price index. [It is equivalent to roughly $35 today.]
- **Full Cost Recovery:** Each gas and electric company is allowed to recover "any expenses that it may incur in carrying out its responsibilities under this act."
- **Promulgation of Regulations:** The Commissioner of Energy Resources is directed "to promulgate such regulations as may be necessary to carry out the purposes of this act" - which include the items identified above.

4.2.2 Immediate Recommendations

The legislative and regulatory requirements may be broad enough to allow for significant program operation changes, as long as energy audits with demonstration components are still offered by utilities. The short-term recommendations (for the coming year) are thus driven more by practical reality - there is not enough time to institute major changes to regulations affecting the organizational structure or program delivery mechanisms within the next planning cycle, but there is enough time to institute some administrative rule changes allowing for widely-supported incremental improvements to the program features in order to reduce costs and increase cost effectiveness. Additional changes which will require more time can then be deferred to the medium term (Phase 2). These immediate changes include the following modifications:

- **The program reporting requirements should be scaled back as allowed by existing regulations.** Specifically, this should include modification of filing regulations so that only modifications to UIP (rather than the entire document) need be filed, and it can also provide for 2-year program filings instead of the current annual filings. This recommendation is justified because: (a) the program is now mature and features experienced utilities and generally reliable providers, and (b) the interviews have revealed widespread perceptions that continuation of the reporting requirements impose a significant and unnecessarily large labor

burden on utilities, implementation contractors and state staff. Adoption of this recommendation can thus be expected to provide cost savings with relatively little risk of program misuse.

- **The on-site audit requirements should be redefined to allow for greater flexibility in the design and delivery of on-site services.** Specifically, this should allow exploration of capabilities to include more flexible forms of audits as well as additional means of meeting customer needs. This recommendation will allow for a greater degree of responsiveness to customer requests for specific information and specialized services. It provides a form of customized service for which there is significant demand, according to both surveys and interviews. Adoption of this recommendation may also save program costs for utilities as well as time for those customers who would prefer a shorter, more targeted and more customized service.
- **The Contractor Arranging Service, Bulk Purchase Service, and Major Measure Work Order elements of the program should be eliminated.** These services are used by relatively few program participants, partly because the market for energy conservation products and services has been transformed over the past 16 years from an obscure specialty to a mainstream business activity, and partly because there is currently no companion financing mechanism for these services. The current low level of usage makes it hard to justify continuation of the planning, reporting and operational overhead associated with these additional program features - none of which are required by the program legislation.
- **The Low Cost Measure Work Order element of the program should be redesigned to be an automated feature of the audit** process. With today's modern computer technology, it should be more cost-effective for energy auditors to provide a list of recommended materials and associated costs automatically to all audit recipients, by including the applicable information within the context of a computer-generated audit report and associated general information literature. The extent of software modifications (and associated costs) required should be considered before implementing this recommendation.
- **The telephone intake process should be expanded to provide an education/information element.** By having a trained and knowledgeable person available to telephone callers, some of those callers will be able to get a more prompt answer or referral response to their questions and inquiries. Some of them will also benefit from saving the time and cost of remaining at home to wait for a visit from an energy auditor when all that they really wanted was to get some general advice. This recommendation responds to a demand indicated by both customer surveys and interviews with auditors, and improves the cost effectiveness of the program.
- **The program marketing effort should be redesigned to incorporate an active outreach that is more targeted to those segments with higher remaining needs for energy efficiency services.** After 16 years of bill inserts and general advertisements, there is a very high level of general awareness of the energy audit program. Emphasis on those with the greatest remaining need, including low income and elderly households, could thus provide greater potential benefit. (While there is also substantial remaining need for services to renters, more

radical program redesigns are necessary in order to offer appropriate landlord incentives to improve energy efficiency of their rental units.)

- **Consideration should be given to the initiation of a modest fee for audit and/or inspection services.** The adoption of a fee for on-site services, which may be in the range of $10-35 (depending on the services requested), will provide a needed test of consumers "willingness to pay" and will also help to change perceptions of energy audits from a "free service" to a "valued service." The off-site information and advisory services would still remain free in any case. While not absolutely necessary at the present time, the eventual adoption of fees for on-site services will most likely be necessary if the state wishes to encourage rather than discourage private sector offerings of bundled energy efficiency services under future retail energy competition. Such fees are already allowed under the existing legislation.

Some or all of these seven recommendations could be instituted sometime during the coming year. These recommendations are all designed to improve the effectiveness and cost-effectiveness of the existing program. It is believed that they are all compatible with the existing legislative and regulatory requirements, and that they will not require any change in organizational roles.

4.3 Phase 2: Medium-Term Modifications

4.3.1 Need for Legislative and Regulatory Changes

Major revisions to the 1980 legislation are needed to update the program to 1996-7 conditions, as well as to make allowances for retail competition in deregulated electricity and gas markets in the coming years. It is estimated that legislative changes may require a one to two year time horizon to take effect. The specific components of the legislation which are outmoded are:

- The **economic objectives** stated in the 1980 legislation - to address high inflation and unstable petroleum prices - need to be updated and other motivations, such as environmental considerations, need to be recognized.
- The singular requirement for **in-home energy audits**, which was very applicable in 1980, is overly restrictive and narrow in the later 1990's. Today, there is more of a need to allow for a broader yet more targeted set of information and assistance services to a population that is generally more aware of energy efficiency issues and options.
- Today, advocacy of energy efficiency has moved towards **promotion of market solutions.** This includes support for "market transformation" - that is, encouraging and facilitating the long-term availability and demand for higher efficiency materials and equipment in product markets. With the expected advent of energy deregulation, there is an additional state interest in encouraging rather than discouraging energy suppliers and others from offering energy efficiency services to residents. The utility requirements spelled out in the 1980 legislation do not provide for such market solutions.

Requirements of the current legislation effectively constrain utilities to offer a uniform, state-designed energy audit and materials demonstration to their customers. The legislation needs to be amended, updated or replaced - as legally appropriate - so that it replaces that fixed requirement with a "needs based policy" that permits delivery of a fuller range of information and support services to households. (That wider and more flexible range of services is what the residents of the state have indicated a desire for.) The program further needs to promote "market transformation" and encourage market-based energy services rather than mandating fixed services. (That direction is necessary to update the program to current strategies for promotion of increased energy efficiency. It will further be necessary to keep the program from interfering with the expected future advent of retail energy competition in the state.) At the same time, the legislation still needs to provide for actions to ensure the availability of information, in-home energy audits and related services which are not otherwise being provided to the state's residents.

4.3.2 Medium-Term Recommendations

The recommended actions over the next one-two years include both major legislation revisions and major regulation revisions. The actions listed here cover additional program improvements (as identified in Chapter 2), which are designed to further improve the effectiveness of the program in increasing energy conservation and efficiency in a cost-effective manner. These "Phase 2" actions are intended to apply under conditions in which the electric and gas utilities remain under current regulations as well as under future conditions in which there is further deregulation and retail competition (as discussed in Chapter 3). The recommended further steps necessary under deregulation are discussed later, under "Phase 3." However, any changes made now to legislation should be done in a manner which allows for (and does not preclude) eventual implementation of the Phase 3 recommendations.

The following recommendations are made for changes in legislation and regulation over the next two years. The first five relate to program feature enhancements; the latter two address thornier organizational and financial issues that must be addressed as Massachusetts moves towards utility deregulation.

- Legislative and Regulatory Changes: **The program design specified under the existing 1980 legislation and regulation should be replaced with a "needs-based" design that permits optional education methodologies,** including:
    - delivery of **educational information** by phone, electronic media, mail, and in-person (based on customer choice);
    - delivery of **a range of additional installation and/or assistance services** from which consumers may choose, with varying value-added fees depending on the nature of the services provided; and
    - **provisions for sliding-scale fees,** to provide for non-pay or reduced-pay options for low-/moderate-income population segments.

There should not be a prescribed list of program features, but rather, flexibility to allow the Commissioner to identify needs as times change. Thus, the implementation of the

above cited specific features should be permitted **but not required.** The Commissioner of Energy Resources should make a determination of the need for such actions within the ECS program, based on the extent to which those services are deemed needed and not otherwise provided in the necessary form by other parties.

The provision for "educational information" is designed to allow for a wider range of information and education delivery options which are: (a) more responsive to customer desires and (b)which allow for lower cost off-site consultations in place of the more costly on-site services for cases when appropriate. The current legislative requirement that focuses the program specifically on in-home energy audits should be eliminated.

The provision for "additional installation and/or assistance services" is designed to allow for further energy audit services (such as blower door tests, infrared photography, etc.), customized assistance and post-installation inspection services to those that request them. Such additional services would be allowed in response to customer requests, and could be met either by referral to private contractors or through extension of the energy audit and information services at an additional cost equal to prevailing market prices. Regulations should be revised to allow for such additional fee-based services to be "piggybacked" onto the basic on-site audit.

The provision for "value-added fees" is designed to allow for customers to gain access to a wider range of information and assistance services, with incentives for customers to value and make effective use of the additional services. Thus, there can be some basic information and education services provided free to all, plus additional services made available at additional cost. It is intended that the fee structure should allow the ECS program to move away from undercutting private sector providers of energy audits and broader energy services in the future. It is recognized that, in reality, the determination of value-added fees is a complex matter in which actual costs, consumer ability-to-pay, consumer willingness-to-pay, fee structure of private market entrants, and program objectives, must all be considered. The setting of appropriate fees is thus not an easy matter. Furthermore, the nature of the free and additional cost services can vary over time, reflecting changing costs, needs and changing market conditions. However, fee setting is necessary as deregulation and market competition approach. Fees for low income groups can be subsidized as deemed appropriate. In any case, the current legislative limit on fees should be eliminated.

- Legislative and Regulatory Changes: **The currently legislated and regulated program focus on education and demonstration of energy conserving measures should be shifted to focus more on "market transformation" objectives.** This latter focus is aimed at reducing consumer and other market barriers to greater energy efficiency, such as the extent of higher cost and more limited availability of high efficiency materials caused by consumer lack of information and awareness, consumer perceptions of additional "hassle," and contractor/dealer failures to adequately provide information about efficiency levels to consumers. While ECS is not intended to be a full market transformation program (with dealer incentives, etc.), it can identify and target consumer

education at specific markets and technologies where there is particular opportunity for enhanced energy efficiency. By providing more targeted education about options available, this type of program can potentially help to increase consumer demand and improve product availability and cost features for energy efficient products in the marketplace.

- Legislative and Regulatory Change: **The program should be redesigned to incorporate financing opportunities for customers to encourage the installation of major energy efficiency measures.** One of the major barriers to significant implementation of major recommendations for acquisition of higher efficiency measures is the additional up-front cost to the homeowner. Even though the cost payback may be financially beneficial to the homeowner, the up-front cost remains a significant barrier. The success of the program in affecting the behavior of its participants could thus be significantly enhanced if attractive financing options were available, which allowed for financing costs to be offset by the energy savings in later months. The financing option could be provided by interested private providers, and may not need to be subsidized by the state.
- Regulatory Change: **The measure of program success should be shifted to focus on output performance instead of input effort.** It is suggested that aggregate indicators of program success, such as the annual energy-saving actions taken by participants, be measured instead of monthly counts of the numbers of audits delivered. A periodic survey of program success could then substitute for some of the current monthly reporting statistics. The results of this effort would provide a basis for determining the cost-effectiveness of the various different program information and assistance features.
- Legislative Change: **The program organization and cost structures should be redesigned to facilitate private sector alternatives and market-based on-site services.** Utilities, energy service companies, financial service firms and other relevant providers should be encouraged to provide energy audits, financing and on-site assistance services on their own, without subsidy, at costs low enough to attract significant response. To do so, any on-site services which are directly offered through the program should include charges that provide a potential for (eventual) private market entry. However, charges to participants must also remain reasonable enough to attract a significant response. Thus, program costs may still be subsidized and fixed-level subsidies may also be provided to utilities and/or other outside services, when deemed necessary and appropriate.
- Legislative Change: **Management and coordination of off-site information services and remaining on-site services (that are not already provided by others) should be provided via a centralized, statewide system.** The use of a central program contractor (as discussed in Chapter 3), can have advantages for the current situation, and will become most relevant as Massachusetts moves toward utility deregulation. A centralized contractor could help address several existing concerns, as identified in Chapter 2. It could minimize overhead costs for operations, and also minimize the currently significant effort required for program oversight of a variety of different program contractors. Looking toward the future, this type of organization will help ensure a consistent and impartial information delivery at the statewide level, and will most importantly allow for rapid

adjustment to program features as Massachusetts starts to move towards utility deregulation. A central program contractor would be responsible for a basic set of statewide information services, such as telephone information hotline, world wide web information dissemination, referral information service and media information dissemination. It is suggested that the program contractor also provide (or contract to provide) on-site audits and assistance services, but only for those areas and those services that are not already covered by others. In preparation for deregulation, this operational model allows energy distribution utilities and their affiliated service companies (as well as other private market service providers) to be free to provide their own on-site audit and assistance services if they so desire. Those that do not wish to do so can see their customers covered by the central contractor.

- Legislative Change: **Address existing cost-burden inequities through the initiation of charges to participants for enhanced services, and the use of a universally applied non-duplicative, and equitable per-household energy bill charge.** This recommendation has two goals. The first goal is to minimize total program cost burden placed on all Massachusetts ratepayers by encouraging the entry of unsubsidized, private sector services and by adding charges for added value services. The second goal is to eliminate differences in household cost burdens among customers of different utilities. This includes the payment burden on households that pay double for the program through their electric bills and again through their gas bills. As Massachusetts moves towards energy utility deregulation, it will become important to ensure that there is no bias in the relative cost burden placed on one form of energy over another. Details of the collection of this fee are discussed in the last section of this chapter.

These seven medium-term recommendations call for significant program redesign. The first five of these recommendations should be addressed as soon as possible. Together they provide for a redefinition of the services made available to Massachusetts residents. They are intended to make it possible for the program to achieve a substantial improvement in its (currently modest) cost-effectiveness associated with bringing about real energy savings. The last two recommendations are different. They do not affect program features per se, but they do attempt to address topics that will have to be addressed as Massachusetts moves towards utility deregulation. If they are not addressed in Phase 2, then they will have to be addressed in Phase 3.

4.4 Phase 3: Longer-Term Modifications

4.4.1 Potential Changes Over Time

The ECS program should not necessarily have to continue forever. The program was originally set up to educate the residents of Massachusetts homes about the advantages of energy conservation and energy efficiency, and about the products and actions which they can use to address those objectives. If the program is working, then the level of knowledge and awareness of these issues among Massachusetts residents should continue to rise over time. In addition, the availability of products and services to increase the

energy efficiency of Massachusetts homes should continue to improve over time. As "market transformation" occurs, the need for the original types of education services should diminish.

The Massachusetts Department of Public Utilities has ordered that restructuring of electric utilities at the retail level occur no later than January 1, 1998. Gas utility restructuring is also proceeding although there is no set deadline. Given this, it is expected that there will be many new entrants selling competitive or unregulated energy services and supplies to residents, and there is a distinct possibility that at least some of them will offer energy audits and energy efficiency services to residents in conjunction with energy sales. It is further possible that existing utilities (as energy suppliers, energy distribution companies, or affiliates), as well as other firms, may offer audit and efficiency services by themselves or in combination with other offerings of financing services or equipment sales. No one really knows how this future will turn out. As some market barriers fall, other market barriers may arise. However, there is a possibility that if market-based energy services do in fact become widely available sometime in the future, then the need for the ECS program to directly provide the full range of continuing information, audit and support services could eventually diminish or even disappear.

4.4.2 Exit Strategy Under Deregulation

The Phase 3 Plan provides an "Exit Strategy" for the ECS Program. It lays out conditions under which some or all of the program elements could be eliminated in a deregulated market. The recommended plan is relatively straightforward, and includes the following three elements:

- The ECS Program should utilize a central contractor to provide information, audit and other energy efficiency assistance services only to the extent that those services are not already widely being provided by others on a statewide basis. The program should focus on filling "gaps" that are not already being met by the marketplace.
- DOER (or its designee) should continue to monitor market availability of specified services, based on pre-determined market transformation and service availability criteria. It should direct the ECS Program Contractor to provide specific services on a statewide basis or to particular market segments based on its determination of the remaining need.
- As warranted by future trends and conditions, DOER should eliminate the role of the state in the direct provision of energy audit, information and/or support services, to the extent that the private sector provides adequately available and reasonably priced services to meet customer needs and demands in those areas. The state, however, will need to maintain an on-going role in creating a policy context which facilitates this private market activity.

4.5 Options for Future Program Funding Mechanisms

4.5.1 Perspective

The cost of every state program is ultimately borne by residents, whether those costs be raised through taxes, user charges or increments to product or service costs. In that respect, the method by which the ECS program costs are covered is a value judgment and ultimately a political decision, based on what cost distribution seems to be both fair and palatable to residents of the state. The Massachusetts legislature will ultimately be responsible for deciding whether the ECS program should continue and whether its funding should continue through the methods used to date.

4.5.2 Current Situation

Currently, the ECS program delivery costs are borne by the customers of gas and electric utilities of the state, which are allowed reimbursement of program costs through a small monthly surcharge included in each customer's gas and electric bill. Households with gas serve pay for a portion of the program through their electric bills and then pay again through their gas bills. This factor leads staff of gas companies (among others) to perceive that their customers are paying more than their "fair share," since they pay for the program through two different utility bills. In addition, currently small commercial customer electric and gas bills include the ECS surcharge. Again, there was some concern among various stakeholders that these customer are being unfairly burdened with sharing in the funding of ECS while not currently permitted to participate in the program. Hagler Bailly has not conducted any empirical analysis of the actual distribution of cost burden and benefit associated with the ECS program. However, there is certainly a widely perceived appearance that the program's cost burden is not fairly distributed. Customers of different utilities pay different amounts for the service due to different size customer bases among utility territories and varying program delivery costs among providers.

4.5.3 Future Needs and Options

With the expected emergence of utility restructuring in Massachusetts, the utilities of the state have started to more keenly monitor factors that may affect their cost competitiveness. Although the ECS program funding burden is small, it is of concern. There are several alternative approaches to program funding that could be considered to address the equity concern. They include the following:

1. **Keep costs covered in electric and gas utilities bills, but also add a surcharge to major oil wholesaler transactions.** This would improve the financing equity, and be easier to administer than adding surcharges to the transactions of the large number of small heating oil distributors. However, this does not address the issue of some customers paying more than once.
2. **Pay for program costs through taxes.** That does distribute costs to all residents of the state, but is widely considered to be unlikely in a context where there is intense pressure to reduce state taxes.
3. **Pay for program costs through an increment to the fixed "basic monthly charge" billed now by the state's local electric utilities (and under restructuring, by the local distribution companies) to each home in the state.**

Since essentially everyone has electricity, every household pays a similar fee and there is no increased or decreased burden associated with use of any particular heating fuel.

4. **Keep the financing method as is.** That is the default action.

Based on the information cited above, it appears that options #2 and 3 are the most equitable, and that option #3 may be the most feasible of these two options. However, the ultimate decision concerning cost and fairness of burden is one to be made by the state legislature.

Volume 2, Chapter 1 - Introduction

Description of Program

1.1 Background

The Massachusetts Energy Conservation Service (ECS) provides home energy audits and follow-up services to all residents of the state. All gas and electric investor-owned utilities (IOU) and municipal utilities have been mandated to provide the program to their customers since 1980 as per Massachusetts statute, Chapter 465, and Regulations 225 CMR 4.00 and 5.00. The ECS program was originally established as a result of the federal Residential Conservation Service (RCS), but was enhanced by the state regulation whose requirements exceed those of the federal regulation. In 1990 when the federal RCS regulation sunsetted, the state requirement prevailed, leaving Massachusetts as one of the few states where home energy audits and services are universally provided.

The ECS program is jointly administered by the Massachusetts Division of Energy Resources (DOER) and the Massachusetts Department of Public Utilities (DPU). The DOER oversees all operations, guarantees quality, sets the annual goals for each utility, and reviews and approves each utility's annual program plan. The DOER also reviews and approves municipal utility ECS budgets.

As required by statute, a DOER appointed Public Advisory Committee (PAC) meets quarterly to advise DOER on ECS program administration and policy. The PAC is afforded the opportunity to review and comment on state and individual utility plans for implementing the ECS program, provide input on policy decisions affecting the ECS program, and act as a forum for comment on particular issues as they arise. The Committee also advises the Commissioner of the Division of Energy Resources of the effects of ECS policies on various constituent groups. In FY 1995, the Committee consisted of 24 members, each serving a one-year term and representing an interest group which is concerned with the operation of the ECS program.[1]

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[1]Chapter 465 of the Acts of 1980 states that groups represented on the PAC shall include: ECS program operators, home heating suppliers, savings and commercial banks, the residential renewable energy resource industry, energy retrofit contractors, registered professional engineers with retrofit and audit experience, the Massachusetts Community Action Program Directors Association, the realty profession, tenant senior citizen and consumer advocacy groups and the Massachusetts Department of Public Utilities. Prior to the beginning of FY 1995, DOER reached out to recruit PAC nominees from some twelve organizations and, as a result, the PAC gained six new members representing: energy retrofit contractors, the residential renewable energy resource industry, the realty profession, senior citizens; consumer advocacy groups, and a residential engineer with retrofit and audit experience.

The DPU is responsible for reviewing and approving program budgets and surcharges for investor-owned utilities (IOUs) and has established certain regulations concerning informing customers about the availability of the service. The program is funded by an

Energy Conservation Service surcharge which is assessed to IOU residential rate payers monthly in each gas and electric bill. Municipal utilities include ECS program operating expenses within their residential customer rates.

There are 57 gas and/or electric IOU and municipal utilities in the Commonwealth of Massachusetts. Each may either provide the ECS program independently or may join other utilities in a collaborative delivery effort. During the 1995 fiscal year (FY95), there were three collaborative delivery programs, two of which had only municipal utilities. In addition to these, eleven utilities provided the ECS program independently. Most utilities and collaborative programs subcontracted for auditor services, although the largest collaborative and several municipal utilities employed auditors directly.

1.1.2 Qualifying Customers

Every residential customer of an investor-owned or municipal utility in the state qualifies to receive services from the ECS program. The type of dwelling determines which part of the program is delivered:

- one-to-four unit audit and services;
- multifamily building (five-plus units) audit; or
- tenant services.

The multifamily building audit and tenant services (Multifamily Building Program, MFB), in combination, are a small part of the ECS services delivered statewide. In fact, municipal utilities are not required to offer these parts of the ECS program. While touching on these MFB services, this evaluation primarily focuses on the one-to-four unit audit and services.

1.1.3 ECS Program Services

When it was first offered, the ECS program consisted of only an audit and demonstration material installations (DMI). Participants were left with a customized report of energy improvement recommendations, as well as some demonstrated measure installations, but the program offered little additional assistance to encourage further measure installations.

Over the years, the program has been expanded to include a variety of follow-on assistance services - *equivalent services* - designed to assist homeowners and tenants with implementing the recommendations, such as the bulk purchase service, major measure and low-cost measure work order preparation services, contractor arranging services, and post-installation inspection services.

In addition to these enhancements within the ECS program, beginning in 1990 some utilities began to "piggyback" Demand-Side Management (DSM) program services[2] with the ECS audit visit. These piggybacked DSM measures include domestic hot water (DHW) measures, compact fluorescent lamps (CFLs), as well as cost-effective DSM measures. These DSM services further enhanced the value of participation for ECS

customers by: a) capturing lost opportunities, b) reducing duplication of effort, and c) allowing $30 of ECS to go toward the cost of other demonstration measures. The delivery of piggybacked DSM measures allowed utilities to deliver (in some cases) DSM measures that would otherwise not have passed the utility cost-effectiveness test if delivered as stand-alone services.

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[2] "Piggybacked" DSM program services are defined here as situations where two or more energy efficiency programs are delivered at the same time, thereby sharing (and saving on) program costs.

During its sixteen-year history, the ECS program has been coordinated with several other types of energy assistance programs. The two primary coordination efforts have been the Weatherization Assistance Program (WAP) and the Home Energy Assistance Team (HEAT) Loan Program. In the former, modest ESC resources supplement WAP resources when an eligible WAP client is serviced through the WAP program. During the two waves of the HEAT Loan Program, an ECS audit indicating a recommendation(s) for the applied-for improvement(s) was a requirement for loan approval. During FY95, the WAP coordination continued while the HEAT coordination ended with the defunding of the HEAT program in 1992.

1.1.4 Program Awareness and Request

Every utility is required by regulation to devote one bill-insert per year to informing customers of the availability of the ECS program.[3] Customers also become aware of audit availability through general publicity/marketing, word-of-mouth, calling their utility to ask questions, and other methods. In most cases, a customer who is interested in the program contacts the utility via telephone or a postage-paid card (attached to the bill insert) and requests the service. An appointment is made for an auditor to come to their home.

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[3] IOUs are required by DPU regulation to notify customers annually. Municipals are required to do this by DOER regulation.

1.1.5 Energy Audit

The ECS audit is fuel-blind, meaning that all end-uses are examined regardless of the fuel used. Whether or not a customer's electric utility or their gas utility provides the audit, all electric, gas, oil, and other (if used) systems are covered. As delivered during FY95, fuel-switching could not be recommended in the 1-4 program component, but could be considered in the multi family component.

A trained, utility-certified ECS energy auditor makes a survey of the customer's home and identifies areas where energy conservation improvements can be made. Specifically,

during the audit, the building's heating and DHW systems, shell insulation and appliances are examined.

The program is designed for the resident to accompany the auditor in the examination of the building so that explanations and education occurs during the course of the visit. The customer is provided with a written report which describes the efficiency of the building and lists measures which should be taken for improvements, based on order of priority . If appropriate, the auditor writes a work order for low-cost or major improvements and leaves it with the customer. The auditor also explains and leaves materials about other *equivalent* services available to assist the resident to make the changes. A folder with the audit report and descriptions of all follow-up equivalent services is left with the customer. Toll-free phone numbers are given to customers for technical assistance, bulk purchase orders, contractor arranging services, post installation inspection, and any other assistance which they may need after the visit.

1.1.6 Equivalent Services

Demonstration of Materials Installation - During the ECS visit, the auditor installs several energy saving items. The purpose of the DMI is to show the resident "how to" and to get them started. While different in each dwelling, typical installation items include: a water heater wrap and pipe insulation, a CFL, weatherstripping of one demonstration window, a door sweep, a low-flow showerhead, and a sink aerator.

Low-Cost Work Order - During the ECS visit, the auditor may prepare a low cost measure job specification sheet detailing work to be done in the customer's home or building (e.g., caulking, weatherstripping). These low-cost measure work orders are designed to assist customers in do-it-yourself applications. In addition, as requested, the auditor may complete a bulk purchase (see below) order form for the customer with amounts, sizes, and other specifications customized to their home and energy need.

Bulk Purchase Service - This "after-visit" service provides energy saving materials at or below market prices for do-it-yourself projects. In addition to providing telephone- and mail-order, the service offers DOER-approved materials, including caulking, weatherstripping, clock thermostats, energy saving light bulbs, etc.

Work Order Preparation - During the ECS visit, depending on the need of a particular dwelling, the auditor will prepare a job specification sheet for home energy improvements. Examples of projects are attic insulation, window retrofit, and new heating system. Work orders for large projects can be used by the customer to solicit bids from contractors either through the ECS contractor arranging service component (see below) or on their own.

Technical Assistance Service - This "after-visit" service involves telephone assistance from qualified, experience audit staff who will answer questions concerning heating, hot water systems, insulation, space conditioning, lighting, and appliances. In addition,

municipal utilities provide complete information regarding hiring contractors, materials, and proper installation of materials.

Contractor Arranging Service (CAS) - This service matches customers who need a contractor to implement their energy improvements with contractors who have been pre-approved by the ECS program. The participating contractors have agreed to perform work at reasonable prices and within a specified period of time and to warranty installed measures. Customers are matched with contractors on a rotating basis or customers solicit bids on their own from the CAS contractor list. Independent municipal utility programs are not required to offer CAS.

Post-Installation Inspection (PII) - An inspection of energy improvements by a trained inspector is available in conjunction with the Contractor Arranging Service or for customers who have made improvements themselves or hired a contractor on their own. The inspector indicates if work or materials are not up to ECS standards. Customers who have participated in the CAS are not obligated to make their last payment until the work is approved by the inspector. This service reviews only the energy-worthiness of work; it does not replace required code and safety inspections, where needed. Independent municipal utility programs are also not required to offer this service.

Appliance Efficiency Education Service (AEES) - Customers can receive site specific, energy efficiency education and information about the appliances in their home. The customer will learn which appliances in their home use the most energy and how to use them more efficiently. Customers will also obtain information on the estimated cost to run some common household appliances and information on how and why to purchase energy efficient appliances.

1.2 Evaluation Goals

As discussed above, ECS has been delivering energy conservation services to Massachusetts utility customers since 1980 and, since the mid-1980s, additional energy conservation services have become available to Massachusetts residents through ECS and other utility sponsored programs delivered separately and also through coordination with ECS. Hagler Bailly Consulting, Inc. (Hagler Bailly) was selected to complete the ECS evaluation and determine whether the Energy Conservation Service is or can be:

- an efficient mode of delivery for residential conservation services;
- efficiently coordinated with other Massachusetts residential energy conservation programs;
- technically/educationally state of the art; and
- efficiently administered.

The specific objectives of the evaluation are to answer the following questions:

1. Does ECS achieve energy efficiency actions (installations and/or practices)?
2. Does ECS achieve energy savings/conservation?

3. Does ECS provide energy education?
4. Does ECS achieve other societal benefits?
5. What are the household, participation, and energy efficiency measure adoption characteristics of those served by the ECS program between July 1, 1994 and June 30, 1995?
6. What is the degree and nature of the potential coordination and/or overlap between ECS and other residential energy conservation programs, including Demand Side Management (DSM) programs, the Weatherization Assistance Program (WAP), and a potential Home Energy Rating Service (HERS)?
7. What is the status of the technical/educational aspects of the ECS program?
8. What has been/could be the effectiveness and efficiency of overall ECS program administration?
9. What is the need for DOER to conduct a future evaluation of the ECS Multifamily Building Program?
10. How should the ECS program be changed to best meet the energy efficiency needs of Massachusetts residents throughout the transition to and after the restructuring of the gas and electric utilities?
11. Does the ECS program as presently operated (as documented in answers to questions 1-9), achieve the goal of energy conservation and energy actions in the most efficient manner possible? If not, what can be done to facilitate better results?

The answers to these questions have been formulated based on research and analysis completed by Hagler Bailly and its subcontractors, Energy Resource Group (ERG) and Stratford Associates, as part of this evaluation project. Specific components of this research are described below in Section 1.3.

It should be noted that the focus of this report is the evaluation the FY95 ECS program, and the effectiveness of its coordination during this time period with other residential energy conservation programs (e.g., utility DSM programs, Weatherization Assistance Program). With the exception of these coordination issues, this evaluation does not address evaluation issues specifically related to utility DSM programs or the WAP program.

1.3 Evaluation Methodology

A total of eleven tasks were implemented to address the overall evaluation goals and specific research questions discussed above. These tasks were developed by DOER with participation by an appointed Evaluation Advisory Group, consisting of representatives from a cross-section of utilities, vendors and the DPU. The ECS Public Advisory Committee also reviewed and commented on the tasks. These eleven evaluation tasks are described in the following sections.

1.3.1 Task 1: Determine whether ECS Achieves Energy Efficiency Actions

To determine whether ECS was responsible for energy efficient improvements, Hagler Bailly:

- identified energy-saving actions implemented in Massachusetts during the period of July 1, 1994 to June 30, 1995; and
- ascertained the sole or contributory role that the ECS program played in encouraging those actions.

Hagler Bailly made this determination based on information collected through telephone surveys of ECS participants and general Massachusetts residents. The sampling and data collection procedures for these surveys were developed in close consultation with and approval of DOER. Representatives from the Evaluation Advisory Group and the ECS Public Advisory Committee also provided input to the procedures and survey instruments.

In order to determine what actions have occurred, respondents were asked a series of questions for each key ECS measure. The surveys were designed such that answers to the following questions would be available for further analysis:

- Are respondents aware of the measure(s)?
- Have they installed the measure(s)? If so, when? If not, are they planning to? If so, when?
- What role did ECS and/or DSM programs play in that installation?

This information was collected for each major category of energy saving measure recommended through ECS audits and/or installed as part of ECS and/or utility DSM programs. In fact, each action taken for the July 1, 1994-June 30, 1995 period was classified into an "attribution category" based on the particular program/service to which this installation could be attributed. Four categories were determined for purposes of analysis:

- ECS induced
- DSM induced
- ECS and DSM induced
- Other (e.g., naturally occurring)

These classifications were determined through two sources. First, information was obtained from ECS providers to understand the scope of equivalent, piggyback, and DSM services available in specific utility service areas during the evaluation time frame. Second, customer responses to additional survey questions were analyzed to determine (a) whether or not they participated in non-ECS energy-efficiency program(s), and (b) the true motivation for measure adoption.

The results of these analyses were used to compare, for each installation category, the following: (a) participation level, (b) measure installation (by measure), and, (c) information source (by measure). Hagler Bailly identified and ranked the extent to which

installation levels (for each type of measure) are occurring for ECS program participants and the extent to which they are attributable to the ECS program, by comparing these rates and patterns for all segments of the participating and non-participating population.

1.3.2 Task 2: Determine Whether ECS Achieves Energy Savings

Hagler Bailly developed estimates of energy savings for measures recommended/installed based on the following sources of information:

- ECS/utility program tracking databases
- Wisconsin Center for Demand-Side Research: Measure Database
- Other, Northeast region utility measure savings estimates

As discussed above, Hagler Bailly established the quantity of specific measure installations attributable to the ECS program in Task 1. In this task, a reliable and reasonable savings estimate was developed for each applicable measure based on the source material listed above. These savings estimates were then applied to the quantity of the various ECS measure installations found through the telephone surveys. The analysis results provided an estimate of:

- the extent to which there is real and effective energy savings being realized by ECS participants,
- the magnitude of those savings,
- the measures from which those savings come, and
- the relative roles that the ECS audit, equivalent services, DSM piggyback services, and other coordinated delivery and referral services each had in the achievement of those savings.

1.3.3 Task 3: Determine Whether ECS Provides Energy Education

The underlying objectives of this task were to assess the extent to which ECS audits (and associated materials) increase participants' level of understanding of:

- the types of energy-saving measures that are available,
- their costs and the benefits (comfort and energy bill savings),
- the necessary effort to purchase and self-install, and
- available follow-up financial and installation services (including DSM programs).

Utilizing telephone surveys of ECS participants, Hagler Bailly assessed the extent to which the ECS program and other information sources increased participants' knowledge of these factors, and whether or not customers wanted/needed additional information. This assessment included: (a) estimates of the extent to which participants reported an increase in their knowledge of available measures and benefits and the steps necessary to install them; and (b) the relative roles that the ECS audit process and other sources had in the achievement of that education.

In addition, a review of available reports concerning the extent of educational impacts achieved through other audit programs has been incorporated into this assessment, and other utility audit programs, including the Rhode Island program, have been compared with the Massachusetts ECS results (from this study).

1.3.4 Task 4: Determine Whether ECS Achieves Other Spcietal Benefits

This task consists of gathering information on benefits in addition to energy savings that accrue to ECS program participants. In consultation with and approval of DOER, Hagler Bailly developed and included in the customer telephone survey questions that would identify benefits, other than energy savings, acquired through the ECS process. The data gathered through this process will be available in the Customer Profile Information System (see Task 5) for future analysis by DOER.

1.3.5 Task 5: Determine the Profile of ECS particpants and Non-Particpants

The underlying objective of this task was to develop a database that captures important classification information for a representative sample of ECS participants and nonparticipants (for the FY95 period). The database is intended to be useful for program planning and updating purposes. Consisting of carefully weighted survey results, as well as selected items from utility tracking databases (where available), this database will allow users to query and cross-tabulate based on any variable or set of variables.

The development of this database involved an extensive data collection effort in which tracking systems were obtained from 11 ECS providers. Hagler Bailly worked within the different database structures and implementation arrangements to process, review, manipulate and combine these various data sets. The final, combined data set has incorporated case weights to adjust for disproportionately stratified sample designs.

Examples of variables contained in this database include[4]:

- **Household characteristics:** primary space/water heating fuel; utility service area; household composition; household income; dwelling type, dwelling age, owner/renter status; geographic location.
- **Participation:** ECS provider; number of ECS audits received; ECS demonstration measures received; ECS equivalent services received; measures recommended via ECS audit; DSM program participation; DSM program availability; ECS information source.
- **Energy efficiency measure installation:** installation category; installation rates; program influence; gross and net estimates of fuel savings.
- **Effects of factors that vary over space and time:** utility rates; availability of ECS equivalent services and DSM coordinated installations; co-payment fees.

[4] A listing of the actual variables included in the final database is contained in Volume III. Also, the completeness of data for each variable is highly dependent on (1) the availability of data from utility tracking databases, and (2) the availability of data from the survey effort.

As the deliverable from this task, Hagler Bailly provided the above information in a relational database format (accessible to Microsoft ACCESS 2.0). We have also summarized the principal findings regarding the profile of ECS customers serviced during the FY95 period. Recommendations regarding how ECS could be modified to better address all, as well as specific, residential customer segments have also been provided.

1.3.6 Task 6: Evaluate the Coordination of ECS with Other Massachusetts Residential Conservation Programs

The objective of this task was to develop recommendations that would eliminate unnecessary overlap between the various existing and potential Massachusetts residential energy conservation programs. Hagler Bailly examined the coordination and overlap of the ECS, DSM, WAP, and potential Massachusetts HERS programs. The examination resulted in recommendations concerning the future direction of ECS with respect to these other programs.

A source of data for this investigation was the participant and general population surveys completed by Hagler Bailly. These surveys were designed (among other things) to obtain feedback from utility customers regarding their understanding of and reactions to the ECS, DSM, and WAP and potential HERS programs. Additional issues explored during these surveys included:

- understanding of the energy conservation services available to them
- source(s) of information - particularly for other energy conservation programs - from which they learned about services available to them
- the extent and/or nature of any duplication of service and/or costs
- satisfaction with the type and quality of the information, and installations provided/demonstrated.

In addition, Hagler Bailly addressed the degree and nature of potential coordination and/or overlap of residential energy conservation programs through:

- a review of selected evaluations of Massachusetts residential DSM programs that speak to coordination issues with the ECS program
- a review of utility plans for future residential DSM programs
- a review of 225 CMR 2.00, 4.00, 5.00 and 7.00 to determine regulatory barriers to coordination of conservation programs
- a review of Chapter 465 of the Acts of 1980 to determine statutory barriers to coordination of conservation programs

A total of forty-eight structured in-depth interviews were completed with eighty-four representatives from the following groups:

- DOER policy and ECS program staff (4 interviews).
- Utility staff, including utility managers, DSM managers, and ECS administrators, from:
    - investor-owned gas utilities (10 interviews),
    - investor-owned electric utilities (6 interviews), and
    - municipal utilities (7 interviews).
- ECS Program vendors,[5] including management as well as field personnel (9 interviews).
- Low-income advocates and community action agencies (4 interviews).
- Fuel oil alliance groups, including supplier alliances and consumer alliances (2 interviews).
- Representatives from 'other' groups and agencies with an interest in promoting residential energy-efficiency, including consumer and environmental advocates and the Massachusetts Department of Public Utilities (DPU) (6 interviews).

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[5] Vendors are firms (both for-profit and not-for-profit) that employ auditors, and conduct ECS audits. One vendor is also an ECS provider. Providers are responsible for all utility aspects required by the program, including responsibility for administering the program (i.e., they report directly to the DOER.) Many utilities act as their own providers, and most of these utilities use an ECS vendor to conduct ECS audits for them. In a few municipal utilities, however, utility employees conduct ECS audits.

Each individual was asked a similar serious of questions during the interview process. Issues addressed during the interviews were developed with the assistance and approval of the DOER and participation by the Public Advisory Group. An informal interview template was used to guide Hagler Bailly staff through the interview process. First, each individual was asked to identify his/her role with regard to the ECS Program (and/or other energy efficiency efforts within their organization) and individual perspectives on the program. Then, each individual provided an overview of their understanding of the program's stated objectives. Next, each individual was asked to specifically provide opinions regarding the effectiveness of the program in the following areas:

- Operations (including program planning, marketing and promotion, and customer request, screening and scheduling)
- The audit process (including technical analysis, educational approach, and auditor preparation)
- Program administration and coordination issues

Next, the interview explored a number of important issues, such as individual's opinions regarding the current ECS regulations, the strengths and weaknesses of the program, segments of the residential market that are currently under served by ECS, whether or not ECS is necessary today, and what they would change about the current program. Finally, individuals were asked to suggest what they felt was the best approach for ECS today, and would be the best approach in a restructured utility environment.

The analysis of the interview results presents areas where ECS and other Massachusetts residential conservation services overlap. These results have been synthesized with the customer survey results to provide DOER with recommendations on the future direction of the ECS program in terms of coordination with other energy conservation programs and market services.

1.3.7 Task 7: Evaluate the Technical/Educational Aspects of the ECS Program

As a subcontractor to Hagler Bailly, Energy Resources Group (ERG) completed a review of the status of the adequacy of energy conservation measures evaluated under ECS, educational procedures, and ECS auditing tool validation procedures. This review assessed whether or not the current ECS procedures utilized:

- state of the art energy-saving technologies (measures)
- state of the art educational procedures
- state of the art procedures to review and approve new audit tools or enhancements to approved audit tools.

ERG compiled available information on state-of-the art residential conservation and audit technologies available from sources such as the Electric Power Research Institute (EPRI), Department of Energy (DOE), and the national laboratories subsidized by DOE. In addition, ERG accompanied six ECS auditors in the field, observing the effectiveness of the audit and associated educational approach. The procedures utilized in these field observations were developed in consultation with and approval of DOER.

In fulfilling this task, ERG completed a review of the required residential ECS measures (1-4 and multifamily) in terms of their validity given the current state-of-the-art. ERG drew upon the available technology literature provided by the sources cited above and used this information to prepare a matrix, which:

- rates the relative energy savings potential of each measure (negligible, minimal, moderate, maximum)
- identifies market barriers to installation (cost, replacement versus retrofit situations)
- assesses each measure's status as a conservation measure (i.e., not current, standard, progressive, state-of-the-art)

For each valid measure, ERG identified existing standard technical auditing methods.

In addition, ERG reviewed the current audit procedures to determine whether the educational procedures and approaches are adequately achieving the educational objectives of the ECS program. ERG also reviewed training documents and established audit procedures to determine whether the auditor certification procedures are adequate to address these education objectives.

Finally, in light of the results of the technical assessment (described above), ERG developed a process and guidelines for reviewing proposed new audit tools and proposed enhancements to existing audits.

The result from this task is a report that (1) analyzes the appropriateness of the current measures, (2) assesses the strengths and weaknesses of the current ECS educational approaches as they are actually implemented, and (3) recommends a process and guidelines for reviewing proposed new audit procedures. As appropriate, recommendations have been provided for future changes in ECS energy conservation measures and the delivery of ECS educational activities.

1.3.8 Task 8: Evaluate the Current Administrative Practices of the ECS Program

The objective of this task was to identify unnecessary administrative burdens in the operation of the ECS program. To address this objective, Hagler Bailly reviewed and examined the ECS statute, and relevant regulations, with focus on the following areas:

- annual ECS goals setting for utilities;
- annual utility implementation plans;
- ECS budget reviews;
- efficacy of division of responsibilities between DOER and DPU;
- monitoring of ECS program plan implementation;
- review and approval of customer notification procedures regarding the ECS program;
- Public Advisory Committee representation and function;
- municipal ECS funding formula;
- municipal ECS additional services;
- new and existing audit review and approval processes;
- selection procedures for ECS delivery contractors; and,
- definition and applications of customer eligibility rules.

In addition, Hagler Bailly utilized the interview process described above under Task 6 to address these issues with key program stakeholders.

As a result of this task, Hagler Bailly has identified (as appropriate) areas where the current administrative requirements and practices have inhibited the efficient administration of ECS. We have provided recommendations for modifying ECS administrative requirements and practices to address these problem areas. Where practical, these recommendations include recommended "performance measures " for administrative activities.

1.3.9 Task 9: Conduct a Preliminary Study of the ECS Multifamily Building Program

As part of the evaluation effort, Hagler Bailly assessed the need for a future, more detailed evaluation specifically addressing the ECS Multifamily Building Program

(MFB). Through our interviews with MFB program providers and other interested parties, issues related to the program's delivery methods, costs, and beneficiaries were discussed. The results of the applicable interviews, as well as other applicable data, have been summarized in this report. We have also developed recommendations for future actions regarding a full evaluation of the ECS MFB program.

1.3.10 Task 10: Provide an Energy Efficiency Needs Assessment of Massachusetts Residential Customers

The objective of this task was to assist in determining if and how ECS should be changed to best meet the energy efficiency needs of Massachusetts residents throughout the transition to and after the restructuring of the gas and electric utilities. In conducting this task, Hagler Bailly implemented a general population survey of Massachusetts residents to ascertain their views on a number of issues, including:

- what residential energy conservation needs exist, and what is the extent of these needs;
- how the needs identified by survey respondents could be addressed and delivered;
- who should provide and pay for these services; and
- what levels of payment would the respondents themselves be willing to pay for these services.

A telephone survey with a representative sample of 597 Massachusetts residents was completed, following survey sampling and data collection procedures developed in consultation with and approval of DOER, and participation by the PAC.

In order to be able to compare different customer segments, respondents were identified as to their membership in one of three primary groups:

- Unaware nonparticipants (i.e., respondents who have never heard of, nor received, an ECS audit);
- Aware nonparticipants (i.e., respondents who have heard of, but never received, an ECS audit); and
- Participants (i.e., respondents who report that they have received an ECS audit since 1980).

The questionnaire contained several questions asked only of participants (e.g., Who provided your ECS audit? How many ECS audits did you receive? How much would you pay for the ECS audit?), and other questions were asked only of aware nonparticipants (e.g., How did you hear about the audit? Why did you not participate?). The bulk of the questionnaire, however, was common to all respondents and addressed the respondents' perceptions regarding their need for and interest in energy conservation services, including:

- "how to" information on purchasing and installing energy saving measures and equipment;

- assistance in finding and contracting with reliable companies who install energy saving resources and equipment;
- financing assistance for improving home energy efficiency;
- mortgages that provide favorable terms for homes that are more energy efficient;
- customized home energy analysis;

Once respondents' identified energy conservation needs, the interview questioned them about their views on the following:

- Who would be the most appropriate entities to market and make available the services (e.g., federal, state, or local governments, utilities, not-for-profit agencies, for-profit parties, other private parties)?
- How might the services be most effectively delivered (e.g., in-person, electronic media, utility mechanisms, retail outlets)?
- Should utilities be required to offer auditing services?
- Should state government be involved in ensuring that energy conservation services are available to Massachusetts residents?
- Who should pay for the identified desirable services (e.g., government tax payers, utility rate payers) and what should be the mechanism for payments?
- What would be the level of payment customers think they would be willing to pay?

In addition, Hagler Bailly collected data regarding household and demographic characteristics of the survey respondents, including: heating/hot water fuels utilized; household composition; household income; dwelling type; length of residence in Massachusetts and current dwelling; dwelling age; and owner/renter status.

Finally, a two-stage segmentation analysis was completed using information collected via the needs assessment survey. Three major dimensions were used to segment the market: (1) awareness of and participation in the ECS program, (2) extent of and need for energy efficiency in the dwelling, and (3) energy "consciousness" and interest in obtaining assistance to address energy efficiency needs. As a result of this analysis, four final segmentation groups were developed. Specific analyses and results were completed to assess issues relating to targeting current and future ECS services for each group (and specific subsectors within groups).

1.2.11 Task 11: Summarize ECS's Overall Effectiveness and Provide Recommendations

In this task, Hagler Bailly consolidated and synthesized the prior task findings and their individual conclusions and recommendations. This synthesis has resulted in a coherent set of recommendations and an implementation plan for administrative, regulatory and/or legislative modifications to improve the ECS program. The plan provides DOER with a strategy to implement the evaluation's recommendations, including ideas and strategies for addressing relevant institutional barriers and political concerns.

This document represents Hagler Bailly's final report. In preparation of the interim draft report, Hagler Bailly presented DOER with the overall findings and tentative recommendations for review of accuracy, clarity and organization. After receiving DOER's comments on the interim report, Hagler Bailly modified the draft report as appropriate[6] and submitted this report to DOER on December 20, 1996. This draft report was circulated for review and discussion, and all substantive comments received through March 3, 1997 have been incorporated in this final version.

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[6] Hagler Bailly's findings have not been modified by DOER. Rather, feedback from DOER on the accuracy, clarity and organization of our results was incorporated into the development of the final report.

This final draft report includes a set of individual task findings, a set of consolidated and synthesized findings, recommendations for modifications, and a strategic plan for implementation of the recommendations.

1.4 Organization of This Report

In addition to an Executive Summary, this report consists of two volumes. Volume I contains a concise yet complete summary of the evaluation findings and recommendations. Volume II, of which this chapter is a part, contains the detailed evaluation results.

As the first chapter in Volume II, this chapter has presented background on the history and principal design elements of the ECS Program, as well as an overview of the goals of and approach to this evaluation. The remaining chapters of this Volume are organized as follows:

- **Chapter 2: Stakeholder Interviews** -- presents an overview of the sample design and data collection process, as well as specific findings regarding stakeholder views on program objectives, program operations, the audit process, program administration, and visions for the future.
- **Chapter 3: ECS Participant Survey** -- presents an overview of the sample design and data collection process, as well as specific findings regarding the participant profile, satisfaction with audit process and ECS equivalent services, adoption (and barriers to adoption) of recommended measures, demonstration measures, and DSM "piggyback" measures.
- **Chapter 4: Needs Assessment Survey** -- contains an overview of the sample design and data collection process, as well as a profile of Massachusetts residents, an assessment of their awareness of/participation in ECS/DSM programs, their perceptions regarding the energy efficiency of their home and its major components, their interest in energy efficiency services, and their willingness-to-pay for these services.
- **Chapter 5: Technical Assessment of ECS Audits** -- contains a critical assessment of audit methods and identifies opportunities for improvement.

- **Chapter 6: ECS Audit Education** -- presents an analysis of the effectiveness of the educational component of the ECS Audit.
- **Chapter 7: Impact Analysis and Results** -- contains an overview of the analysis and results of the impact analysis completed for measures implemented through ECS and non-ECS services during FY95.

Volume 2, Chapter 2 - Stakeholder Interview Results

There are more than one hundred organizations throughout Massachusetts with some level of involvement and/or interest in the ECS program. These organizations include (but are not limited to) utilities, government agencies, and energy services companies. In order to complete a comprehensive evaluation of the program, Hagler Bailly conducted forty-eight in-depth interviews with representatives of many of these ECS 'stakeholders' in 1996. The list of interviewees was developed by DOER with input from selected members of the PAC and other stakeholders. A total of eighty-four individuals were interviewed in interviews that were usually one-on-one. However, several group interviews were conducted (usually in groups of two, with a few larger groups), so that more viewpoints could be included in the study. Group interviews always consisted of representatives from the same organization or type of organization.

An interview guide, consisting of a series of questions organized by topic, was used to guide each interview. However, some questions and topics were not appropriate for some subjects and organizations, so not all questions were asked of all subjects. Furthermore, during each interview, the interviewers and stakeholders worked together to focus on the areas of inquiry in which the subjects had the highest level of interest and expertise, and on the stakeholders' most deeply felt opinions, ideas, and concerns. While this approach may result in the under-examination of some topics in some interviews, this loss is far outweighed by the advantages of focusing, in each individual case, on the topics where the most insight can be gathered.

This chapter presents the findings from the stakeholder interviews in nine sections. These sections discuss finding for each of the key topics explored in the stakeholder interview guide, which are:

- Roles and Perspectives
- Program Objectives
- Program Administration and Operations
- Audit Design and Process
- Coordination
- Regulations and Legislation
- Under-Served Residential Sectors
- Best Approach Today and Best Approach After Restructuring
- Multifamily Building Program

Each topic section is further subdivided into a maximum of six subsections. These subsections correspond to the following six organization types:

- DOER staff (4 interviews).
- Utility staff, including utility managers, DSM managers, and ECS administrators; these results are usually further divided into three subgroups:
    - investor-owned gas utilities (10 interviews),
    - investor-owned electric utilities (6 interviews), and

    - municipal utilities (7 interviews).
- ECS Program vendors,[1] including management as well as field personnel (9 interviews).
- Low-income advocates and community action agencies (4 interviews).
- Fuel oil alliance groups (2 interviews).
- Representatives from 'other' groups and agencies with an interest in promoting residential energy-efficiency. This group also includes the Massachusetts Department of Public Utilities (DPU) (6 interviews).

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[1] Vendors are firms (both for-profit and not-for-profit) that employ auditors, and conduct ECS audits. Some vendors are also ECS providers. Providers do everything vendors do, but they take more responsibility for administering the program (i.e., they report directly to the DOER.) However, many utilities act as their own providers, and most of these utilities use an ECS vendor to conduct ECS audits for them. In a few municipal utilities, however, utility employees conduct ECS audits.

It is important to realize that in-depth interviews are a qualitative, not quantitative, research technique, and as such, the opinions of the stakeholders interviewed do not necessarily reflect the opinions of the whole population of stakeholders that they represent. Instead, their comments are collected and considered in a manner that is, by design, somewhat subjective. The results provide a sort of 'color commentary', consisting of insights, details, motivations, beliefs, and examples, as opposed to an accurate or complete depiction of each group and their majority opinions. However, during all steps of the interview process (the selection of stakeholders to be interviewed, the interviews themselves, and the analysis of results) every effort was made to reach stakeholders of varying opinions, and to represent all of their comments in a similar manner, regardless of their organizational affiliation or their level of responsibility within that organization.

2.1 Roles and Perspectives

2.1.1 DOER Staff

The Division of Energy Resources is the state government's energy policy arm. Essentially, this agency formulates and implements state energy policies, including the ECS program. In the case of the ECS Program, DOER staff administer the program, i.e., they ensure that the legislative and regulatory requirements of the program are being met by providers and utilities. While not directly involved in day-to-day program operations, DOER reviews and approves each provider 's implementation plan on an annual basis, sets goals for the program, and monitors whether these goals are being met. Interviews with DOER staff included representatives from both ECS and policy staff.

2.1.2 Utilities

Most of the thirty-four utility representatives interviewed are the individual at their utility most responsible for the implementation of the ECS Program and its integration with their company's other DSM programs. For those utilities who act as their own ECS

providers[2] (rather than contracting this role out to a third party), the program managers have more involvement in, and therefore more to say about, program administration issues. Others interviewed are senior managers/directors of the department or division[3] under which ECS falls. These individuals had less knowledge of program operations but were better able to address their companies' policy positions on ECS and related matters. In presenting responses below, utility interviews are further subdivided into three subgroups: *investor-owned gas utilities, investor-owned electric utilities,* and *municipal utilities*.

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[2] See footnote 1.

[3] These departments include Marketing, Energy Management, DSM, Business Planning, Conservation & Load Management, Consumer Affairs, and Field Implementation. The General Managers of two municipal systems were also interviewed.

2.1.3 Vendors

Vendors are firms (both for-profit and not-for-profit) that employ auditors, and conduct ECS audits. Some vendors are also ECS providers. Providers do everything vendors do, but they are responsible for administering the program (i.e., they report directly to the DOER.) However, most of the utilities who act as their own providers use an ECS Program vendor to conduct ECS audits for them.

All of the principal ECS Program vendors were interviewed, and the results are presented in two subgroups: *managers* include presidents and directors, program managers, and field operations supervisors. *Auditors* include insights gathered from three focus groups conducted with 19 auditors working for various vendors across the state.

2.1.4 Low Income Advocates

Community action agencies have a direct role in delivering ECS audits in conjunction with the Weatherization Assistance Program (WAP). WAP is a Department of Energy funded residential conservation program administered by the Massachusetts Department of Housing and Community Development (DHCD). WAP delivers comprehensive residential conservation services to eligible low income households. Through the ECS/WAP coordinated delivery component, utility ECS providers who choose to participate in this program supplement WAP resources with modest additional ECS resources. These resources are used to increase energy conservation educational services and materials installations delivered to WAP clients.

Representatives from community action agencies see themselves as uniquely qualified to deliver energy efficiency and education services to low- and moderate-income customers because of their close ties to the low-income community, and their knowledge of that community's housing characteristics and other needs.

2.1.5 Fuel Oil Alliances

Although the ECS Program has been the responsibility of gas and electric utilities since its inception, there are many who have questioned the nonparticipation of the fuel oil sector for as many years. They point out that because oil heat is widespread in Massachusetts homes, oil represents a significant proportion of customers served by the program. However, the program is (unfairly, they say) funded only by the gas and electric consumer. The fuel oil sector was included in the study to address this issue in particular, since their nonparticipation means that they have little knowledge of the program. Those from fuel alliances represented two viewpoints: fuel oil *dealers* and fuel oil *consumers* in Massachusetts, and their affiliation is identified below when their opinions differ.

2.1.6 Other

This category includes two subgroups: representatives from *energy efficiency advocacy groups*, which represent organizations that deliver and promote energy-efficiency technologies, and the *DPU*, which represents consumers in public utility proceedings in Massachusetts. The DPU has a formal role in the program, in that the ECS legislation requires that the DPU must review and approve all budgets submitted by investor owned utilities in a process that includes hearings and full discovery. In the discussions that follow, the subgroups are identified when their opinions differ.

2.2 Objectives

2.2.1 DOER Staff

Most DOER staff members interviewed said that the ECS Program's primary mission is to provide an informational and educational service to constituents. These staff members also mentioned the goal of motivating consumers to act on what they learn through the program. They pointed out that these motivations are achieved through the removal of barriers to installation (such as contractor arranging). However, as one said, "no immediate action is necessarily expected; rather, the payoff from this comes over a lifetime."

Only one DOER staff member interviewed feels that the primary objective is to save energy. This person said that education is the "means, but savings are the end" and pointed out that the statutory intent of the ECS Program is "petroleum reduction in the residential sector."

2.2.2 Utilities

Investor Owned Utilities - Gas. Representatives from gas utilities unanimously agreed that the program's objective is to educate consumers, so that they will understand how they "use and lose" energy. Some representatives also mentioned that the program "intends" to motivate customers to implement what they learn, but believe that without further assistance (e.g., financial, installation) many consumers "just do nothing with education. "

Other program objectives noted were: "excellent public relations; " a way to deal with high bill complaints; and, "to keep the ECS Program going." One utility representative feels that the ECS Program has become a "production program" that basically counts the number of completed audits, and believes that less education is taking place as a result. Another noted that "a lot has changed" since the program was devised in the late 1970's, but that the program design has remained virtually the same.

Investor Owned Utilities - Electric. Most investor-owned electric utility representatives also see the program's objective as providing energy education and promoting energy awareness among consumers. Interestingly, a few interviewees were actually unclear about the program's objectives. One representative also sees the program as a "vehicle for delivering DSM," while another noted that the ECS audit may be "perceived as having less value in the presence of DSM."

Municipal Utilities. While representatives from municipal utilities understand that the presumed objective of the program is to educate consumers about energy-efficiency, most of them mentioned that the original intent was to achieve residential energy savings and believe that the savings that actually comes from ECS audits are not worth the cost.

2.2.3 ECS Program Vendors

All of the vendor representatives interviewed agreed that the primary objective of ECS is to provide energy conservation information to residential customers. Many also mentioned the related goal of "motivating" them to act on recommendations by overcoming barriers to installation. Additionally, ***auditors*** mentioned that the program provides a valuable customer service and improves air quality, while a few ***managers*** feel that ECS is delivered "because it has to be" in order to the fulfill regulatory requirements.

2.2.4 Low Income Advocates

No comments from members of this group on this topic were recorded.

2.2.5 Fuel Oil Alliances

The oil ***dealer*** representative feels that the program's objective is to satisfy regulators, while the oil ***consumer*** representative sees ECS as promoting education and conservation, but only among "middle income homeowners."

2.2.6 Other

Among those familiar with the program, all see it as an educational tool. This includes the opinions of both the representatives from energy efficiency advocates and DPU staff. However, the ***DPU*** added that this objective is deficient in that it does not "ensure the implementation of energy saving measures."

2.3 Program Administration and Operations

This section covers many administrative and operational aspects of the program, including planning, marketing and promotion, and customer request, screening and scheduling, audit delivery, and all related subtopics. In the interest of space and readability, only those aspects that received specific praise or criticism are mentioned. That is, if a topic is not mentioned, it was because none of the interviewees had knowledge of or comment upon the topic.

2.3.1 DOER Staff

Most DOER staff members interviewed feel that, in their **program administration** role, DOER is " too bureaucratic" and that the reporting requirements and budget process are onerous. Having DOER act as the "overseer" for the program seems to cause delays in meeting utility and customer needs. Additionally, those interviewed at DOER think that some utilities resent them for their "micro-managing" the program. It was suggested that it might be more efficient if utilities were allowed to submit only major revisions to their program plans from year-to-year, rather than having to re-submit the entire filing. However, they also noted that current legislation and/or regulations require this existing level of reporting and oversight.

In addition, one interviewed DOER staff member feels that the **program goals** should not simply count the number of audits being completed (and mentioned that the new regulations should address that.)

2.2.3 Utilities

Investor Owned Utilities - Gas. Among those with experience with the **goal-setting process**, most felt that it had improved. While it was formerly based on a 'bad formula, the utility representatives interviewed said that they now work in a 'cooperative ' manner with DOER to find 'common ground' in finalizing utility goals. However, a few characterized the process as being somewhat frivolous, with one saying that the goals are set by either "increasing or holding constant" achievement levels from the previous year, and another saying that the goals are meaningless because there are no penalties for failing to meet them and no rewards for achieving them. Others, however, take meeting their goals very seriously, and yet they worry that they may be doing their customers a disservice: "if consumers who don't request audits don't need audits, and we convince them (through telemarketing) to get audits so that we can meet goal, is this really cost-effective?"

Without question, the harshest criticisms of any aspect of the program concerned the **Utility Implementation Plan** (UIP), a comprehensive document that must be submitted annually by all providers. The UIP contains detailed descriptions of each step of each aspect of the ECS program as implemented by the provider. Comments included: "voluminous" "stifles creativity" "overkill" "frustrating" "evidence that ECS is intensely micro-managed" "bureaucracy at its worst" "major burden" "a waste of time and energy" "a lot of repetition" "a most archaic process" and "ties up resources that could actually be used for something of value."

Many interviewees cited a positive change in the regulations concerning the **distribution of program announcements** (bill inserts) offering the ECS program. Previous regulations had required that they be distributed during the first three months of the year. This caused huge backlogs which and was generally disruptive to operations. Gas utility staff were pleased that they are now allowed to announce the program over 12 months.

Those who mentioned the **budget review and approval process** feel that it should be streamlined. Although they recognize that the hearing format is legislated, they feel that the process should be revised to resemble the less formal process used for DSM budgets (which involve a lot more money.)

Gas utility representatives had mixed opinions of DOER staff's performance as the **program administrator**. Several said that there was "way too much administration for a simple program," but nearly as many said that DOER's work in this area was not problematic.

Most gas representatives think that the **Public Advisory Committee** (PAC) meetings are "useful and good for sharing ideas. " However, some negative comments were aired, with one interviewee saying that there are "just too many different opinions" to listen to, and another saying that the 'public,' does not attend, just "providers and bureaucrats," all with personal stakes in the program.

Also, while some gas utility representatives discussed DOER's **quality control** (QC) reporting requirement, a few expressed an interest in learning what was done with the information. Another feels that DOER's QC efforts are misdirected: instead of looking at what benefits the customer is (not) receiving, they focus on whether the provider is meeting the requirements of their UIP.

In terms of **program costs**, several issues were raised. Several protested the inequity of having gas customers pay for services provided to oil heat customers. Also, one feels that this residential program should not be supported by commercial customers, while another noted that the program simply costs "too much."

Investor Owned Utilities - Electric. Generally, representatives from investor-owned electric utilities had less to say about ECS operations than did representatives from gas utilities, because most were not their own providers (and therefore do not get as involved in operational issues). The one representative whose utility was also a provider echoed the gas utilities on the announcement schedule and the UIP (although the UIP criticisms were comparatively tame), and pointed out that because the program has been marketed in the same way for a long time, new **marketing strategies** must be employed, because the current strategy will probably be unable to continue to attract customers.

Representatives from electric utilities also echoed the gas utilities regarding: 1) fuel oil being relieved of sharing in program costs, 2) wanting to know what DOER has learned from their QC activities, 3) giving mixed reviews to DOER for their administration of the program, and 4) giving mixed reviews to the PAC. Regarding the **PAC**, one said

"communication with other utilities, particularly gas utilities, is becoming more problematic as competition looms."

One representative also had some negative comments about the **budget review and approval process**, saying that it has become tedious, antagonistic, and adversarial, where questioning can sometimes focus on a $100 item. According to this staffer, some problems may result from a "lack of continuity" at the DPU.

Municipal Utilities. Municipal representatives characterized the **UIP** process in much the same way as the gas utilities, adding such comments as "too costly cumbersome" "every year they make major changes in the requirements" and "it's make-work to justify DOER jobs."

Moreover, most municipal representatives feel that **program goals** have become inappropriate. Many feel that program is "saturated," particularly in their service areas, which tend to be smaller towns where the residential customers do not move around as much. Several feel that, at this point, they are primarily providing multiple audits and audits to people who want them for the 'wrong' reason. When someone calls with a high bill complaint, they are sent an auditor "all too quickly" when that might not be the best response for that customer.

Most municipal staffers who had opinions about DOER's **administration of the program**, were not satisfied with their performance. One said that they "overzealously review minutiae" and that, "each year, the requirements get more prescriptive and burdensome."

2.3.3 ECS Program Vendors

All of the comments in this section are from *vendor management representatives*. Generally, vendors regarded the **goal setting process** as adequate and the targets established by DOER as "fair," although they objected to the general concept of "goals" at this point in the program's life cycle. As one explained, when the program began, utilities were unenthusiastic, and therefore, goals made sense. Now the utilities have provided ECS audits to their customers for many years, and they realize that customers value the service, so the goals are totally unnecessary. Another suggested that companies with comprehensive DSM programs should be 'exempted.'

Vendors tended to regard the **UIP** process as a negative aspect of the program bureaucracy. One said that every year, there are "creeping changes. " This stakeholder also sees the UIP process as a disincentive to legitimate program improvements: putting a new item in the package requires a great deal of work and takes a long time - so much so that some may not even attempt it. Another suggested that only revisions to the previous year's documentation should be required each year.

Generally, the program's **marketing and promotional** efforts were perceived as adequate. Almost all vendors discussed how the change in the program's mail-out

schedule has improved the effectiveness of this delivery channel. This change has helped them maintain the workforce and better manage program backlog prior to and during the peak heating season. In some areas, the mailings have been so effective that there is a constant pattern of over-subscription resulting from these efforts. In at least some areas, vendors felt this marketing vehicle was indeed effective in getting the message out to all potential participants - including low-income customers and tenants. However, one representative feels that the program is geared to the "single family homeowner with lots of money."

Vendor management had differing opinions regarding the issue of repeat or **duplicate customers**. A few vendors felt that while these types of leads are generated, they are not significant and do not pose serious problems. However, some of the vendors were concerned about the level of repeat or duplicate customers that are processed through the program each year.

A few vendors questioned DOER's **quality control** efforts. One felt that the level of oversight was "inappropriate" for a small vendor with only a handful of auditors. Another mentioned that it's really "the utilities that should be QC'ing us, not DOER."

There was a general split in opinions regarding the overall effectiveness of ECS **program administration**. Generally, staff of one vendor feels that DOER oversight is at the right level. They consider DOER staff to be accessible to them and they never have felt "constrained" by DOER and regard them as reasonably flexible.

However, staff of the other vendors did not agree. In fact, one vendor representative considered many aspects of ECS program administration to be quite ineffectual, with specific references to communications bottlenecks, and overly burdensome and inappropriate regulations and reporting requirements (e.g., DPU budgeting requirements, quarterly training, QC reports, etc.). This vendor recommended greater local control over the audit process at the utility level, and increased flexibility in program design to enhance program cost-competitiveness. Similarly, another vendor representative indicated that, despite its years of experience implementing similar programs, the requirements of ECS are "overkill," creating more work than necessary for both the vendor and the utility.

2.3.4 Low Income Advocates

Representatives from this group did not offer any specific comment on how the program is administered and operated, except to recommend that, regardless of how program funds are collected, the *allocation* of such funds should continue to be fuel blind.

2.3.5 Fuel Oil Alliances

No comments from members of this group on this topic were recorded.

2.3.6 Other

DPU Staff feels that **program administration** is adequate, but reports that there are some sources of friction between the DPU and the DOER. For one, DPU staff reported that they are charged with reviewing budgets, but have no input into the organization of these submittals. They feel that this makes their job very difficult, and the DPU staff members interviewed would like to have some say on this issue. (However, DPU Commissioners do not want them to take on the responsibility.) The DPU staff interviewed also feel that DOER wants them to "rubber stamp" the budgets so that DOER can "move on," whereas these DPU staff feel obliged to review both the utility plans and budget documents carefully.

While most representatives from ***DPU staff*** felt that the program was planned well, there were some concerns. For example, a few reported that there was too much emphasis placed on simply getting the audits completed rather than conducting quality services (quantity rather than quality). A few representatives from this group stated some concern about the number of audits being completed at each customer's home. One suggested that there should be a better tracking system to avoid over-spending on repeat audits. Finally, one DPU staffer was also concerned about the fact that commercial customers are paying the ECS surcharge.

Energy efficiency advocates had little to say about program operations and administration. However, one noted that DOER takes "a lot of unfair criticism" for enforcing the statute, and pointed out that "good bureaucrats" do not ignore the law.

2.4 Audit Process

The discussion on the audit process included specific issues such as technical analysis, educational approach , auditor preparation, and all related subtopics. As described above in section 2.3, only those aspects that received the specific praise or criticism of one or more members of a group (or subgroup) are mentioned.

2.4.1 DOER Staff

Interviewed DOER staff generally agreed that the audit process was of good quality. They see the addition of the Appliance Efficiency Educational Service (AEES) as an improvement to that process.

However, several of those interviewed from DOER noted the existence of some differences (or inconsistencies) in the nature of the audit tools and technical information currently provided by the various vendors. It was also noted that there is no mechanism to ensure that currently-approved audit packages remain updated, technically accurate and constant. In addition, existing requirements to approve new or updated audit packages are generally considered to be laborious. It was suggested by several staff that this process needs to be reexamined in terms of effectiveness and cost.

An additional concern was the length of the audit itself, which some felt was generally too long. Two staff members suggested that consumers should have an option of a mini-

or partial-audit, or of receiving information in another manner (rather than an audit). Additionally, DOER staff pointed out that information about participants in the program was not captured in a consolidated tracking system. This makes statewide follow-up to determine whether measures/recommendations had been implemented much more challenging, and it does not permit an efficient analysis of the extent of multiple or repeat audits across the state.

2.4.2 Utilities

Investor Owned Utilities - Gas. Many in this group had concerns regarding the technical analysis portion of the audit process. Several felt that there were problems with the **savings estimates**. One stakeholder said that the savings are "overstated" and the paybacks are "too short" and that makes the ECS audit of less value. Another pointed out that the savings are based on many "underlying assumptions" and that the auditor needs to know what they are and change them when they are not applicable or else the recommendations will be wrong. This stakeholder feels that many auditors do not do this.

Some felt that the **audit report** was too cumbersome for customers, and that customers did not understand or read them. One feels that they could improve the report format if "DOER would let them." Others said that the report was OK, but that it could be better.

Several stakeholders complained about the **audit approval process**. One said that "there is little incentive to modify the audit, because the review process is time-consuming, expensive, and no fun" and added that "this is an example of how the regulations stifle competition and innovation." Another compared the process with "electing a new pope." Several also lamented the fact that no **measure recommendations** can be added to the audit because of specific language in the legislation. And there was general concern about the lack of **follow-up** to ensure recommended measures were actually implemented

There were only negative comments on the **demonstration measure installation** (DMI) aspect of the audit. One stakeholder pointed out that it's tough in many instances to motivate the customer to further install the measure because "they are having trouble making ends meet, and we're asking them to invest in energy-savings." Another says that it is now "really an installation service" that does not go far enough. Similarly, one stakeholder thought the utility should have the flexibility to install more measures. And another said it "can't help much" in instances where people are elderly or not handy.

The **Contractor Arranging Service** (CAS) was also viewed negatively. Several said it was "not used" and "unnecessary" because there is no demand, which is due in part to a lack of available financing programs. One said it is "an overly regulated service that is too costly." However, reviews were mixed on the **Bulk Purchase Service** (BP). A few think it is effective, but a few more think it is unnecessary because the products are widely available. Regarding the **Appliance Efficiency Educational Service** (AEES), a few gas utility representatives felt the demand for this service among gas customers is low (customers look for this service to be provided by their electric utility).

Overall, most were very satisfied with **auditor preparation levels**, and sang the praises of the audit corps. One stakeholder, however, pointed out that the level of training has "diminished over time" and that auditors are now really "technically savvy installers, not energy advisors."

Investor Owned Utilities - Electric. Generally, representatives from investor-owned electric utilities had less to say about the ECS audit process than did representatives from gas utilities. Those comments that were received were similar to the gas utility comments on the savings estimates, DMI, BP, and CAS aspects of the program. They also were very satisfied with the level of auditor preparation. The only different comment concerned the **AEES**. An electric stakeholder said that customers were very pleased with the service and that it "corrects a major shortfall of the past."

Municipal Utilities. Representatives from municipal electric utilities also had much less to say about the ECS audit process than did representatives from gas utilities. Those comments that were received were similar to the gas utility comments on the audit report, DMI, CAS, BP, follow-up, and auditor preparation.

2.4.3 ECS Program Vendors

Vendor *management representatives* and *auditors* had substantial comments on the ECS audit process. In the interest of brevity, members of the former group are called *managers* throughout this section. Unless the groups are explicitly identified, comments can be assumed to have come from both groups.

Generally, most *managers* regard the **technical analysis** component of the audit process as sufficient to get the important information into the customers head and hands. "This isn't hard science, we aren't doing a full heat loss analysis, but we are getting the relative information out there." A few managers offered specific suggestions for improving the quality or accuracy of results generated from the technical analysis component of the audit process: allow the use of site-specific cost data (as opposed to state-wide averages); make calculations based on variable degree days (as opposed to heating degree days); discontinue recommending replacement heating systems for systems that are over five years old; and have DOER periodically review savings estimates for recommended measures.

Those *managers* who commented on the **audit report** feel that most customers understand them. They attribute this in part to the auditors de-briefing. As one said, "we have a 1-800 number to call with questions on the audit report. We get very few calls." *Auditors* feel that it is a "useful tool" but that it can not and does not capture everything, and that is why the auditors are there: to interpret, caveat, prioritize, and explain. Auditors describe how customers may say they think they need more efficient windows, but do not always see the correlation between energy use and lack of attic insulation. The computerized audit report is helpful in this regard; it assists the auditor in diverting the customer's attention from the windows to the attic insulation measures.

A few *managers* had concerns about the time and money required to take part in the **audit approval process**. One wants to improve their audit tool, but is unwilling to risk investing in making the change given that their ECS contract is only for one year. Another is undergoing the process, but only because they received the financial support of their client utility. "A lot of expense went into debating all the details with the Energy Office. It was crazy because the new audit is a vast improvement over the one that is in place that was approved."

Some *managers* offered suggestions on **recommended measures** that should be added to or deleted from the list of measures included in the technical analysis component of the audit. These findings have been integrated into Chapter 5, which presents a more detailed summary of our findings regarding the appropriateness, technical significance and/or accuracy of the measures included in the audit, as well as the measure changes recommended by vendor managers.

Auditors reported that their job during the **educational phase** is to "synthesize" information, some of which the customer may already be aware of, and give customers a place to start by establishing for them a set of priority measures and/or practices. One group of auditors described their approach: they usually enter the home and ask the customer "What can I do for you today?." From the customer's responses, the auditor picks up on what they really need and recognizes the limitations of what he/she can provide. Usually, auditors can give customers what they really need.

Auditors commented that while they would like to think that there is widespread **implementation of recommended measures**, they have done enough "second audits" to know that previous participants had not "gone ahead and installed that second outlet gasket. " One group of auditors suggested that they should be allowed to conduct (or at least provided with findings from) follow-up research to determine the rate of measure implementation. Another group of auditors claimed they would be more "motivated" if they had access to information regarding measure installation rates and participant satisfaction.

Generally, vendor *managers* and *auditors* perceived the delivery of **AEES** to be effective because it addresses a past deficiency of ECS. Although one manager said that it was instituted "out of jealousy, " another said that "AEES has been helpful in providing information to customers- even gas customers- on why their electric bill is the way it is." *Auditors* feel the AEES component is a real eye-opener for many participants. In fact, one group of auditors mentioned that this aspect of the program has solved a few family arguments, such that residents now realize that it is the electric water heater, not the lights, that is driving the electric bill. The AEES component also helps the auditor gain credibility in the eyes of the participant. For example, if the auditor can find that one item or appliance that is causing them to spend significant energy dollars - and they can tell them how to reduce their spending on this item/appliance - it helps the auditor appear more credible.

Generally, the **DMI** or "do-it-yourself" measures were regarded by *managers* and *auditors* as effective and customers have been pleased with the results. However, several commented that this component of the program could be expanded to (a) allow auditors to "sell their services" to finish the installations, and (b) give auditors greater flexibility with respect to the quantity of each demonstration measure that can be installed. One group of auditors indicated a desire to be allowed to sell some of the smaller demonstration items on the spot, and some customers have asked auditors if they could hire them to install the measures outside of the program. The limitation on quantity is especially frustrating in elderly and low-income households, because when weatherstripping is demonstrated in an elderly person's home, this person clearly cannot complete the installation on their own. Auditors suggested that the customer should be allowed to "pay extra" in these cases to have the complete set of measures installed for them. Similarly, in low-income homes, if all windows require weatherstripping, then all windows should be treated - not just the demonstration window - because it is not likely that the low-income customer will pay to purchase (and install) the remaining measures.

Managers and *auditors* questioned the usefulness of and need for the **bulk purchase** component of ECS. Generally, vendors agreed that for items that are not readily available (or otherwise cost-prohibitive) in the market place, the bulk purchase option is useful. However, many of the bulk purchase items included in ECS are available locally (e.g., Home Depot) at competitive prices (e.g., bulk purchase price may be lower than market price, but shipping and handling makes up the difference). One *manager* suggested that vendors should be allowed some flexibility in what they can leave behind, instead of being required to install certain quantities of important items and hope that customers "finish the job" on their own.

For **CAS** to be effective, most managers agreed that it needs to be bundled with some type of financing or financial assistance package. One manager indicated that 4-5% of their ECS-only customers ask for CAS, whereas when DSM assistance is involved, 40-60% of the recommendations involve contractor arranging. Finally, one vendor noted that CAS may not be appropriate for and is not often used in rural areas. As a result, efforts to make all utilities offer CAS make the implementation of these services more expensive for smaller vendors to implement.

As with CAS, a few vendors agreed that **work orders** would be more effective if bundled with some type of financing or financial assistance package. One vendor estimated that approximately 20-30% of the homes have work orders prepared. While the auditor prepares the specifications, this vendor perceives the lack of financing as the principal barrier to follow-through on the part of the customer. Another vendor commented that for work orders (and CAS) to be most useful, they need to be placed in the context of a "system." However, one vendor questioned the effectiveness of the work orders in the sense that a work order prepared by an auditor would never be used by an installation contractor

Generally, **post-inspections** are regarded as effective. However, one vendor mentioned that including post-inspection services as formal program feature is much more difficult

and costly in the more rural areas. Moreover, efforts to make all utilities conform and use standard protocols make the implementation of these services more expensive for smaller vendors to implement.

Finally, all three groups of auditors (19 total) commented on specific problems relating to **heating system efficiency tests** conducted by oil dealers. While each group of auditors reported that they have run into cases where the efficiency test "tags" on oil systems overestimated the actual efficiency of the system, one group of auditors actually estimated that 10% of the systems with efficiency tags are grossly wrong, 80% are "too high," and the remaining 10% are probably about right. Sometimes auditors find that tests were never performed (i.e., no "test hole"), although efficiency tags are present on the system. At this point, most auditors mentioned that they are careful in handling customers' concerns about their oil systems - some customers have been using the same oil dealer all of their lives. These auditors do not want to be in the middle of a battle between the oil companies and their customers, so they are careful not to imply that their oil company is deliberately misleading or misinforming them- but some auditors are convinced that they are.

Generally, managers and auditors agreed that **auditor certification** represents a good baseline for each auditor to start with. Training provided in an open forum that promotes the exchange of ideas and experiences is regarded as the most effective approach. Vendors and auditors also agreed that it is the experience that comes after the initial training that is the most crucial. "Auditing" was regarded by many vendors and auditors as a "cultural thing," in that auditors pass down their knowledge and experience to new hires. As new methods are developed or ideas are generated, auditors work together to share their experiences and do better. In this light, vendors highlighted the importance of maintaining a stable workforce to support this level of experience to pass down to new hires.

While all vendors and auditors agreed that some type of training program is needed for new hires, they did not agree on the value of the **quarterly training requirements** of ECS. For example, several vendors and auditors questioned the quality of training ("our auditors know more than the trainers, utilities, and DOER put together"), and others indicated that they only use about 10% of what they learn in these training situations (most valuable learning experience: in-field training with experienced auditors). On the other hand, some vendors regard the quarterly training and certification as "very thorough," providing for follow-up observation and supervision of newly trained audit staff. Another vendor mentioned that the quarterly training activities are important because they introduce auditors to new products and technologies (e.g., blower door tests, infrared scans).

2.4.4 Low Income Advocates

No comments from members of this group on this topic were recorded.

2.4.5 Fuel Oil Alliances

Representatives from fuel oil alliances expressed some concern over the adequacy of training provided to ECS auditors.

2.4.6 Other

Both energy efficiency advocates and DPU staffers are concerned about the fact that the program only educates, but does nothing to **motivate** customers to install recommended measures. They are also concerned about the accuracy of savings estimates.

The DPU staff interviewed, as well as one energy-efficiency advocate, were also very negative about **auditor preparation**, saying that auditors are not trained well and do not always care about making the right recommendations. These stakeholders think that auditors need more incentive to motivate customers, but they only incentive auditors receive now is to get the audits done quickly and move on to the next one.

2.5 Program Coordination

2.5.1 Utilities

Investor Owned Utilities - Gas. All gas utility representatives were pleased with the level of coordination between the ECS program and their piggybacked DSM programs[4]. A few pointed out that this was not always the case, and that the desire to improve this level of coordination led to their decision to act as their own ECS provider.

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[4] "Piggyback" refers to situations where two or more energy-efficiency programs are delivered at the same time, thereby sharing (and saving on) program delivery costs.

Investor Owned Utilities - Electric. For the most part, investor-owned electric utility representatives are also pleased with the coordination between the ECS program and their DSM programs.

Municipal Utilities. Because municipals offer few programs beyond the ECS program, coordination is not much of an issue.

2.5.2 ECS Program Vendors

Generally, vendors were split with respect to their comments on coordination issues. Representatives of one vendor remarked that they coordinate with DOER and other entities (e.g., WAP, other utilities) very well. They claim to have a more structured intake system that efficiently maps a customer request with the appropriate delivery service. In addition, a few utilities request the vendor to coordinate closely with WAP agencies.

However, another vendor commented that coordination between DOER, utilities, other entities (e.g., WAP) is somewhat difficult because of the difference in systems and

structures within each group. This vendor commented that there is no incentive for anyone to make it work any better - in this vendor's opinion, there is a tremendous internal inertia to meet "your" goal. As such, developing an appropriate and effective reward system for improving coordination among key players under these circumstances is a challenge.

One vendor noted coordination problems between gas and electric companies, since one vendor provides services to customers under contract to the gas utility, yet another vendor provides services to customers under contract to the electric utility servicing the same customer. More importantly than the coordination bottlenecks that this arrangement presents, there is duplication of effort because there are two vendors providing legitimate service to the same customers.

2.5.3 Low Income Advocates

Some community action agency representatives commented that a "substantial" amount of paperwork is required for the ECS, WAP and DSM piggyback programs, and noted that the process is a "very complicated way to do business." Short of suggesting a complete over-haul of the programs, these representatives indicated that, if things are to stay the same, the administration and implementation of the DSM, ECS, and WAP components needs to be made more seamless. They suggested that the best way to do this would be to develop several 'generic' programs (e.g., low income, new construction) that incorporate the same standards and requirements.

2.5.4 Fuel Oil Alliances

No comments from members of this group on this topic were recorded.

2.5.5 Other

No comments from members of this group on this topic were recorded.

2.6 Regulations and Legislation

2.6.1 DOER Staff

All DOER staff members interviewed would like to see some changes to the legislation and regulations. One thinks that more flexibility is the way to go- keep just enough requirements to ensure that program objectives are being met without the current high level of oversight. (Section 2.7.1 covers some of the administrative requirements that interviewed DOER staff would like to see reduced.) Another simply said that the regulations need "major re-vamping" while a third suggested some more concrete changes: eliminate the CAS and other equivalent services, and change the municipal funding mechanism. Unfortunately, regulatory changes cannot be made easily or quickly.

2.6.2 Utilities

Investor Owned Utilities - Gas. Representatives from gas utilities feel that ECS regulations are outdated and inappropriate in several ways. One pointed out that, after deregulation, the fact that gas customers are forced to fund the program while oil customers get a free ride will be even more unfair than it is now. Another noted that some high efficiency measures are excluded because they are not listed in the regulations- but only because the measure was not available when the current regulations and legislation were written. A third said that ECS auditors should be allowed to educate customers on what is right for them, even if this involves fuel switching.

Investor Owned Utilities - Electric. Very few representatives from investor-owned electric utilities offered any specific comments regarding ECS regulations. Those who did comment questioned the appropriateness of having such a regulation when they are about to be deregulated.

Municipal Utilities. Several municipal utility representatives feel that the ECS regulations are outdated, unnecessarily burdensome, inflexible, and generally inappropriate for municipal utilities. However, a few conceded that, without such a requirement, some municipal utilities would do nothing to promote residential energy efficiency. (However, they also believe that most municipals would do "what makes sense.") They would like to see the Contractor Arranging Service (CAS) go away (even though, as municipals, they are not required to offer it), because they think it only made sense when the Heat Program[5] was around. They know that the regulations are too constraining because every time they propose a different approach or a new angle, the DOER says they can not do it because the regulations would not allow it.

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[5] The Heat Program was available for a few years in the late 80's and early 90's. Using oil overcharge funds, consumers could get zero-interest loans to fund energy efficiency improvements to their homes. The first step to receiving such a loan was receiving an ECS audit.

2.6.3 ECS Program Vendors

Several vendors agreed that the regulations inappropriately try to make all utilities do the same thing. In one vendor's opinion, ECS forced some investor-owned utilities to get more involved in providing services, while another vendor felt that current regulations limit the level of service even investor-owned utilities can provide to their customers.

In the context of regulations, several vendors commented that the PAC is not very useful. The main purpose of the meetings, as reported by several vendors, is to satisfy a regulatory requirement - whether or not they are needed. Some argued for the keeping group forum but not on a quarterly basis. Others felt the meetings were just unnecessary.

2.6.4 Low Income Advocates

No comments from members of this group on this topic were recorded.

2.6.5 Fuel Oil Alliances

No comments from members of this group on this topic were recorded.

2.6.6 Other

All members of this group who are familiar with the program feel that the regulations should be revised. One thinks that new regulations should state program goals in terms of market transformation, while another feels that they should explicitly include a financing component. However, one stakeholder feels that DOER should work on passing a new statute. This stakeholder thinks the new statute should be more loosely framed (saying that the program should do something like "focus on customer needs" and "overcome market barriers") and give DOER the ability to "reject, but not direct" utility activities.

2.7 Under-served Residential Sectors

2.7.1 DOER Staff

Most DOER staff interviewed feel that low-income residents are under-served by the current program. In the case of low-income customers, the DOE's WAP program meets some needs but it is more installation than information. Furthermore, the low-income sector is disproportionately burdened with energy costs: "thousands of people are struggling to pay their heating bills, and yet we're doing audits in Brookline." The elderly population was also mentioned by one staffer, who feels that they need more help in gaining an understanding of why energy issues are important and necessary. In addition, one DOER staff member mentioned the moderate income sector, and pointed out that they also struggle to meet their energy costs, but are not eligible for government (i.e., low-income) programs.

2.7.2 Utilities

Investor Owned Utilities - Gas. Nearly all representatives from gas utilities feel that all residential markets are adequately served through ECS. However, one representative from this group expressed interest in seeing the new construction sector and the low income sector better served, while another feels strongly that the program does a very poor job reaching non-English speaking residents.

Investor Owned Utilities - Electric. For the most part, representatives from investor-owned electric utilities felt that all residential segments were being appropriately served through ECS. Only one representative from this group felt that perhaps the program does not adequately serve tenants and/or low-income customers, while another noted that everyone who wants an audit has already had one and "only the disinterested remain."

Municipal Utilities. Several mentioned small "mom & pop" businesses as being under-served by the program. Although these are not considered the residential sector, stakeholders feel that members of this group should be similarly protected because they

share the same characteristics, i.e., they need information and access to funds for improvements. Another municipal stakeholder feels that, if anything, some customers are "over-served" rather than under-served by the ECS program.

2.7.3 ECS Program Vendors

Many auditors (as well as one manager) believe that the low-income sector is currently under-served by the program. As one auditor in western Massachusetts said, "I see middle class, middle-aged couples." A few auditors also feel that their program materials should be translated into Spanish.

2.7.4 Low Income Advocates

The representatives from community action agencies commented on what they called a "huge crack" into which many people in Massachusetts fall: the working poor. This sector of the residential population makes too much (maybe $20,000 to $30,000 per year) to qualify for low-income programs (e.g., WAP), but they do not have the income and/or credit-worthiness for conventional loans to implement energy savings measures.

One of the low-income advocates commented that tenants are also under-served by the current program. In this individual's opinion, utility programs targeting this sector are primarily designed for building owners and/or landlords, yet building owners/landlords may be more inclined to place the burden on their tenants (since they pay the energy bills). Not an uncommon dilemma within this complex sector, this low-income advocate suggested that some sort of program should be designed to provide specific benefits for tenants, who are usually low-income and under-served.

2.7.5 Fuel Oil Alliances

One representatives from this group feels that tenants, the low-income sector, seniors, and minorities under-served through ECS.

2.7.6 Other

Several representatives from this group believe that the low-income sector is under-served by the ECS Program. One representative thinks that oil heat customers are also under-served.

2.8 Best Approach Today and Best Approach After Restructuring

2.8.1 DOER Staff

The DOER staff interviewed believe that the current program provides valuable information in a useful manner. They cite the personalized, financial analysis of custom audit recommendations completed on-site with laptop computers, and the personal service ("hand holding"), and have the opportunity for give and take with the auditor.

However, some staff members pointed out that the audits themselves were somewhat inflexible. The administrative requirements is seen as a high burden, as is failing to fully help customers implement plans and failing to provide below-market (or even market-rate) financing for low and moderate income families.

The DOER staff interviewed also believe that energy education, information and services are still very necessary today, and hold similar opinions on the best approach to delivering energy-efficiency services to the residential sector in the near-term. Most feel that: (1) DOER's role should be less "hands-on"; (2) an independently-run third party (instead of utilities) should deliver the program; and, (3) the legislation and regulations should be changed so that a more flexible menu of services can be offered.

In the flexible "menu approach" envisioned by DOER, customers would receive the service (e.g., full audit, partial audit, information services) which gives them what they need. This approach could also eliminate the need for repeat visits, so that the customer gets exactly what they want the first time, and would also reach those who need information but avoid the audit because of the time commitment. The program should also be flexible over time, because technological changes will result in changes in the consumer's need for information. This approach would also include more effective ways to disseminate information to "do-it-yourselfers," considering such avenues as the Internet, brochures, and an 800 customer service number. This information could also include instructions and worksheets for people to conduct audits on their own.

One staffer had many other specific suggestions for the near term: implement a fee for on-site services; incorporate a performance-based program design; relieve gas customers of paying twice; relieve non-residential customers of the ECS surcharge; change the municipal funding mechanism; and market the services more heavily to new homeowners, new tenants, new construction, and low-income.

After restructuring of the electric and gas utility industries, most DOER staff interviewed believe that some form of education or assistance for residential customers should remain in place. Several envision the concept of a program delivered by a third-party, which would be "overseen" by the public. There are several reasons for this, which were cited by various staff members. One is that the state is not in the position to be flexible and respond to changing consumer needs, in a rapidly shifting utility environment. A second reason is a market issue. While some utilities are interested in providing fuel-blind energy efficiency services, other utilities are only interested in providing efficiency services for equipment using their own type of fuel still. Others are not interested in providing the ECS program at all. For these reasons, there may be an interest in a non-utility party, but not necessarily the state government, delivering residential energy services in the future.

2.8.2 Utilities

Investor Owned Utilities - Gas. Gas utility representatives see the current program as having excellent education and customer service elements. They noted that customers are satisfied with the program, giving much credit to the "hands-on" approach and to the

impression that the program is free. One stakeholder thinks the program is well-administered. Another thinks that their ECS vendor is a real asset: they are "lean and mean" and "passionate" about their work.

However, they commonly see the program as too highly regulated. Other problems mentioned include the program's inflexibility, the program design's discouragement of creativity, the presumably low benefit/cost ratio, the amount of paperwork, and the amount of data collected (and the perception that this data is not used.)

Furthermore, most representatives of gas utilities feel that an ECS-type program is necessary today and will continue to be necessary in the future. These stakeholders think that public education and information are still important "because homes aren't up to standards - we should keep doing this until we can go into homes and make no recommendations." One pointed out that, with the continual erosion in DSM programs, ECS may be the sole remaining service utilities offer, and another thinks it is important to have such a "baseline" program. However, one stakeholder thinks that ECS should be "abolished" because there is no longer any demand for audits.

Representatives from gas utilities generally felt that utilities should continue to be responsible for providing an ECS program that is more flexible and less regulated. However, they felt strongly that oil customers should be required to contribute toward program costs, although one commented that this is "not worth fighting over," because the service is so highly valued by customers. Gas stakeholders were split on the issue of a nominal customer fee- about half thought it would be good (waived for income-eligible households), to improve cost equity, to weed out customers who do not really need the service, and to increase the program' s credibility. The other half thought it would be too much of a barrier to participation and would be too burdensome to administer.

Several stakeholders feel that, after restructuring, utilities should have the option of providing an ECS-type service if it fits with their product mix. After all, the "provider of any product has a social responsibility to educate their customers about the use of that product." Others, however, see a need for continued (but vastly reduced levels of) regulation, with costs recovered in transportation rates. However, one stakeholder thinks costs should be recovered by the distribution companies.

Gas stakeholders are intrigued by the potential that Home Energy Rating Services (HERS) and Energy-Efficiency Mortgages (EEMs) have for improving the energy-efficiency of the housing stock. However, most feel that these services should not be provided in conjunction with any audit/information services, but should be encouraged by some other means (e.g., the financial industry, building codes.)

Investor Owned Utilities - Electric. Representatives of investor-owned electric utilities think that the current program is "not cost effective in terms of achieving energy savings, " and forces ratepayers to pay for an education program which they may not want to pay for. They tend to see the education provided by the ECS Program as very valuable, but some wondered whether the program has "outlived its usefulness" because it has reached

its saturation point and because DSM programs, which did not exist when the ECS Program began, have now made ECS somewhat obsolete.

Almost all representatives from this group feel that, if the program continues, it should continue to be provided by utilities, although one feels that a "third party" should deliver it. All wanted to see more flexible, customized services: perhaps provide referrals, introduce new technologies, and lift the ban on providing fuel-switching information. Another wanted to keep the AEES and to apply cost-effectiveness standards as is done with DSM programs.

After restructuring, several think that all regulations should be dropped and that market forces should prevail. One person suggested that the state could fill any perceived gaps by offering information services at that time, by telephone or publications. If utilities were to be required to continue offering such a service, they want very little in the way of prescriptive regulation.

Municipal Utilities. Municipal utility representatives also feel that the program is not relevant in its current form. In addition to more flexibility and less regulation, they would like to see a financing option, or some other type of financial incentive mechanism to encourage the adoption of energy saving measures. One pointed out that electric companies are "subsidizing oil company efficiency," and another mentioned that there is not enough follow-up with participants. Some would like to see a third party deliver the program, others want a fee imposed, another wants to see energy efficiency become more of a commodity (so that, for example, the hook-up fee could be a function of energy efficiency), another wants to target those sectors with the most energy savings potential,

Several municipal stakeholders pointed out that the municipal spending requirement serves a very valuable purpose: if it were not in place, many municipals would do nothing to promote energy efficiency. Therefore, several feel that the state should continue to require municipal funding of energy-efficiency programs, but that they should not prescribe and regulate these programs as they do with ECS. However, stakeholders want the funding mechanism to change (it should be a percentage of residential revenues, not total revenues).

One municipal stakeholder had very specific ideas about how to offer financing assistance. Utilities are "not the best organizations to secure money" so the state should either encourage the financial sector to form an energy-efficiency loan pool, and/or should issue bonds to develop funds. Then, a third party would provide the technical assistance and approve loans based on some set level of cost-effectiveness. Only capital expenditures would be allowed. To reach the new construction market, the energy efficiency requirements in the building code should be tightened.

2.8.3 ECS Program Vendors

Most vendor representatives view ECS as a program with an as-yet unfulfilled mission. Managers think that, after deregulation, a less regulated, more flexible ECS Program

should remain so that there will continue to be an "unbiased" vehicle for delivering energy efficiency education to customers. One said "after restructuring, this program can play an important role as the one place where important issues can be sorted out." Another said, if you remove the regulations entirely, the utilities may still do something but they will definitely "do less."

Virtually every vendor representative interviewed, auditor and manager alike, think that the critical missing piece in this program is the availability of financing- preferably low interest. One auditor suggested teaming with heating system dealers, who already offer financing packages.

Vendor representatives had mixed opinions as to whether or not a fee would be a good idea for ECS. Most managers saw a nominal fee as a good thing (although some did not) and most auditors saw a fee as a bad thing (although, again, some did not.)

Auditors had a few other ideas for what services should be provided. Most of them think some kind of "handyman" service- especially for low income and elderly customers- is necessary. Auditors could complete the weatherstripping and other measures currently 'demonstrated'- perhaps for a fee. They also think that people with oil heat (who have no DSM services available) need and would use and pay for such a service. Most of them would also like to have the freedom to discuss fuel switching.

Other ideas volunteered by auditors: "more follow-up" to audits; some kind of regulated inspection service for oil heater efficiency ("they do it for automobiles, which pollute less") to combat the widespread problems with current efficiency tests (described in section 2.4.3); and base the auditors pay on the amount of savings achieved (rather than the number of audits done.)

2.8.4 Low Income Advocates

All of the low-income advocates agreed that a residential energy-efficiency program is still necessary today. As for the best approach, there were two basic ideas presented in the interviews, both of which incorporate making financing available. In the first idea, the existing program is streamlined, with a lot less administration, and the quotas are abandoned, resulting in fewer audits (of higher quality) each year. The financial savings from this change (presumed to be about half of total program funds) would become a loan pool, which would be available to audit participants who meet certain income and cost/benefit criteria.

In the second idea, the same amount of money that is being collected today would still be collected and split it into two pots: one for low-income households, and the other for moderate-income households. The low-income money would be used to supplement current DOE weatherization program funding (continually eroding) and use DOE standards to ensure that low income families[6] have adequately weatherized homes.

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[6] They would also raise eligibility standards for the low-income program, from 150 percent of the poverty level (the DOE program cut-off) to between 175 and 200 percent of the poverty level.

For moderate income people, a program very similar to the HEAT loans should be developed and administered. In the HEAT program, participants received audits, work orders, contractor arranging, and contractor supervision through the program, and customers paid back only the principal of the loan over time. Program funds were used to pay the interest on their loan. Perhaps participants could be charged a fee for the audit, which would be applied toward the installation cost. In this way, only people who are really serious about implementing measures (i.e., they are willing to pay something up-front) would enter the program.

Recognizing significant political barriers, some representatives from the community action agencies also support a tax credit, citing the success of past tax credits in encouraging solar installations.

Community action agency representatives feel that their agencies are most qualified and most appropriate for running these audit/financing programs as they did for the HEAT program and currently do for the WAP/ECS program. These representatives indicated that while the current vendor organizations are equipped to administer the moderate-income components, they have no special ties to low income groups. They also felt that utilities are not well equipped and/or willing to administer programs with the low and moderate income sectors.

2.8.5 Fuel Oil Alliances

The representative from the consumer fuel oil alliance expressed interest in adding financing and doing more to encourage the installation of recommended measures. After restructuring, this individual would like to see "market transformation[7]" objectives become the focus of the program to help support the introduction of new and emerging technologies (e.g., geothermal heat pumps, solar water heaters, photovoltaic).

[7] Market transformation refers to encouraging changes in the production, delivery, and consumption patterns of the market for energy consuming devices so that more efficient products become standard.

The fuel oil dealer representative commented that the fuel oil industry does not want to be involved in ECS, now or in the future. This individual stated an impression that oil dealers really do not want to be involved in anything "regulated."

2.8.6 Other

Representatives from this group who are energy-efficiency advocates are very upbeat about the achievements of the ECS program. For one, it has been the " training pool" for all of the experts in energy efficiency in this state; and they also think that the program

did a lot to educate utilities about customer service. However, several feel that the current program does not "do enough" to encourage efficiency measure installations.

Everyone in this group also sees a continuing need for residential energy efficiency education. They cite major market barriers, insufficient awareness levels, and the need to protect " the little guy," and the gap left by the disintegration of most DSM programs.

There were three major approaches proposed. In the first approach, proposed by several energy-efficiency advocates, the funding mechanism would remain essentially in place, and market transformation would be the ultimate goal. DOER's role would be to bring players around a problem issue that everyone wants to solve, but no one can solve alone, and to ensure that certain niches get filled. For example, perhaps they could develop research and development programs (as was done with the SERP[8] program), upgrade building codes, mount a campaign to transform the lighting distribution system, and/or put together an 'energy crafted home' program. The money could be spent on research or on market action. They could also choose to continue to offer audits, but that offering would not be a statutory requirement.

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[8] SERP, or Super-efficient Refrigerator Program, was a consortium of utilities who funded the research and development of highly efficient refrigerators.

The second approach was discussed by several energy efficiency advocates, relies on the HERS and the EEM, and really only focuses on two target markets: home buyers, and new home construction. For home buyers, energy efficiency mortgage products could be developed so that, when a home is purchased, the buyer could add, say, an extra $3,000 to the mortgage and use that money to improve the energy efficiency of the house. Banks will be satisfied as long as there is a positive cash flow (i.e., the energy savings are greater than the increase in the mortgage payment), and if investing in the energy efficiency of a home would increase its value in the marketplace, then people would do it.[9] The state must be involved to make this happen, but the stakeholders were not clear on how exactly this could occur. They pointed out that such a system should eventually be market driven: the banks should set up guidelines, and accept a home energy rating developed by a certified energy auditor.

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[9] Currently, a new, energy-efficient home does not capture its true value in the real estate market, because a mortgage lender considers only four costs (principal, interest, taxes, and insurance) as the monthly operating cost of the home. Energy costs, more significant than insurance, are not yet understood by the mortgage industry as an ongoing operating cost. An EEM has the potential to create four winners: homeowner (lower operating costs); bank (higher mortgages, increased probability of payment); economy (weatherization contractors); and society (reduced fuel consumption).

For the second approach's other market, new home construction, there should be more stringent codes, perhaps with more than one path to compliance. For example, the

building could pass a HERS test (which looks at the building as a system, and allows you to include some less efficient materials as long as you make it up somewhere else), or meet the model energy code, or include certain specific materials.

The third approach proposed by the DPU as well as energy efficiency advocates, is very similar to today's approach, but would cater more to the low income segment, place more emphasis on installing measures, and provide additional services such as low-interest loans, partial and comprehensive audits, additional resources for those with oil heat, and support for new technologies (i.e., geothermal heat pump, solar hot water, etc.). Some suggested that ECS should evolve into more of a customer outreach program, with mechanisms for ensuring that customers follow-up with recommended measures.

2.9 Multifamily Building Program

In order to address the issue of whether or not their is a need to conduct a future evaluation of the Multifamily Building Program (MFB), stakeholders were asked about their general reactions to the program. There were only few stakeholders with specific interests and/or involvement in MFB, and a summary of the interview findings is presented below[10].

[10] In an effort to preserve stakeholder anonymity, the findings in this section are not broken out by stakeholder group.

One group of stakeholders regard MFB as a very good service for commercial customers who manage and/or own multifamily buildings. However, theses staff point out that the original intent of the program was to address the needs of tenants, and say that the current program is not helping tenants economically in any way. (Some tenants of MFB buildings get a walk through audit, while others get nothing.)

In addition, if continued in its current form, "participants" should be required to pay a significant portion of the cost of the program, because, as indicated by one of the individuals interviewed, "many large property management companies in Boston are saving thousands of dollars and investing nothing because of this program."[11] In this sense, this individual noted that the MFB program has evolved into a "commercial giveaway" - albeit a very well-managed, quality one. According to this individual, these building owners are commercial customers; therefore, they should not pay the ECS surcharge, nor should they receive ECS services.

[11] Comments from another stakeholder group do not completely support these statements, however. According to this other group, the statewide MFB program has served both smaller and larger complexes and, over the past four years, the number of MFB audits delivered in Boston has decreased substantially. Furthermore, this other stakeholder group feels that it is not necessarily accurate to state that these customers are "investing nothing". When customers take part in both the MFB program and utility DSM rebate programs, it was noted that they often are paying for a portion of the equipment/installation costs.

Another stakeholder regards MFB as a "wonderful" program, which serves small buildings and high rises in the inner city. This stakeholder explained that a trained engineer conducts the audits, which are significantly more complex than residential audits, explains the recommendations to the building owner, and offers follow-on services. However, while this stakeholder generally regards MFB as a technically-sound and well-run program, it is also believed to be (a) costly to implement and (b) potentially reaching saturation levels (especially among larger building complexes). Opportunities for smaller buildings still exist, according to this individual, although it is more difficult to attract representatives from this group into the program (due, at least in part, to the limited resources available from/to smaller building owners).

This stakeholder feels that future programs should provide comprehensive services to the low-middle income sector. In this way, the program would work more closely with these customers, and put them in touch with the resources they need to move toward measure implementation.

Finally, another group of stakeholders offered additional observations and insight with respect to the MFB program:

- There may be increased interest in the MFB program in the coming years, due to the recent "slow down" of utility DSM programs serving multifamily properties.
- Large complexes seem to be the most likely to implement MFB recommendations and, because more money is a stake with the improvements and the expected savings, there is a perception that larger multifamily complexes are more likely to implement the recommendations without financing.
- Building managers and owners, the beneficiaries of program services, should be required to pay the full cost of the audit. Previously when there was a fee for the audits, the program still reached goals. At that time, the fee was $25-$100 while the audit cost was about $200-$300.
- A new release of the audit software should be developed to incorporate some of the latest HVAC and water heating controls.

Volume 2, Chapter 3 - Participant Survey Results

3.1 Introduction

This chapter presents the detailed results of market research completed with participants in the fiscal year 1995 ECS Program. A total of 948 telephone interviews were completed[1]. A stratified sampling design was used to achieve different target completion rates for different utilities/ECS Providers. Exhibit 3-1 presents an overview of the sampling design.

The overall objectives of the participant survey were to:

- Assess participant reasons for, satisfaction with and reactions to specific aspects of participating in the ECS program;
- Determine the extent to which ECS achieves energy saving actions; and
- Determine the extent to which ECS provides energy education and other (non-energy) benefits.

Survey results presented in this report are organized in the following sections according to these objectives[2]. In addition, and as appropriate, specific findings across different participant groups are presented. These participant groups are characterized by the following:

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[1] This chapter presents detailed results of the survey. Volume III contains details on the survey sample design, banner tabulations of the survey results, and a copy of the final telephone survey questionnaire.

[2] As mentioned in Chapter 1, the focus of this report is the evaluation the FY95 ECS program, and the effectiveness of its coordination during this time period with other residential energy conservation programs (e.g., utility DSM programs, WAP). With the exception of these coordination issues, this evaluation does not address evaluation issues specifically related to utility DSM programs or the WAP program.

- **Space Heating Fuel Type.** Participants have been grouped into four categories based on their space heating fuel type: natural gas, oil, electricity and other. This data was obtained from ECS/utility tracking databases.

Exhibit 3-1
Participant Survey Sample Design

Provider	Population	Percent of Population	Survey Target	Unweighted Sample Size	Weighted Sample Size [1]
Massachsetts Electric	16,189	29%	135	167	283
Boston Edison	8,007	14%	90	101	140
Boston Gas	5,518	10%	80	95	96
Colonial Gas	4,784	9%	55	59	84
Commonwealth Electric	4,145	7%	55	69	72
Baystate Gas	4,135	7%	55	61	72
Commonwealth Gas	2,597	5%	55	63	45
Eastern Edison	2,543	5%	25	30	44
Western Mass. Electric	2,175	4%	55	60	38
MMWEC	1,161	2%	25	28	20
MassSave Munis	897	2%	55	62	16
Berkshire Gas	801	1%	25	25	14
Taunton	469	1%	20	25	8
Fitchburg Gas & Electric	394	1%	20	29	7
Peabody	186	0%	20	24	3
Danvers	132	0%	20	25	2
Middleboro	121	0%	20	25	2
WMPUC [2]	1,172	2%	0	0	0
Braintree [2]	119	0%	0	0	0
Other MassSave [2,3]	180	0%	0	0	0
Hingham [2]	97	0%	0	0	0
Total Population	**55,822**		810	948	948
		Any Provider [4]:	*140*	–	–
Total Sample Size			**950**	**948**	**948**

[1] The survey sample was weighted to reflect each respondent's "weight" in the total population of FY95 ECS participants.
[2] Participants from these utilities/providers were not included in the survey sample because electronic data was not available.
[3] "Other MassSave" refers to other utilities for which Mass-Save was the provider (in addition to the municipals included in the category "MassSave Munis").
[4] An additional 140 surveys were targeted for completion from any of the 17 utilities/providers included in the sample design.

- **Service Level.** This relates to the level of service provided to participants through the audit and other utility DSM efforts. Three categories of service level have been developed: highly integrated, moderately integrated, and lightly or not at all integrated. In general, service levels are distinguished from one another according to the extent with which the ECS program services were integrated with other utility DSM efforts. For example, a highly integrated service package might offer

a customer a relatively comprehensive package of ECS and DSM services via a virtually seamless delivery mechanism. Moderately integrated services could also be quite comprehensive, yet often required multiple visits to complete the required work. Finally, none/lightly integrated services were the least comprehensive of all service packages and usually only involved the one visit to the participant's home. In many cases, CFLs and DHW measures were delivered for these participants at the time of the ECS visit.

- **Vendor/Audit Tool.** This category identifies the specific vendor responsible for delivering the audit, as well as the specific audit tool used. The three categories of vendors/audit tools are: Mass-Save (Survey Plus), DMC (Homebase) and CSG (Portable Audit).

- **Income.** Household income data collected through the telephone survey was used to create four classifications of household income level: "low" (<$30,000), "low-medium" ($30,000 to <$50,000), "medium-high" ($50,000 to <$80,000) and "high" ($80,000+). A fifth classification was also developed to identify respondents who refused to report or did not know their household income level.

As mentioned above, as appropriate, results from the survey are presented in this report to highlight differences across these four participant groups. Often, the presentation of the findings in this manner simply confirms what was expected, based on what is known about the different service levels and ECS providers. However, comparing the results across different participant groups may often highlight or draw attention to specific program performance issues that otherwise might not have been known.

Exhibit 3-2 identifies the level of service and vendor/audit tool used by each utility/provider. Exhibit 3-3 presents the final survey sample sizes, according to the four participant groups identified above.

Exhibit 3-2
Service Level and Vendor/Audit Tool Matrix, by Utility/Provider

Utility/Provider	Service Level	Vendor/ Audit Tool
Mass. Electric	None/Lightly	Mass-Save
Mass-Save Munis	None/Lightly	Mass-Save
WMECO	None/Lightly	Mass-Save
Comm. Electric	None/Lightly	Mass-Save
Eastern Edison	None/Lightly	Mass-Save

Colonial Gas	Highly	Mass-Save
Fitchburg G&E	None/Lightly	Mass-Save
Boston Gas	Moderately	Mass-Save
Baystate Gas	Highly	DMC
Comm. Gas	Moderately [1]	DMC
Peabody	None/Lightly	DMC
Boston Edison	None/Lightly	CSG
MMWEC	None/Lightly	CSG
Taunton	None/Lightly	CSG
Danvers	None/Lightly	CSG
Middleboro	None/Lightly	CSG
Berkshire Gas [2]	Highly	CET

[1] The analysis presented in this report assumed that ECS services provided to Comm. Gas customers were "moderately integrated" (based on information provided by DOER and verified in Comm. Gas' FY95 ECS Utility Implementation Plan). Comm. Gas representatives have since informed Hagler Bailly (and DOER) that "highly integrated" services were offered during FY95. This change in classification does not materially affect any of the overall findings or conclusions from this study that were based solely on the cross-tabular analysis of survey data.

[2] In FY95, Berkshire Gas utilized CET to deliver audits. Responses from participants who received services from Berkshire Gas and CET are not included in the survey tabulations under "Vendor/Audit Tool" category. However, these participants' responses are included in the survey tabulations for other categories.

Exhibit 3-3
Sample Sizes for Participant Groups

	Unweighted Sample Size	Weighted Sample Size
Space Heating Fuel Type[1]:		
Natural gas	493	514
Oil	334	335
Electricity	60	48
Other (e.g., wood, propane)	30	28
Service Level:		
Lightly/not at all integrated	645	636
Moderately integrated	158	142
Highly integrated	145	170
Vendor/Audit Tool[2]:		
CSG	228	176
DMC	124	118
Mass-Save	571	640
Annual Household Income:		
<$30,000	228	224
$30,000 to <$50,000	213	212
$50,000 to <$80,000	227	222
$80,000+	116	128
Refused/Don't know	164	161

[1] For 21 participants, space heating fuel type data was missing from the utility tracking

databases. The total unweighted sample size under the space heating fuel type category is 927.

[2] As mentioned above in Exhibit 3-2, Berkshire Gas participants have been omitted from this category (25 participants). The total unweighted sample size under the vendor/audit tool category is 923.

3.2 Reasons for, Satisfaction with and Reactions to Program Participation

3.2.1 Reasons for Participation

Participants were asked to specify their **primary** reasons for taking part in the audit program. They were not given a list of choices, but were required to supply their own answers. The most common response (33% of 948) was that participants wanted to learn about the energy usage of their homes. This was followed by an interest in saving energy (26%) and saving money (21%). Only six percent were prompted by the offering of the installation of free materials. Another 4% indicated that their utility had suggested it when they inquired about a high energy bill. About 1% participated based on their landlords' suggestion.

Some interesting trends can be shown through analyzing participant responses according to space heating fuel type. For example, participants who use oil to heat their homes were more likely to participate in order to learn more about the energy usage of their home, as compared to the average participant (40% of 335 v. 33% of 948). Electric heat participants were more likely to be interested in saving energy (34% of 48 v. 26% of 948), and participants using natural gas and "other" fuels were slightly more likely than the average participant to cite their interest in saving money as their primary reason for participation (26% of 514 and 32% of 28 respectively, v. 21% of 948). While very few participants cited their interest in obtaining "free measures" overall, this reason was most commonly reported among participants using oil to heat their homes (8% of 335). There were no significant trends across the other three participant groups (e.g., service level, vendor/audit tool, and household income).

Participants were asked to offer additional reasons for their decision to participate in the program, other than their primary reasons mentioned above. Among all responses, **saving energy** was the most often cited (by 43% of 948), followed by **learning about energy usage** (41%) and **saving money** (37%). Overall, nine percent were interested in getting the free measures, and 4% participated based on their utilities' suggestion. Thirteen

percent participated for miscellaneous "other" reasons. These percentages total more than 100% as multiple responses were allowed.

3.2.2 Satisfaction with Audit Program

Participants were asked to indicate their overall level of satisfaction with participating in the program. The vast majority of participants surveyed were either very satisfied (68% of 948) or somewhat satisfied (27%) with the audit program. Two percent of the participants were neutral, and another three percent were either somewhat dissatisfied (2%) or very dissatisfied (1%). There are no significant trends to report across the different participant groups (e.g., space heating fuel type, service level, vendor/audit tool, and household income). However, overall satisfaction ("very" and "somewhat" satisfied combined) was highest for the following types of participants:

- electric heat (96% of 48)
- none/lightly integrated services (96% of 636)
- moderate-to-low household income (97% of 212)

In addition, participants were specifically asked to indicate some of the aspects of the program that they liked the most. The most common responses include: "Audit provided useful knowledge" (31% of 948), "Free materials received" (16%), "Auditor was very knowledgeable, answered questions, professional, helpful" (13%), "Audit was comprehensive" (11%), and "Auditor demonstrated/performed installations" (10%),

Overall, the majority of participants surveyed found nothing about the program that they liked least. Some participants' complaints centered on the products installed -- poor quality (4% of 948), auditor ran out of supply (2%), never received products that were promised (1%), poor workmanship (1%), etc. Other negative comments were received for the following: the auditor's lack of knowledge (3%), the impracticality of the audit recommendations (2%), the difficulty in scheduling convenient appointments (2%), the time required to complete the audit (1%), and the lack of comprehensiveness of the audit itself (1%).

Finally, participants were also asked if there was anything "missing from the audit" that they would like to see added to future programs. The majority (78% of 948) found nothing missing from the audit, while 22% were expecting something more or felt that certain elements were missing. Aspects of the program that were most often reported as "missing" include: more programs/free installations (14% of 948), more knowledgeable auditors (6%), more follow-up (2%), and more incentives (<1%).

3.2.3 Satisfaction With Specific Aspects of Audit Program

In addition to giving their overall impression of the audit, participants were asked to evaluate their satisfaction with three specific aspects of the audits provided:

- the amount of time it took to receive an audit after the initial request was made;

- the amount of time the auditor spent in the home; and

- the auditor's knowledge, professionalism, and helpfulness.

Overall, participants indicated that they were satisfied with each of these aspects of the program. Specifically, about half (53% of 948) were very satisfied with the scheduling of the requested audit. Another 32% were somewhat satisfied, while 11% were neutral. Only 4% were either somewhat or very dissatisfied.

Nearly two-thirds (64% of 948) were very satisfied with the amount of time the auditor spent in their homes, 28% were somewhat satisfied, and 6% were neutral. Only 1% was somewhat or very dissatisfied with this aspect of the program.

Participant gave their auditors' performance the highest overall satisfaction rating. About three quarters (74% of 948) were very satisfied with their auditors' knowledge, professionalism, and helpfulness. Another 20% were somewhat satisfied, 4% were neutral, and only 2% were somewhat or very dissatisfied.

Keeping in mind that generally all participants reported high levels of satisfaction with each of these three aspects of the audit, there was some variation across different participant groups. For example, participants receiving the Mass-Save audit were typically more satisfied than the other participants with all three aspects of the audit: (1) audit scheduling -- 87% of 640 "very" and "somewhat satisfied"; (2) audit duration -- 94%; and (3) auditor performance -- 95%.

Again, while generally all participants satisfied with these three aspects of the audit, participants using electricity to heat their homes were somewhat less likely than the average participant to be satisfied with the length of the audit (82% of 48 "very" and "somewhat satisfied" combined). There was no significant trend across service levels or household income categories with respect to participant satisfaction with these aspects of the audit.

While very few negative comments were received about any aspects of the audit, the following summarizes participants' reasons for dissatisfaction with specific aspects of the audit:

- Audit Scheduling: (4% of 948)

- "Took too long"
- "Canceled several times"
- "Had to call several times"
- "Not offered at convenient times"

- Audit Duration: (2% of 948)

- "Auditor didn't do anything; spent too little time"

- "Took too long"

- Auditor Performance: (2% of 948)

- "Auditor didn't know that much, couldn't answer questions"
- "Auditor didn't do that much"
- "Auditor was not helpful"
- "Auditor was rude"

3.2.4 Recall of and Reactions to Various Program Services

Participants were asked to recall whether or not they received certain materials or services as part of the audit program. Specifically, participants were asked if they recalled receiving:

- a computer report listing specific recommendations for energy improvements in their homes;

- energy saving materials, such as water heater blankets or energy efficient light bulbs;

- a work order for contractor work that contained details on materials and work plan;

- a brochure or catalog containing "do-it-yourself" materials to increase the energy efficiency of their homes (i.e., bulk purchase service); and

- information about additional energy services and programs.

Nearly all participants (94% of 948) recalled receiving energy saving materials, such as water heater blankets and energy efficient light bulbs. This is supportive of FY95 year-end production data for ECS, which indicates that 99% (or 55,341 of 55,822) of all participants received energy saving materials (through the "demonstration measure installation", or DMI, component) during their ECS audit.

The majority of participants also recalled receiving the computerized audit report (84%). About two-thirds of all participants (65% of 948) recalled that their auditors gave them information about additional energy services and programs. About half (55%) reported that their auditor told them about contractors who could install recommended energy saving measures, and only about one third of all participants (32%) recalled being offered post-installation inspections services. About 29% of the participants surveyed recalled that their auditor prepared contractor work orders, which is consistent with the number of major work orders actually prepared by auditors based on ECS FY95 year-end production data (22% of 55,822, or 12,487 major work orders were prepared according to this data).

Few significant trends are evident across the different participant groups with respect to participants' recall and receipt of these program services, other than what might be expected (i.e., based on which *vendor* provided which *level of services* to which *types of participants*). For example, gas heat participants who received highly or moderately integrated services delivered by DMC were more likely than the average participant to recall receiving contractor work orders through ECS and/or DSM programs. This is consistent given that, in our sample, DMC was hired by two investor-owned gas utilities to provide highly or moderately integrated service delivery to mostly gas heating customers.

A slight trend is noted across different levels of service when one considers only those services that were intended to be offered to all or most participants (e.g., computerized audit report). For example, as the level of service is enhanced (i.e., from none to highly integrated services), participant recall of the computerized audit falls. That is, 84% of the participants who received none/lightly integrated services recalled the computerized audit report, while 80% of the participants who received highly integrated services recalled this report. This may suggest that, when offered as part of a broader package of services, the computerized audit report may be somewhat less significant in the minds of the participants (such that they recall it less often), or that the auditor did not focus on the audit report as much when delivering highly integrated services.

3.2.5 Satisfaction With Audit Report and Frequency of Use

Participants were asked about their overall level of satisfaction with the computer-generated audit report given to them at the conclusion of their audits. The majority were either very satisfied (56% of 948) or somewhat satisfied (31%). Eleven percent were neutral, and 2% were somewhat dissatisfied. No one was very dissatisfied. There are no significant trends across participant groups with respect to their level of satisfaction with the computerized audit report.

Only 12 participants (or 1% of 948) indicated that they were in any way dissatisfied with the audit report. Most of these participants (10) reported that the report was not helpful or it was too general, while two others indicated that the report was difficult to understand.

Participants were also asked how often they had referred to the report since the auditor left it with them. About half (54% of 948) have used it once or twice, and 19% have used the report several times. Three percent said they refer to it often, while 1% claimed to do so frequently. It appears that the majority of participants who are satisfied with the report (either very or somewhat) have referred to it once or twice since they received it. However, 22% indicated that they have never referred to their audit report.

Participants who heat their homes with natural gas were more likely than the average participant to report that they have never referred to their audit report (26% of 514), as were participants who received highly integrated services (29% of 170), and participants receiving the DMC audit (31% of 118). These trends, as discussed above in Section 3.2.4,

may shed additional light on the effectiveness of the audit report when offered as part of a broader package of services.

3.3 Effectiveness of ECS in Achieving Energy Saving Actions

One of the principal objectives of this evaluation was to determine whether or not ECS achieves energy efficiency actions. Before this underlying question can be answered, it is necessary to understand the many and interconnected influences that played a part in encouraging participants to implement energy efficiency measures.

As described in Chapter 1, there were a number of programs and services available to FY95 ECS participants:

- **The ECS Audit.** Provided by trained and certified ECS auditors, this element provides participants' written reports (1) describing the efficiency of their homes and (2) listing (in order of priority) energy saving measures that can be taken to improve the energy efficiency of their homes. In addition, the ECS audit is designed to provide a significant level of interaction between auditors and participants to facilitate the information-sharing and educational process.

- **ECS Equivalent Services**. A component of the ECS audit, the availability of ECS equivalent services are explained and delivered by auditors during the ECS visit. These services include:

- *Demonstration of Materials Installation (DMI).* This component of ECS involves the direct installation and demonstration of energy savings items (e.g., DHW tank wraps and low-flow devices, CFLs, window caulking, door sweeps).

- *Bulk Purchase Service.* Identified as an "after-visit" service, the bulk purchase service provides participants with a mechanism (e.g, telephone- and mail-order service) for purchasing energy saving materials at market or below market prices for do-it-yourself projects. In addition, the auditor is expected to complete (if appropriate) an order form for each participant with amounts, sizes, and other specifications customized to the specific energy needs of the home.

- *Technical Assistance Service.* Another "after-visit" service, this component provides telephone assistance from qualified, experienced audit staff to answer questions concerning customers' energy needs and equipment. Also, information regarding hiring contractors, purchasing materials, proper installations, etc., is available from this service.

- *Work Order Preparation.* Depending on the need of a particular dwelling, auditors were expected to prepare job specification work orders for do-it-yourself projects as well as "larger" home energy improvements (e.g., attic insulation, window retrofits, new heating systems).

- *Contractor Arranging Service (CAS).* This service was intended to match customers who need a contractor with those who have been pre-approved by ECS. Customers were matched with contractors on a rotating basis, or customers were allowed to solicit bids on their own from their utilities' contractor lists.

- *Post-Installation Inspection Service (PII).* This component was designed to provide post-inspections of energy improvements by trained inspectors. This service was designed to be offered to customers receiving CAS, as well as customers who hired their own contractors or made installations on their own. Participants in CAS were not obligated to make their last payment until the work was improved by the inspector.

- **"Piggybacked" DSM Measures/Services.** Certain utilities offered more comprehensive direct installation services for a number of energy saving measures, such as DHW measures and compact fluorescents. A few utilities also "piggybacked" weatherization measures (e.g., clock thermostats, weatherstripping, caulking, door sweeps) onto the ECS delivery. Other utilities may have provided electric appliance efficiency measures (e.g., AC filter cleaning/replacement, refrigerator coil cleaning). The difference between DSM piggyback and the ECS DMI component is that, instead of weatherstripping one window (as part of the ECS demonstration component), auditors were able to weatherstrip as many windows as the utility allowed under its program guidelines. The underlying purpose of the DSM piggyback component was to minimize the number of visits to customers homes and increase the penetration of cost-effective measures through the ECS audit delivery. That is, some utilities offered DSM measures as part of the ECS piggyback because they were only considered cost-effective when piggybacked onto the already existing ECS program.

Exhibit 3-4 contains a list that identifies specific DSM measures (if any) that were incorporated into the ECS piggyback component.

Exhibit 3-4
Utility DSM Programs/Services Matrix (FY95)

Utility (Provider)	ECS/DSM Piggyback Measures	DSM Program Measures
Bay State Gas	DHW measures Clock thermostat DSM customer offer sheet & work orders	Attic/Wall Insulation Pipe/duct insulation Clock Thermostat

		Pilotless ignition Boiler resets Hi -eff Heating System DHW: tank/pipe insulation, flow restrictors, temp reduction
Berkshire Gas	DHW measures Door weatherstrip Blower door DSM measure work orders	Attic/Wall Insulation Crawlspace/Floor Insulation Pipe/duct insulation Vent Damper Air- sealing Clock Thermostats Door weatherstrip DHW: tank/pipe insulation, flow restrictors, temp reduction
Boston Edison	2 fluorescent light bulbs	Rebates for: Efficient A/C, Heat Pumps, water heaters, light fixtures, whole house fan. Electric-Heat Program (comprehensive)
Boston Gas	DHW Measures	Attic Insulation Duct insulation

		Clock Thermostats Vent Dampers DHW: tank/pipe insulation, flow restrictors, temp reduction
Colonial Gas (MSI)	DHW measures DSM Work Orders	DHW: tank/pipe insulation, flow restrictors Insulation Heating System Controls
Commonwealth Electric (MSI)	Fluorescent light bulbs DHW: tank/pipe insulation, flow restrictors, temp reduction	[1]
Commonwealth Gas	DHW Measures Door & window weatherstripping/caulking Door sweeps Clock Thermostat	Attic/Wall Insulation Door & window weatherstripping/caulking Door sweeps DHW: tank/pipe insulation, flow restrictors, temp reduction
Danvers	Compact bulb A/C filters Refrig coil brush	none
Eastern Edison (MSI)	Fluorescent light bulbs DHW: tank/pipe insulation, flow	Bulb rebates Electric Heat (comprehensive)

	restrictors, temp reduction	
Massachusetts Electric (MSI)	Fluorescent light bulbs Clean Refrigerator coils Clean & replacing A/C filters	Load Management for large appliances Electric Heat (comprehensive) Efficient lighting discounts Super Eff. Refrigerator
MMWEC	Some utilities offer: compact bulbs DHW measures	none
Middleboro	none	none
Other Municipals (MSI)	None	Compact fluorescent discounts & leasing Watt Meter loans Load Management
Peabody	2 fluorescent bulbs A/C filters Refrig coil brush	none
Taunton	Lease compact fluorescents	Lease compact fluorescents
WMECO (MSI)	Fluorescent light bulbs Clean Refrigerator coils Clean & replacing A/C filters DHW: tank/pipe insulation, flow	Discount bulbs [1]

	restrictors, temp reduction	

[1] Additional information on the DSM Program measures offered by Commonwealth Electric and WMECO was not available.

Source: FY95 Utility Implementation Plans.

- **Utility DSM Programs.** Also described in Exhibit 3-4, some utilities offered stand-alone DSM programs to customers meeting certain requirements. These other programs and services were available (as appropriate) to participants receiving the ECS audit. In fact, auditors were expected to promote these programs and services as part of the audit process in order to increase the effectiveness of both the ECS program and the utility DSM programs/services in increasing the penetration of energy efficiency measures.

- **WAP.** In addition, the DOE WAP program was available to income-qualified households. WAP is a Department of Energy funded residential conservation program administered by the Massachusetts Department of Housing and Community Development (DHCD). WAP delivers comprehensive residential conservation services to eligible low income households. Through the ECS/WAP coordinated delivery component, utility ECS providers who choose to participate in this program supplement WAP resources with modest additional ECS resources. These resources are used to increase energy conservation educational services and materials installations delivered to WAP clients.

The preceding section has served to lay the foundation for understanding the range of and interconnection between programs and services offered to ECS participants. It is now appropriate to begin the process of identifying the extent to which ECS achieves energy efficient action. The following sections describe the results from the participant survey as they relate to:

- Participant recall and implementation of ECS audit recommendations, and use of ECS and non-ECS services to install these recommendations (e.g., bulk purchase services, contractor arranging services, work order preparation services, post-installation inspection services, and other installation/financial assistance services);

- Participant recall of direct install measures, both through the ECS DMI component and the DSM piggyback component; and

- Participant reports of *additional* "do-it-yourself" materials purchased and installed without the assistance of ECS and/or other programs (e.g., retail purchases).

3.3.1 Recall and Implementation of ECS Audit Recommendations

About 2,700 measures were recommended to the 948 participants surveyed, according to the information contained in utility tracking databases. On average, each audit produced about three recommendations per household. The number of audit recommendations produced by the ECS audit tool varied somewhat depending on the fuel type: gas and oil heating customers received, on average, three audit recommendations per household, whereas participants using electricity or "other fuels" for space heating customers received, on average, only one recommendation per household.

The following sections describe (a) the rate of recall for audit recommendations among the participants surveyed, (b) the level of reported measure implementation based on audit recommendations, and (c) the attribution of measure installations based on participants use of different services (e.g., ECS, DSM, WAP).

Recall of ECS Audit Recommendations

During the survey, participants were asked to indicate whether or not they recalled receiving the specific audit recommendations as reported in utility tracking databases. The results of the survey indicate that, overall, participants recalled 40% of the measures that were recommended to them via the audit package, or 1,077 of the 2,723 measures recommended. Exhibit 3-5 presents a summary of these results.

As shown, the level of participant recall of audit recommendations varied depending on the type of measure recommended. For example, participants recalled more of the insulation (45%) and other weatherization measure recommendations (43%), as compared to the heating system recommendations (35%). Overall, it appears that participant recall rates are highest

for measures participants feel they understand or are otherwise most familiar with. For example, door and window weatherstripping were among the most commonly recalled recommendations (78% and 66%, respectively). In addition, measures such as intermittent ignition device, boiler reset, and flue dampers were among the least likely to be recalled (11%, 11%, and 13%). While a fair number of participants were given specific recommendations to replace their heating system, it is unclear why only 13% recalled receiving this recommendation.

There were very few significant findings relating to the recall rates for recommended measures across the different participant groups, except for the following:

- **Attic Insulation** (overall recall rate=52%). Participants using natural gas for space heating were most likely to recall this measure when recommended (61% of 142), as compared to participants using electricity (32% of 11) and oil (48% of 97) for space heating.

- **Wall Insulation** (overall recall rate=51%). Participants who received highly integrated services were most likely to recall this measure when recommended

(74% of 45), as compared to participants receiving moderately integrated (45% of 73) and none/lightly integrated (53% of 104) services.

- **Clock Thermostats** (overall recall rate=54%). Participants using natural gas for space heating were most likely to recall this measure when recommended (65% of 228), as compared to participants using electricity (55% of 15) and oil (51% of 134) for space heating.

Exhibit 3-5
Recall of ECS Audit Measure Recommendations

Measure Name:	Number of Participants for which Measure was Recommended	Number of Participants Recalling Measure Recommendation	Recall Rate
Insulation Measures:			
Attic insulation	273	143	52%
Floor insulation	270	96	36%
Wall insulation	237	122	51%
Duct insulation	143	78	55%
Rim joist insulation	45	7	16%
Basement wall insulation	38	6	16%
Crawl space insulation	33	13	39%
Summary	*1,039*	*465*	*45%*
Other Weatherization Measures:			
Storm windows	74	18	24%
Window weatherstripping	65	43	66%
Window insulation	43	18	42%

Replace windows	28	10	36%
Storm doors	56	14	25%
Door weatherstripping	36	28	78%
Replace doors	12	5	42%
Insulate doors	5	2	40%
Summary	*319*	*138*	*43%*
Heating System Measures:			
Clock thermostat	441	238	54%
Heating pipe insulation	261	149	57%
New heating system	231	29	13%
Boiler reset	177	20	11%
Flue damper	92	12	13%
Replace burner	92	19	21%
Intermittent ignition device	65	7	11%
Summary	*1,359*	*474*	*35%*
Water Heating Measures:			
Tankless DHW system	5	0	0%
Solar DHW	1	0	0%
Summary	*6*	*0*	*0%*
All Measures:	**2,723**	**1,077**	**40%**

In general, the overall rate of recall (40%) implies that the audit itself can only be regarded as *moderately effective* in encouraging the adoption of energy efficiency measures. That is, if participants do not recall audit recommendations, it is unlikely that they have acted on them (or would otherwise plan to). However, this level of recall is

somewhat typical based on evaluations of residential energy audit programs conducted throughout the country. For example, this rate of recall is consistent with the results of Hagler Bailly's series of evaluations conducted for various residential audit programs delivered in California, New York and Wisconsin.

Implementation of ECS Audit Recommendations

Participants were also asked whether or not they have implemented any of the audit recommendations. As stated above, based on the rather limited level of recall for audit recommendations, participant implementation rates will naturally be even lower. As shown in Exhibit 3-6, 16% of all measures recommended to participants were actually implemented, or 445 out of 2,723 measure recommendations.

Overall implementation rates were significantly higher for the following participant groups:

- **Low Income Households.** Among low income households, the overall implementation rate is 23% (of 557 measures recommended), whereas the overall implementation rate for high income households is 13% (of 392 measures recommended).

- **Gas Heating Participants**. Participants using natural gas to heat their homes implemented a greater percentage of their audit recommendations (18% of 1,522 recommendations), while oil heat participants implemented about 14% (of 797 recommendations).

Among the different categories of measures, implementation rates were highest for weatherization measures (26%), followed by insulation measures (16%) and heating system measures (14%). When looking at specific measures that were commonly recommended (i.e., to more than 100 participants), heating pipe insulation and attic insulation were most often installed (32% and 26%, respectively). Implementation rates were highest for door and window weatherstripping (58% and 40%, respectively), however, these measures were recommended to relatively few participants (36 and 65 participants, respectively).

Exhibit 3-6
Implementation of ECS Audit Measure Recommendations

Measure Name:	Number of Participants for which Measure	Number of Participants Installing Measure	Implementation Rate

	was Recommended		
Insulation Measures:			
Attic insulation	273	70	26%
Floor insulation	270	29	11%
Wall insulation	237	43	18%
Duct insulation	143	22	15%
Rim joist insulation	45	1	2%
Basement wall insulation	38	2	5%
Crawl space insulation	33	4	12%
Summary	*1,039*	*171*	*16%*
Other Weatherization Measures:			
Storm windows	74	11	15%
Window weatherstripping	65	26	40%
Window insulation	43	7	16%
Replace windows	28	7	25%
Storm doors	56	10	18%
Door weatherstripping	36	21	58%
Replace doors	12	1	8%
Insulate doors	5	0	0%
Summary	*319*	*83*	*26%*
Heating System Measures:			
Clock thermostat	441	69	16%
Heating pipe insulation	261	83	32%
New heating system	231	14	6%
Boiler reset	177	8	5%
Flue damper	92	6	7%
Replace burner	92	6	7%

Intermittent ignition device	65	4	6%
Summary	*1,359*	*190*	*14%*
Water Heating Measures:			
Tankless DHW system	5	0	0%
Solar DHW	1	0	0%
Summary	*6*	*0*	*0%*
All Measures	**2,723**	**445**	**16%**

Because of the small sample sizes associated with actual measure installations, there were no significant findings across different participant groups with respect to the rate of implementation for specific measures.

It should be noted that, absent on-site verification of audit measure installations, it is possible that participants may have over-reported the actual rate of implementation. However, in conducting evaluations of similar programs across the country, Hagler Bailly has found only slight discrepancies between telephone survey self-reports and on-site verifications. When discrepancies exist, they usually involve differences in the assumed "quantity" of measures installed, as opposed to the overall installation itself.

Attribution of ECS Audit Measure Installations to Specific Programs

Once it was determined which of the audit recommendations participants recalled and implemented, respondents were asked a number of questions designed to determine the specific programs or services to which to attribute their actions. Specifically, the following questions were asked:

- Who installed the measures?
- If contractors were used to install measures, did the utility arrange for these contractors, or did auditors help find these contractors, or did participants find these contractors on their own?
- If participants or other household members installed measures, did they purchase materials through the ECS bulk purchase catalog, or did they purchase them from other sources (e.g., retail locations)?
- Were work orders prepared and used to install measures?

- Was a post-installation inspection offered and used to check on the quality of measure installations?

- Who paid the cost of installing the measures?

- Did participants receive any other assistance, from utilities or other agencies, to help install the measures? What was the nature of this assistance and who provided it?

Based on responses to these questions, measure installations were assigned to one of two categories: "ECS Program" or "Utility DSM/WAP Programs". The validity of participant responses regarding the specific services they used was verified by reviewing the listing of services that were actually available to them during FY95 (Exhibit 3-4).

For example, if participants indicated through the survey that their utility (a) arranged for the contractor to install the measures, (b) paid all or part of the cost of installing the measures, and/or (c) provided some other type of assistance (i.e., technical, financial, other) to help them install the measures and these services were available to them from their utility, then the measures installed by these participants were attributable to the category of "Utility DSM/WAP Programs".[3]

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[3] Again, it should be recalled that only those measures installed in the homes of FY95 ECS participants' homes have been assessed through this evaluation. This evaluation does not specifically address any other measures dwlivered through the coordinated efforts of the FY95 ECS program.

A few participants indicated that services were used that were not available to them through their utilities' DSM programs. In these cases, the income level of the participant households was checked and this revealed that these services were most likely provided through WAP. Based on this assumption, a total of 25 audit measure installations were assumed to have been installed through WAP and assigned to the "Utility DSM/WAP Programs" category.

Finally, if participant responses were such that utility or other program services were not utilized to encourage the installation of audit measures, and/or if participants reported that -- in addition to the audit -- other ECS services were used, then the measure installations were attributed to the "ECS Program" category. Similarly, if participants indicated that -- other than the audit -- no specific ECS, utility or other program services were utilized to complete the recommended measure installations, then the measure installations were attributed to the "ECS Program" category.

Together, these assumptions and the resulting analyses led to the final attribution of installed audit measures as presented in Exhibit 3-7. As shown, of the 445 installed measures:

- were implemented utilizing partial or full ECS services, and

- 27% were implemented utilizing services provided through utility DSM or WAP programs.

Measure installations completed using partial or full ECS services can be further broken down to show that the majority of these installations were implemented without the use of specific ECS services, other than the energy audit itself. That is, of the 445 measures installed, 280 (or 63%) were implemented by participants without the use of specific ECS services, such as contractor arranging, work orders, and post-inspections. In fact, very few participants used these other ECS services: 10%, or 46 of 445. However, some participants used more than one ECS service to install audit measures, such that: a total of 36 measures were installed using ECS work orders (or 8% of all measures installed); 23 measures were

Exhibit 3-7
Program Attribution Results for Installed Audit Measures

Measure Description	Total Number of Participants Installing Measures Attributable to DSM/WAP Programs	Total Number of Participants Installing Measures Attributable to ECS Program	Total Number of Participants Installing Measures	Percent of All Installed Measures Attributable to DSM/WAP Programs	Percent of All Installed Measures Attributable to ECS Programs
Attic insulation	21	49	70	30%	70%
Wall insulation	18	25	43	42%	58%
Floor insulation	6	23	29	21%	79%
Duct insulation	5	18	23	22%	78%
Crawl space insulation	1	3	4	25%	75%
Basement wall insulation	0	2	2	0%	100%
Rim joist insulation	1	1	2	50%	50%
Summary Insulation Measures:	***52***	***121***	***173***	***30%***	***70%***
Window weatherstripping	4	22	26	15%	85%
Door weatherstripping	6	14	20	30%	70%
Storm windows	0	11	11	0%	100%

Storm doors	1	9	10	10%	90%
Window insulation	0	7	7	0%	100%
New windows	2	5	7	29%	71%
New doors	0	1	1	0%	100%
Summary Weatherization Measures:	***13***	***69***	***82***	***16%***	***84%***
Heating pipe insulation	11	72	83	13%	87%
Clock thermostat	32	38	70	46%	54%
New heating system	3	11	14	21%	79%
Boiler reset	1	7	8	13%	88%
Flue damper	2	4	6	33%	67%
Burner replacement	3	3	6	50%	50%
Intermittent ignition device	1	3	4	25%	75%
Summary Heating System Measures:	***53***	***138***	***191***	***28%***	***72%***
All Measures	**118**	**327**	**445**	**27%**	**73%**

installed using ECS contractor arranging services (or 5% of all measures installed); and 9 measures were installed using ECS post-installation inspection service (or 2% of all measures installed).

As stated above, the overall rate of measure implementation using utility DSM/WAP services is 27%. This implementation rate is highest for insulation measures (30%) and heating system measures (28%), and lowest for weatherization measures (16%). When looking at specific measures, some of the more frequently implemented measures were installed using utility DSM/WAP services more often than the average (27%). For example, 46% of the clock thermostats 42% of the wall insulation measures, and 30% of the attic insulation measures were installed via utility DSM/WAP programs.

In addition, it was found that participants using natural gas to heat their homes are more likely than the average participant to have implemented audit recommendations via utility DSM/WAP programs (36% v. 16%). Similarly, participants receiving highly integrated services were more likely to implement audit recommendations via utility DSM/WAP programs (40%). And, finally, participants receiving audits from DMC were the most likely to implement measures through utility DSM programs (46%). These trends tend to illustrate what is expected, since DMC was responsible for delivering audits for two investor-owned gas utilities offering highly or moderately integrated services to participants who generally used natural gas to heat their homes.

Finally, this analysis also shows a higher rate of implementation through utility DSM/WAP programs among the lower income households. That is, 40% of the low income participants installed measures through utility DSM/WAP programs, v. 23% of the high income participants. Again, this trend supports what would be expected, given the more comprehensive range of implementation services available free-of-charge to qualified low income residents across the state.

3.3.2 Recall of Direct Install Measures

During the survey, participants were asked to recall whether or not during the ECS audit visit, the auditor directly installed specific energy efficiency measures. Using data from utility tracking databases, participants were asked if they recalled specific direct measure installations. According to these databases, about 4,000 direct install measures[4] (both DMI and DSM piggyback) were installed in the homes of the 948 participants surveyed. On average, each participant received about 4 measure installations.

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[4] These measures include both DMI and DSM piggyback measures directly installed and/or demonstrated in participants' homes during the ECS audit visit. Although not specifically discussed in this section, but discussed in more detail in Chapter 7: Impact Analysis and Results, the majority of the 4,000 direct install measures included in the utility databases for the participant sample were associated with DMI measure installations. That is, only 33% of the 4,000 direct install measures were associated with utility DSM piggyback services.

A total of 2,884 direct install measures were recalled as having been installed in participants' homes at the time of the ECS audit, or 72% of the measures recorded in the utility databases. There were few significant trends across different participant groups with respect to their recall of direct install measures, other than to note that a greater percentage of electric heat participants recalled these measure installations as compared to the average participant (81% of 167, v. 72% of 2,884).

Exhibit 3-8 presents a detailed measure-by-measure summary of the level of participant recall for direct install measures.

The following summarizes the recall rates for each of the measures categories shown in this exhibit:

- Lighting measures (90% of 748)
- Water heating measures (74% of 1,184)
- Weatherstripping measures (68% of 1,780)
- Electric appliance efficiency measures (42% of 288)

Among the most frequently installed measures (i.e., installed in over 100 participants' homes), recall rates were calculated as "above average" (i.e., 72%) for the following specific measures:

- DHW tank wraps (93% of 231)
- CFLs (92% of 723)
- Door sweep (82% of 299)
- Door weatherstripping (80% of 562)
- DHW low-flow devices (77% of 656)
- Window weatherstripping (75% of 257)

Exhibit 3-8
Participant Recall of Direct Install Measures

	Number of Measures Installed	Number of Measures Recalled as Having Been Installed	Recall Rate
Water Heating Measures:			
DHW low-flow device	656	505	77%
DHW pipe insulation	261	145	56%
DHW tank wrap	231	215	93%
DHW temperature setback	36	12	33%
Summary:	*1,184*	*877*	*74%*
Lighting Measures:			
Compact fluorescent bulb	723	668	92%
Lighting fixture adapter	25	3	12%
Summary:	*748*	*671*	*90%*
Weatherization Measures:			
Door weatherstripping	562	452	80%
Outlet/switch plate gasket	428	205	48%
Door sweep	299	245	82%
Window weatherstripping	257	194	75%
Interior plastic storm window	100	64	64%
Pulley seal	44	17	39%
Caulking	45	12	27%
Glass patch	20	8	40%
Clock thermostat	17	16	94%

Attic hatch insulation	4	2	50%
Radiator reflector	2	1	50%
Duct insulation	2	0	0%
Summary:	*1,780*	*1,216*	*68%*
Electric Appliance Efficiency Measures:			
Refrigerator coil cleaning	263	107	41%
AC filter cleaning/replacement	25	13	52%
Summary:	*288*	*120*	*42%*
All Measures	**4,000**	**2,884**	**72%**

[1] Numbers shown in this Exhibit reflect the number of households receiving direct install measures, not quantity of measures installed.

Source: Utility tracking databases.

On the other hand, measures that were commonly installed yet less frequently recalled include: DHW pipe insulation (56% of 261), outlet/switch plate gaskets (48% of 427), interior plastic storm windows (63% of 101), and refrigerator coil cleaning (41% of 263).

Exhibit 3-8 also shows that specific measures for which recall rates were lowest represented some of the measures that were less frequently installed. For example, only 12 participants recalled that their auditor setback their water heater temperature, but only 37 of these measures were actually installed (32% recall rate). Similarly, only 3 participants recalled receiving a lighting fixture adaptor, yet only 25 such measures were actually installed (12% recall rate). Similar trends are noted in Exhibit 3-8 for caulking and pulley seals.

3.3.3 Installation of Additional "Do-it-Yourself" Energy Saving Materials

Participants offered reports of *additional* energy efficiency measures that they had purchased and installed after the audit was conducted. Some of these "do-it-yourself" measures were purchased through the bulk purchase catalog, although the majority were purchased through retail sources -- that is, without the direct assistance of any specific ECS and/or other program service. Exhibit 3-9 presents a summary of participants' self-reported purchases.

As shown, only about 7% of all 948 participants reported purchasing DIY materials through the bulk purchase catalog. However, just over half (54%, or 512 of 948) reported that they had purchased and installed at least one additional energy saving measure

through retail sources. For the most part, the types of DIY materials purchased through the bulk purchase catalog were also purchased through retail outlets, although with much less frequency. In addition, all 71 participants who purchased materials through the bulk purchase catalog also reported that they purchased additional measures through retail outlets.

The most commonly purchased materials (through both bulk purchase and retail sources) include: energy efficient lighting products, weatherstripping materials, door sweeps and caulking materials. Materials purchased by participants through retail sources were generally purchased at Home Depot (41%) and/or local hardware stores (37%).

Exhibit 3-9
Purchases of "Do-it-Yourself" Energy Saving Materials from Retail Sources

Measure Purchase	Number of Participants Reporting DIY Purchases Through:		Percent of All Participants Reporting DIY Purchases Through: (n=948)	
	Bulk Purchase Service	Retail Locations	Bulk Purchase Service	Retail Locations
Energy efficient lighting products	24	242	3%	26%
Weatherstripping	21	244	2%	26%
Door sweeps	9	126	1%	13%
Caulking	0	126	0%	13%
Insulation	0	59	0%	6%
Outlet gaskets	7	46	1%	5%
Interior storm windows	8	42	1%	4%
DHW low-flow devices	3	20	0%	2%
DHW pipe insulation	1	15	0%	2%
Clock thermostat	4	2	0%	0%
Draft covers (e.g., AC covers, attic hatch insulation, window quilts)	6	0	1%	0%
New windows	0	4	<1%	<1%
DHW tank wraps	0	4	<1%	<1%
Attic vents	0	2	<1%	<1%
AC filters	0	2	<1%	<1%

Pulley seals	2	0	0%	0%
Chimney plugs	2	0	0%	0%
Refrigerator brush	1	0	0%	0%
Duct insulation	1	0	0%	0%
Total Number of Materials Purchased	*89*	*933*		
Number of Participants Purchasing At Least One Material	*71*	*512*		

3.3.4 Factors Influencing Participant Installation Decisions

As discussed in previous sections, participants were offered a wide range of and interconnected set of services in order to increase the penetration of energy saving measures. The challenge of determining the correct "program" to which measure installations should be attributed (e.g., ECS audit, ECS DMI, DSM piggyback, stand-alone DSM, etc.) is far underscored by the difficulties associated with assessing the *influence* each of these different yet interconnected service offerings may have had on a given participants' installation decision. The following describes the approach and results of this assessment for audit measure installations, followed by an assessment of the relative influence for direct install measures.

Influence of ECS Audit and Other Services on Audit Recommendation

Implementation Decisions

At various points in the survey, participants were asked to indicate whether or not they would have implemented ECS audit recommendations had they not been provided with a specific service associated with the ECS or other programs. For each measure and its applicable service, each participant was asked to respond to a question such as "Do you think you would have installed the same amount of [measure name] at the same time had it not been for [service type]?". Exhibit 3-10 presents participants' responses to these questions.

Exhibit 3-10
Influence of ECS and Other Services on Audit Measure Installation Decisions

		Percent of Measures that	**Percent of Measures that**

	Number of Measures Installed Using Service	Would Have Been Installed Regardless of Service	Would Not Have Been Installed Without Service
ECS Audit	280	43%	57%
ECS Work Order	36	52%	48%
ECS Contractor Arranging	23	37%	63%
ECS Post-Inspection	9	48%	52%
DSM/WAP Services	118	30%	70%

The following summarizes the results shown in Exhibit 3-10 above:

- **ECS Audit**. Participants who reported that no specific ECS or other services were used to implement audit recommendations (other than the ECS audit itself) were asked if they would have installed these measures without having received the energy audit. Of the 280 measures in this category, 57% would not have been installed had it not been for the ECS energy audit. There are no significant trends across the different participant groups with respect to the level of reported influence for the ECS energy audit.

- **ECS Work Orders, Contractor Arranging, and Post-Inspections.** While very few participants reported that these services were used to install audit recommendations, the level of influence each had on these participants' decisions varied -- 63% for contractor arranging services, 52% for post-inspection services, and 48% for work order preparation services. Again, since the sample size is so small, there are no significant findings across different participant groups.

- **DSM/WAP Services.** A total of 118 measures were installed utilizing utility DSM/WAP services. Of these, 70% were installed because of the influence these services had on participants' decisions.

Influence of ECS Audit and Related Services on Direct Install Measure Decisions

With respect to direct measure installations, participants were asked if they would have installed these measures on their own had it not been for the ECS audit and related

services. Of the 2,884 measures that participants recalled as having been installed, participants report that 24% would have been installed[5] anyway, regardless of the audit. Therefore, based on participants' self-reported information, about three quarters (76%) of the direct install measures were influenced by the program.

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[5] As stated in previous sections, a total of 4,000 direct install measures were received by the sample of FY95 participants included in this evaluation. However, only 72% of these measures (or 2,884) were recalled by participants during the telephone survey as having been installed during their ECS audit. Therefore, data presented in this section regarding the level of influence the ECS audit had on measure installation decisions is based on the 2,884 measures participants' recalled, not the 4,000 measures participants received.

Overall, few significant trends exist across participant groups, except that:

- The ECS audit appears to have influenced more participants using oil (79% of 826) and "other" fuels (87% of 72) for space heating, as compared to participants using natural gas (74% of 1,439) and electricity (69% of 115).

- While overall the ECS energy audit has influenced the majority of participants, the level of influence increases as service levels are decreased. That is, 72% of the participants receiving highly integrated services would not have installed these measures had it not been for the audit, as compared to 77% of the participants receiving none/lightly integrated services.

Influence of ECS Audit on DIY Measure Purchase Decisions

Participants were asked a similar question regarding their purchases of energy saving DIY materials, including those purchased through the bulk purchase service and/or those purchased at retail outlets. Overall, the audit appears to have been effective in influencing participants' reported purchases of DIY materials. That is, 46% of all participants (71) reporting purchases of DIY materials via the bulk purchase service indicated that they would not have installed these same measures had it not been for the audit. Similarly, about half (49% of 512) who reported purchases of DIY materials at retail outlets reported that they would not have installed these same measures had it not been for the audit.

3.3.5 Barriers to Installation of Energy Saving Measures

As a final step in the assessment of ECS effectiveness in achieving energy saving actions, it is important to determine what are the most significant barriers to measure adoption. As reported above, a total of 651 audit measure recommendations were recalled but not implemented. This equates to 57% of all measures that were recalled by participants as having been recommended by their auditor. The following are the most frequently cited reasons for not implementing auditor recommendations: "too expensive" (28% of 651), "don't think it's necessary" (23%), "too busy/haven't gotten around to it" (14%), and

"landlord won't allow it" (10%) . Some interesting trends across participant groups are summarized below:

- While overall cost is a frequently cited barrier to measure implementation across all household income groups, it is most frequently reported as a barrier for lower income households (33% of 133). Similarly, lower income households are more likely than other households to report that their landlord will not allow the measure to be installed in their home (15%). As expected, a much higher percentage of low-income households rent their homes as compared to high-income households (25% v. 2%).

- As household incomes rise, measure cost continues to be perceived as a significant barrier to implementation. However, other factors increase in their importance. Higher income households are more likely to report a lack of time as a barrier to measure installation. In addition, a perceived lack of need is more frequently reported as a barrier for high income households. Finally, almost none of the highest income households reported the rental property barrier, which is expected given that most of the higher income households own their homes.

Barriers to implementation also varied widely depending on the measure recommended. Cost was reported as a barrier for nearly all measure types. Measures for which cost was most frequently reported as a barrier include:

- new heating system (61% of 15)
- burner replacement (59% of 12)
- boiler reset (59% of 11)
- window insulation/insulated windows (48% of 11)
- wall insulation (42% of 75)
- attic insulation (33% of 67)

Measures where cost was reported less frequently than the overall average (28%) are presented in Exhibit 3-11. Also shown in this exhibit are the most frequently reported barriers for these measures.

Exhibit 3-11
Barriers to Measure Implementation, Where Measure Cost Is Not the Most Important Concern

Measure	Number Reporting Measure Not	Percent Reporting Cost as a Barrier	Most Frequently Reported Barrier (%)

	Installed		
Clock thermostat	162	21%	Don't think it's necessary (29%)
Floor insulation	67	26%	Don't think it's necessary (27%)
Htg. Pipe insulation	61	17%	Don't think it's necessary (20%) Haven't gotten around to it (20%)
Duct insulation	56	26%	Haven't gotten around to it (28%)

3.4 Effectiveness of ECS in Achieving Energy Education and Other Benefits

3.4.1 Influence of ECS Education on Participant Practices

To be considered effective, programs designed to provide energy education should encourage customers to take specific actions to improve the energy efficiency of their homes. To evaluate the effectiveness of the program in this regard, participants were asked during the survey whether or not they have taken certain "energy saving actions" and whether or not the information (or education) they received during the audit influenced their decision to take these actions. Specifically, participants were asked if they:

- lower the heating system thermostat at night or when leaving home;
- tune-up their heating systems;
- repair leaky hot water faucets; and
- lowered their water heater temperature setting.

Participant responses to these questions are shown in Exhibit 3-12 and significant findings across different participant groups are discussed below:

- **Lower Heating System Thermostat**. Overall, 89% of the participants surveyed claim to lower their heating system thermostat at night or while away from home.

There are no significant trends across different fuel types, service levels, or vendors/audit tools. However, as household income levels increase, the frequency with which participants reported taking this energy saving action tends to decrease.

- **Heating System Tune-ups.** Overall, about two-thirds (67%) of the participants surveyed reported that they get their heating systems tuned-up. Further analysis of responses across different participant groups indicates that:

• Nearly all of the participants who heat their homes with oil (95% of 335) report that they get their heating systems tuned-up, as compared to only 52% of the gas heating participants (514 total) and 32% of the electric heat participants (48 total).

• Participants who rent their homes are less likely to get heating system tune-ups, as compared to home owners (52% of 100, v. 68% of 826). Nevertheless, a significant portion of the participant renters claim to be implementing this energy saving practice.

- **Repair Leaky Hot Water Faucets.** Overall, about half (54%) of the participants surveyed report that they repair leaky hot water faucets. While few significant trends are evident across different participant groups, it was found that participants who heat their water with an oil-fired system are more likely than participants using other types of water heating systems to practice this measure (61% of 201 participants using oil for water heating, v. 51% of 550 using natural gas for water heating).

- **Lower DHW Thermostat.** About half (56%) of the participants surveyed reported that they have lowered the temperature setting on their water heater. There are no significant trends across different participant groups with respect to this finding.

Exhibit 3-12
Energy Efficiency Actions Taken

	Lower Thermostat at Night or When Leaving Home	**Get Your Heating System Tuned-up**	**Repair Leaky Hot Water Faucets**	**Lower Thermostat on Hot Water Heater**	**Other Actions**
Action Not Taken	11%	33%	46%	44%	47%

Action Taken	89%	67%	54%	56%	53%
Base	946	934	940	923	940
Action Taken Because of Audit	20%	19%	13%	55%	28%
Action Taken Regardless of Audit	80%	81%	87%	45%	72%
Base	842	626	508	517	498

Further interpretation of the data presented in Exhibit 3-12 indicates that, other than reducing DHW temperature settings, few energy saving practices were influenced by the information (and education) received during the audit. For example:

- Many participants (89%) indicated that they tend to set back the thermostat for their space heating systems at night or when leaving home. However, few of these participants (20%) reported that the ECS education on this important action influenced their decisions to take this action. Across participant groups, the only significant finding relates to income: that is, as household incomes increase, the frequency with which participants report ECS education as having an influence on their actions tends to decrease.

- Heating system tune-ups were somewhat less frequently reported as actions taken by participants (67%) and, when taken, the education provided through the program may not have been a significant influence on these participants' decisions. Generally, most of these participants (81%) indicated that they took these actions regardless of the audit. There are a few significant findings across specific participant groups:

• Oil-heat participants are the least likely to have been influenced by the audit to take this action in that only 13% of the 315 oil-heat participants reported taking this action because of the audit's influence. However, the audit influenced a greater percentage of gas-heat participants to take this action (25% of 263 gas-heat participants taking this action).

• As household incomes increase, the influence of the audit on participants' actions tends to decrease. That is, among low-income households 78% (of 144 taking this action) indicated that the audit did not influence their actions, yet among high-income

households, 88% (of 81 taking this action) reported that the audit did not influence their actions.

- Finally, education on the importance of repairing leaky hot water faucets and reducing DHW temperature set points appears to have influenced a fair number of participants to take this action. However, only about half of the participants reported that these actions have been taken, reducing the overall significance of this finding. There are no significant findings across different participant groups regarding this issue.

Overall, these findings suggest that, for some energy saving practices, participants report that they have taken action. However, the program was not reported as a significant influence on most of these participants' decisions to take action. Despite this finding, a number of direct and indirect findings from the participant survey indicate that the energy education provided through ECS might be a significant factor in the overall "success of program", while perhaps not directly influencing specific energy efficiency actions taken as a result of it. Findings supporting this statement are discussed below:

- An important aspect of any energy education program is to encourage the active participation of the recipient in the audit process. ECS appears to have been successful in this regard. According to the survey results, nearly all participants accompanied their auditors while they inspected their homes during the ECS visit. That is, the majority of participants (72% of 948) reported that they accompanied their auditors during the entire ECS visit, and another 22% accompanied their auditors at least some of the time. Only 6% did not accompany their auditors, which may well reflect circumstances beyond the auditors' control (i.e., unavoidable constraints on the participants' abilities and/or time).

- Education takes time, and the ECS audit process was designed to allow the auditor sufficient time to respond to customers' questions and concerns, as well as complete the processes of data collection, analysis, information-sharing, and education. As mentioned above in Section 3.2.3, from the participant's perspective, the ECS auditors were successful in meeting customers' expectations regarding the length of time required to complete these processes. Nearly two thirds of the participants surveyed (64%) were very satisfied with the length of time spent on the ECS visit, and another 28% were somewhat satisfied. Only one percent of all participants surveyed (or 16 respondents) were in some way dissatisfied with this aspect of the audit process.

- Education also takes skill. Auditors need to be both knowledgeable and helpful, while at the same time capable of balancing the demands of meeting program's technical and administrative requirements with the demands placed on them by participants once in their homes. It appears that ECS auditors were also successful in this regard, as discussed above in Section 3.2.3. Nearly all of the participants surveyed were very or somewhat satisfied with their auditor's knowledge level,

helpfulness and professionalism. Only two percent (or 19 customers) offered negative comments regarding their auditors' performance in these areas.

- When specifically asked what they liked most and least about the program, the educational aspects of ECS were among the most commonly reported "likes" and factors having little or nothing to do with the specific provision of energy education were most commonly reported as "dislikes". As reported in Section 3.2.2 above:

• About one third of the participants (31%) indicated that the audit provided "useful knowledge" that might be used in future decision making. In addition, survey results indicate that some participants were impressed with their auditors' knowledge and responsiveness (14%), the comprehensiveness of the audit (11%), the audit report (11%), and the demonstration of measure installations (10%). Each of these factors indirectly contributed toward the provision of energy education to participants. Several national studies have demonstrated that the information and "tools" (e.g., audit reports, DMI techniques) provided to participants via energy education programs can lead to increased energy [6].

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[6] "Annotated Bibliography of Research - Verified Energy Education Programs", Professional Association for Consumer Energy Education, July 1, 1994.

• While the majority of participants (78%) had nothing negative to report about the ECS audit, few specific comments relating directly to educational aspects of the program were provided by participants. In fact, most of the aspects participants did not like centered on specific products installed or not installed, the cost required to implement recommended measures, and the inconvenience of the audit schedule. A few participants did report that the audit "wasn't useful" "didn't solve problems", or "was not complete/thorough" (5%), and that the auditor was "rushed", "provided inaccurate information", or "wasn't knowledgeable" (3%).

3.4.2 Influence of ECS Energy Education on Participant Knowledge/Capabilities

Energy education, if effective, should also "leave behind" information and knowledge that can be used in future energy-related decision making. To evaluate this aspect of the energy education component, participants were asked to indicate whether they agreed or disagreed with a number of statements regarding energy efficiency knowledge and capabilities. These statements were read as follows:

- I understand what actions I need to take to save energy in my home;

- I can install do-it-yourself energy-saving measures or materials in my home;

- I feel confident talking to contractors or my landlord about energy-saving products that need professional installation in my home;

- I understand how my everyday behavior contributes to energy savings or consumption in my home; and

- I understand how much energy my home uses and where the energy is being used.

Participants who agreed with a given statement were then asked whether or not they felt that the audit contributed to their knowledge or capability. Overall, participants agreed with nearly all of these statements and the majority indicated that the audit had contributed to their knowledge or capabilities. Exhibit 3-13 below presents participant responses to these questions.

Exhibit 3-13
Influence of Program on Energy Efficiency Knowledge/Capabilities

	Agree	Disagree	Total Responses	Audit Influence	NO Audit Influence	Total Responses
I understand what actions I need to take to save energy in my home	98%	2%	945	87%	13%	929
I can install do-it-yourself energy-saving measures or materials in my home	92%	8%	942	76%	24%	865
I feel confident talking to contractors or my landlord about energy-	81%	19%	922	61%	39%	741

saving products that need professional installation in my home						
I understand how my everyday behavior contributes to energy savings or consumption in my home	98%	2%	943	67%	33%	919
I understand how much energy my home uses and where the energy is being used	90%	10%	936	74%	26%	840

Further analysis of the data presented in Exhibit 3-13 across the different participant groups shows only one significant trend relating to household income levels. Keeping in mind that, overall, participants tended to agree with all of these statements, regardless of their household income level, the frequency with which participants agree with these statements increases as household incomes increase. However, among those participants agreeing with these statements, the frequency with which participants report that the audit has contributed to their current knowledge and capabilities is highest among the low-income segments, suggesting that the educational elements of ECS may have been most effective when provided to low-income households.

The results discussed above and presented in Exhibit 3-13 present some potential conflicts with the findings presented above in Section 3.4.1 regarding actions participants report they have taken to save energy. For example, the first row in Exhibit 3-13 above indicates that 98% of the participants believe they understand the actions they need to take to save energy. However, as reported in Section 3.4.1 (and shown in Exhibit 3-12), the percentage of participants who report that they have taken specific energy saving actions are not as high as 98%. It is possible that participants are indicating in Exhibit 3-13 that they are aware of what is needed to be done, and (as indicated in Exhibit 3-12) some have been relatively "proactive" in taking actions on their own. However, some

participants are not taking actions -- perhaps more for because of cost, procrastination, or other market barriers (e.g., renting)[7], as compared to lack of education or awareness.

[7] Market barriers to audit measure installation were reported in Section 3.3.5.

Further, it would appear that participant responses regarding the *contribution* of the audit to improvements in participants' knowledge/capabilities are somewhat in conflict with their responses regarding the *influence* the audit had on their decision to take specific actions. For example, most participants feel the audit has contributed to their current knowledge and capabilities, as shown in Exhibit 3-13 above. However, few participants indicated in Section 3.4.1 above (and shown in Exhibit 3-12) that the audit influenced their decision to take specific actions. Again, this may imply that while some participants view themselves as generally proactive, and others report taking little specific action, overall, responses from participants may indicate that the education provided through ECS has been effective in reinforcing or strengthening their current awareness and knowledge of what needs to be done.

3.4.3 Realization of Benefits

In order to assess the extent to which ECS provides benefits (other than energy savings), participants were asked a number of questions regarding whether or not they had experienced:

- Increased comfort and/or lower energy bills in both the summer and winter;
- Increased value of their home;
- Personal satisfaction with helping conserve energy and/or the environment; and
- Any other benefits.

Exhibit 3-14 presents the actual survey results. As shown, there appears to be evidence that participants gained a significant level of "personal satisfaction" with respect to helping conserve energy and improve the environment. In addition, many felt that they had benefited in terms of increased comfort and lower energy bills in the winter season. About one third of the participants felt that they had experienced increased comfort and lower energy bills in the summer, and a similar percentage felt that the value of their home had increased as a result of participating in the program.

Exhibit 3-14
Realization of Other Benefits

	Benefit Realized	Benefit Not Realized	Benefit Not Applicable	Base
Increased comfort in summer	32%	62%	6%	898
Lower energy bills in summer	36%	58%	6%	884
Increased comfort in winter	71%	26%	3%	937
Lower energy bills in winter	64%	32%	4%	890
Increase value of home	34%	55%	11%	831
Personal satisfaction with helping conserve energy	89%	10%	0%	942
Personal satisfaction with helping the environment	88%	11%	1%	937
Other benefits (e.g., improved understanding of energy usage, good/helpful service, new equipment/measures, monetary savings)	11%	89%	0%	943

The only significant trend that is evident across the different participant groups relates (again) to household income levels. For certain benefits, low income households are more likely than high income households to report that they have increased the comfort of their home and lowered energy bills in the summer. In addition, when looking at only current home owners, low income households are more likely than high income households to report that they have increased the value of their home through their participation in the program.

However, the benefits discussed above and shown below in Exhibit 3-14 regarding increased comfort, lower energy bills, and increased home value should be interpreted with caution. Given the relatively limited level of measure implementation (as discussed above in Section 3.3), it is unclear whether the participant population is likely to have actually experienced the full magnitude of these benefits. However, the survey results

suggest that participants "perceive" these benefits to be real, regardless of their reports on the specific actions they have taken to warrant the realization of these other benefits.

Volume 2, Chapter 4 - Needs Assessment Survey Results

The chapter presents the results of an energy efficiency needs assessment for Massachusetts residential customers. The objective of this assessment was to gather information to assist in determining how the ECS program should be changed to best meet the energy efficiency needs of Massachusetts residents throughout the transition to and after the restructuring of the gas and electric industries. In addition, the needs assessment was intended to identify and characterize segments within the general residential population of Massachusetts that would represent the target market for the current program services, as well as representing the target market(s) for new, specialized energy efficiency services.

In order to accomplish these objectives, Hagler Bailly conducted a telephone survey with a representative sample of 597 Massachusetts residents, following survey sampling and data collection procedures[1] developed in consultation with and approval of DOER and participation of representatives of the Public Advisory Committee (PAC). In addition to reporting on simple descriptive statistics, a two-stage segmentation analysis was completed to assist in the development of more targeted marketing, design and delivery elements that would attract participation from these two segments of the residential population.

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[1] Volume III of this report contains details on the survey sampling and data collection procedures, as well as copies of the final survey instrument, banner tabulation reports and technical memorandum describing the two-stage segmentation approach.

Presented first in this chapter is an overview of the key findings from the needs assessment survey. The second section highlights some important distinctions between the ECS participant population and the general population as a whole, and the final section presents the key findings from the needs assessment segmentation analysis.

4.1 Key Survey Findings

Before presenting the key survey findings, some important demographic information about the population of Massachusetts residents included within the needs assessment survey sample is presented. Where available, these data are compared to 1990 US Census data to determine whether or not the random sampling techniques used to conduct the needs assessment survey resulted in an accurate representation of the demographic characteristics of the general residential population within the state. This comparison is presented in Exhibit 4-1 and summarized below:

- The survey sample adequately represents the space heating fuel type characteristics found within the general population, as well as the average number of rooms per dwelling and occupants per household.
- Adjusted for inflation and growth, the per capita income level for the typical Massachusetts resident in 1995 is consistent with the average per capita income level reported by the survey sample for the same time period.
- Some segments of the population may not be accurately represented within the survey sample. Specifically, the survey sample sizes for multifamily households and renters are smaller than that found in the general population. In addition, the survey sample also appears to over-represent residents in the state who (a) recently moved into their current home (e.g., within the last 10 years), and (b) live in somewhat older homes. These factors are important to keep in mind when reviewing the results presented in this chapter.

The rest of this section contains a detailed summary of the key findings from the needs assessment survey, organized as follows:

- Identification of ECS participants among the general population[2]
- Recall and identification of ECS providers
- Awareness of ECS among nonparticipants
- Recall of participation in other energy conservation programs
- General perceptions and concerns regarding energy efficiency
- Expressions of "energy consciousness"
- Perceptions regarding selected energy efficiency needs
- Awareness of specific actions needed to improve energy efficiency
- Barriers to energy efficiency measure installations
- General beliefs regarding "fees for service" and "willingness to pay"
- Likelihood of using selected energy efficiency services
- Preferences for energy efficiency service delivery methods
- Preferences for energy efficiency service providers and overseers
- Awareness and preferences for energy efficiency charges/credits

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[2] References to "participants" hereafter refer to the population of participants who reported during the survey that they received an ECS audit, and references to the "general population" hereafter refer to the population of Massachusetts residents represented within the needs assessment survey sample.

Exhibit 4-1

Comparison of Survey Sample to General Population Demographics

Population Demographic:	Survey Sample: (Base=567 households)	General Population: (Base=2.5 million

		households)
Housing Stock: Residential 1-4 Units Multifamily 5+ Units	 90% 10%	 80% 20%
Tenure: Owner occupied Renter occupied	 75% 25%	 59% 41%
Space Heating Fuel Type: Oil Natural Gas Electricity Other (e.g., bottled gas, wood, coal)	 45% 39% 11% 5%	 44% 38% 13% 5%
Water Heating Fuel Type: Oil Natural Gas Electricity Other (e.g., bottled gas, wood, solar)	 30% 47% 20% 3%	 n/a n/a n/a n/a
Age of Home: Average Years	 50	 43
Number of Rooms: Average Number	 6	 6

Per Capita Income: Average	$24,000 (1995)	$28,000 (1995) [1]
Number of Occupants: Average Number:	3	3
Years in Current Residence: < 6 years 6-10 years 11-15 years 16-26 years > 26 years	 38% 19% 12% 14% 18%	 17% 27% 15% 18% 23%
Years in Massachusetts: Average	36	n/a

[1] The average per capital income in Massachusetts in 1995 is reported as about $17,000 in the 1990 US Census. Adjusting for inflation and growth brings the average to $28,000 in 1995. (Source: The Salt Lake Tribune, September 25, 1996. "Per Capita Incomes Up Across U.S." by John D. McCLain, Associated Press.)

Sources: Hagler Bailly needs assessment survey (completed in October 1996), and 1990 US Census Data.

n/a = information not available from 1990 US Census Data.

4.1.1 Identification of ECS Participants

The needs assessment survey was designed to identify ECS participants from among the general population of Massachusetts residents. Since no list of individual participants was available, the survey questionnaire was used to determine whether or not a respondent had previously participated in ECS. The specific question was worded as follows: *"Since 1980, the state has required the electric and gas utilities in Massachusetts offer energy audits to residential customers. As part of these audits, an energy specialist comes to your home, examines its energy characteristics, installs some simple energy-saving items*

such as weatherstripping, and recommends other energy-saving items. Have you ever received an energy audit in Massachusetts?".

Based on responses to this question, a significant portion of the residential population of Massachusetts has participated in the ECS Program. That is, 41% of the general population surveyed (or 244 of 596 residential customers) indicated that they had participated in the program since its introduction in 1980. This finding is consistent with DOER's ECS production data, which indicated that, of the 2.2 million households in the state, approximately 39% (or 859,293 customers) have participated in ECS since its inception in 1980 through October 1996. Overall, it would appear that the level of participation determined through the survey process is about equal to the actual level of participation to-date. Subsequent references to "participants" in this chapter are associated with residents who have identified themselves as participants through the survey effort, as opposed to verified, actual participants. Nevertheless, the closeness of these two statistics indicates a strong likelihood that residents' self-reports are not too far away from reality, at least in the instance concerning participation levels.

According to the survey results, the majority of this participation has occurred in the 1990s: about 73% of the participants reported that their audits were completed during the 1990-1996 period. However, actual DOER production data does not support this level of program activity during the 1990-1996 period. That is, DOER reports that about 48% of the total participation through October 1996 (or 409,607 customers) has occurred during this period, which suggests that surveyed participants may have over reported participation during this period (or they have participated in other energy conservation programs, such as utility DSM, and do not know the difference).

Only 11% of the participant population (or 4% of the general population) indicated that they had received more than one audit through the program, and even fewer reported receiving a third audit (1% of the participant population, and less than 1% of the general population). There is no readily accessible quantitative data available from DOER or other sources to substantiate surveyed participants' claims to have received more than one ECS audit.

4.1.2 Identification of ECS Providers

Respondents who indicated that they had participated in the ECS program were also asked to specifically name the utility or other entity who provided their audit services. As shown at right, a significant portion of the surveyed participant population (26%, or 63 of 244) could not recall the specific name of the utility/other entity that provided these audits. While 18% of these 63 respondents could not recall the specific year in which they participated, the majority (62% of 63) reported that they had participated since 1990.

An additional 16% could not identify the specific name of the electric, gas or municipal utility that provided them with their energy audits. About as many of these respondents "did not know7quot; when they participated, as reported that they participated in the last three years (i.e., since 1993).

Another 6% reported that "other" entities, some of which do not exist in Massachusetts, provided their energy audits. Nearly all of these respondents reported that they received their energy audit within the last six years.

It is unclear why such a significant portion of the surveyed participant population could not accurately recall their specific ECS utility/provider. However, because participants are represented in the surveyed population with the same frequency as in the actual population, we have assumed that, regardless of surveyed participants' responses to questions about the year in which they participated, as well as the question designed to identify their ECS utility/provider, participants identified through the survey represent a good "proxy group" for the actual segment of participants who exist in the population.

4.1.3 Awareness of ECS Among Nonparticipant Population

Including the self-reported participants identified above, awareness of ECS among the general population is estimated at 78% (or, 464 of 594). Among self-reported nonparticipants, about two thirds (or 63% of 350) reported being aware of the program, while the remaining nonparticipants (37% of 350) were unaware of the program prior to the survey. There are no significant differences between aware and unaware participants according to: the type of fuel they use to heat their home, whether they own or rent their homes, whether they live in single v. multifamily homes, and their level of per capita household income.

However, length of residency in the state does appear to have an influence on nonparticipant awareness. For example, 67% of the nonparticipants who have lived in Massachusetts for more than 16 years (i.e., since the program's inception in 1980) were aware of ECS prior to the survey. Only half (50%) of the nonparticipants who have lived in Massachusetts for less than 16 years reported being aware of ECS prior to the survey.

4.1.4 Participation in Other Programs

Only a small portion of the general population surveyed reported that they had participated in other energy conservation programs. Specifically, 10% (or 59 of 594) indicated that they had "participated in an energy conservation program -- other than energy audits -- that was sponsored by a utility or a government agency", in which they may have received (for example) "low- or no-cost installation of energy conservation materials, rebates, weatherization, etc.". The remaining portion of the general population (90%, or 535 of 594) had not participated in any other programs. Although not statistically significant, participation in other programs is highest among the ECS participant population (12%, or 29 of 242), and lowest among ECS nonparticipants (9%, or 31 of 352).

Respondents who indicated that they participated in other energy conservation programs were asked about the specific measures installed as part of these programs, and whether or not they paid for all or part of the cost of installing these measures. Just over half of

these participants (56%, or 33 of 59) reported that they did not pay for all or part of the measures installed through these other programs.

Most often, these participants reported that they had light bulbs and/or fixtures (37%, or 20 of 55), and/or DHW measures (24%) installed as part of these programs. A few (9%) reported installing insulation as part of these programs, and another 6% indicated that minor weatherization materials were installed through these programs. The remaining respondents either reported installing miscellaneous other measures, or did not know what specific types of measures were installed.

4.1.5 Perceptions v. Concerns Regarding Home's Energy Efficiency

Respondents were asked, on a scale of 1 to 5, with 1 meaning "not at all energy efficient" and 5 meaning "extremely energy efficient", how they would rate the overall energy efficiency of their homes. Exactly half of the sample (50%) reported that they perceived their homes to be fairly energy efficient (i.e., rated 4 or 5). A greater percentage of respondents indicated that they were concerned about energy conservation in their every day life. That is, on a similar scale, respondents were asked how they would rate their overall concern for energy conservation in their everyday life. Nearly three quarters (72%) reported that they were concerned about energy conservation on a daily basis (i.e., rated 4 or 5).

There are no significant findings across different space heating segments with respect to their perceptions and concerns about energy efficiency. However, high per capita income households are significantly different from the average resident in that they are more likely to report being concerned about energy efficiency as part of their every day life.

In addition, respondents were asked about their perceptions regarding the energy efficiency of their homes through several direct questions, such as "Are your windows energy efficient?", "Do you have energy efficient lighting?", etc. A discussion of the responses to these questions is presented below in Section 4.1.7. However, the findings from these specific questions are consistent with responses to these more general, scaled questions discussed above in this section. That is, respondents who are likely to report ratings of 4 or 5 (i.e., they generally perceive their homes to be energy efficient) are also among the most likely to perceive that, for example, their windows are energy efficient.

4.1.6 Expressions of Energy "Consciousness"

Respondents were also asked to rate, on a similar scale of 1 to 5, their level of agreement with a number of statements regarding energy efficiency and awareness issues. Generally, there was broad agreement with nearly all of the statements regarding energy conservation "consciousness" --

- I understand how much energy my home uses and **where** the energy is being used (86%[3] of 597)
- I am interested in learning more about **how** my household uses energy (68%)

- I know where to **purchase** energy-saving measures for my home (78%)
- I (or someone in my household) could install do-it-yourself energy-saving materials in my home (80%)
- I feel comfortable talking to contractors/landlords about energy-saving products that need professional installation in my home (72%)
- I (or someone in my household) have taken **actions** to improve my homes energy efficiency (84%)
- I am interested in learning more about **specific ways** to save energy in my home (73%)
- I believe it is important to be energy efficient (98%)
- I encourage household members or co-workers to be energy efficient (91%)
- What I can **personally** do for energy efficiency will make a difference[4] (84%)

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[3] These percentages are for ratings of 4 or 5, with "5" representing strong agreement.

[4] The actual statement was worded "What I personally can do for energy efficiency will not make a difference...". For simplicity in reporting purposes, we have re-worded the question to be consistent with other questions.

Nevertheless, most respondents (80%) agreed that while more could be done to improve the energy efficiency of their homes, "right now" other things had higher priorities in their households.

There is only one significant finding across different segments of the population with respect to their agreement with these statements about energy "consciousness." That is, when compared to nonparticipant statements, participants are significantly more likely to report statements that indicate a higher level of energy "consciousness" (see Exhibit 4-2).

Exhibit 4-2

Differences in Reports of "Energy Consciousness" Across

Participant and Nonparticipant Segments[1]

Statements of Energy "Consciousness":	**Percent of Participants Agreeing[2] with Statement:**	**Percent of Nonparticipants Agreeing[2] with Statement:**
I understand how much energy my home uses and **where** the energy is	**90%**	**83%**

being used		
I am interested in learning more about **how** my household uses energy	68%	67%
I know where to **purchase** energy-saving measures for my home	**84%**	**72%**
I (or someone in my household) could install do-it-yourself energy-saving materials in my home	81%	80%
I feel comfortable talking to contractors/landlords about energy-saving products that need professional installation in my home	**80%**	**67%**
I (or someone in my household) have taken **actions** to improve my homes energy efficiency	**92%**	**78%**
I am interested in learning about **specific ways** to save energy	72%	73%
More can be done to make my home more energy efficient, but right now other things have higher priority	**75%**	**84%**
I believe it is important to be energy efficient	**100%**	**97%**
I encourage household members or co-workers to be energy efficient	**97%**	**87%**
What I can **personally** do for energy efficiency will make a difference[3]	85%	84%

[1] Findings that are statistically significant at the 95% confidence level are shown in **bold**.

[2] These percentages reflect ratings of 4 or 5, with "5" representing strong agreement.

[3] The actual statement was worded "What I personally can do for energy efficiency **will not** make a difference...". For simplicity in reporting purposes, we have re-worded the statement to be consistent with other statements.

As shown in this exhibit:

- Participants are significantly more likely than nonparticipants to state they: understand how much energy is used, know where to purchase energy saving measures, feel comfortable talking with contractors/landlords about professional installations, have taken actions to improve the energy efficiency of their homes, believe in the importance of energy efficiency, and encourage others to be energy efficient.
- Nonparticipants report with greater frequency that "other" priorities are keeping them from making improvements.

4.1.7 Energy Efficiency Service Design Considerations

The needs assessment survey addressed residents' perceptions regarding the energy efficiency of their home and major end-uses. In addition, their awareness of specific actions they could take to improve the energy efficiency of their home was also explored. Exhibit 4-3 presents a summary of the key findings from these survey questions. As shown, for some measures there seems to be a rather low perception of "need" (e.g., energy efficient heating systems). For others, the need for improvement is more evident, yet "awareness" of specific actions to take is relatively limited.

Exhibit 4-3

Perceptions Regarding Energy Efficiency Needs[1]

and Awareness of Specific Actions Needed

	No Perceived Need for Energy Efficiency Improvement:	**Perceived Need, Yet Unaware of Specific Actions Needed**	**Perceived Need and Aware of Specific Actions Needed**
Attic insulation	39%	42%	19%
Energy efficient windows	49%	36%	15%

Energy efficient heating system	66%	29%	5%
Energy efficient lighting	52%	31%	17%

Base: 597 respondents (General Population)

[1] The derivation of "perceived needs" was completed through analysis of responses to two survey questions. For example: (1) "Is your attic insulation sufficient to keep heat from escaping in the winter?", and (2) "How do you know that your attic insulation is sufficient?". For the purposes of reporting the percentages shown in this Exhibit, respondents who indicated that they perceive their attic insulation to be sufficient (1) because they "just know" (2) were reclassified as having a potential need for improvement.

The needs assessment survey also addressed what "barriers" are facing residents who are aware of the specific actions they should take to improve the energy efficiency of their homes, but have yet to take them. The top three barriers to installing measures (among the segment of the population that has identified specific actions they can take) are: **(1) cost** (37% of 423); **(2) not a priority** (22%); and **(3) landlord/rental barriers** (13%).

Taking into account perceived needs, awareness, and barriers, three distinct segments of the population have been defined according to the level of service(s) with which each segment might be most appropriately targeted:

- **Specialized Implementation Services**
  - This group contains residents who perceive to have a need for energy efficiency improvements, are aware of the specific actions they need to take, yet have not taken any specific action to-date. There might be three types of specialized implementation services offered to this group:
    - *financial assistance services:* residents who report "cost" as a major barrier to measure adoption
    - *installation assistance services:* residents who report "non-priority" as a major barrier to measure adoption
    - *rental property assistance services:* residents who report "rental property" barriers to measure adoption
- **Limited Education and Implementation Services**
  - This group consists of residents who perceive to have a need for energy efficiency improvements, but are not aware of the specific actions they need to take. This group might be targeted with limited education and implementation services to increase awareness. As awareness is increased, some within this group might be best targeted with the specialized services described above (depending on the barriers they face once they are made aware of what their options are).

- **Limited Outreach and Information Services**
    - The remaining group consists of residents who do not perceive to have a need for energy efficiency improvements. Since it is unlikely, that in all cases, residents "perceptions" regarding energy efficiency needs are accurate, it is unclear what should be done to address this remaining (yet undetermined need). It is possible that limited outreach and information services might be the most cost-effective means through which to address this segment. As the outreach and information services begin to address their "real" (as opposed to perceived) needs, the other services described above (as appropriate) could be more effectively targeted to address the remaining awareness issues and barriers.

4.1.10 General Beliefs Regarding "Fees for Service" and Expressions of "Willingness to Pay"

During the needs assessment survey, residents were asked about their general beliefs regarding whether or not residents who use energy efficiency services (i.e., provided through state and/or utility programs such as ECS, DSM, etc.) should pay fees for these services. From the analysis of this data, it can be concluded that a significant portion of the general population believes in the concept of "fees for service". While many (40%) feel that residents using the services should not have to pay fees for these services, a slightly greater percentage (42%) indicated their belief that residents using these services should pay a fee covering at least part of the cost of these services. Another 18% advocate a policy were residents using these services pay fees that covers the full cost.

There was little difference in these findings across participants and nonparticipants, other than to note that a somewhat greater portion of nonparticipants (as compared to participants) feel that residents using these services should pay fees covering the full cost (21% v. 14%). Although each group does not significantly differ from the average (18%), this may indicate two things: (1) some nonparticipants, who are unlikely to take part in future programs offering energy efficiency services, may feel more strongly that those who do use these services should pay the full cost through fees, and/or (2) participants, who have previous experience using similar services, may be somewhat reluctant to pay the full cost via fees for the services they may recall receiving through prior programs.

In addition, there is some indication of "willingness to pay" for ECS audit services among the general population. That is, about 35% of the general population would be willing to pay at least $30 for audit services, such as those provided through ECS. About one quarter (25%) would pay $30 and another 10% would pay up to $60. Overall, the percentage is somewhat higher for residents who reported that they had already participated in ECS, as compared to nonparticipants. That is, about half (52%) of previous participants would have been willing to pay at least $30 for the services they received, whereas only 22% of nonparticipants are currently willing to pay at least $30 to participate. These findings are summarized below in Exhibit 4-4.

These findings clearly indicate that (a) a significant portion of the general population would be willing to pay something to receive ECS services, and (b) some previous participants have placed a "dollar value" on the services they received. Specifically, 38% would have paid $30, and another 14% would have paid $60. It should be noted that, due to limitations on the survey interview length, only three choices were given to survey respondents with respect to their willingness to pay: $0, $30, and $60. It is possible, therefore, that some of the respondents who indicated that they would participate in ECS if offered for free might have been willing to pay something in between $0 and $30, further increasing the significance of these findings.

Exhibit 4-4

Willingness to Pay for ECS Audit Services

	Overall	**Participants**	**Nonparticipants**
Not interested in participating, even if free	27%	0%	47%
Participate only if free[1]	38%	48%[2]	31%
Willing to pay $30 to participate	25%	38%	15%
Willing to pay $60 to participate	10%	14%	7%
Base	565	236	329

[1] Due to limitations on the survey interview length, only three choices were given to survey respondents with respect to their willingness to pay: $0, $30, and $60. It is possible, therefore, that some of the respondents who indicated that they would participate in ECS if offered for free might have been willing to pay something in between $0 and $30.

[2] Some of these participants may have, in fact, paid to participate in ECS when fees for service were included in the program in prior years.

The findings regarding residents' general beliefs on "fees for service" are slightly inconsistent with (although not significantly) the findings presented above in Exhibit 4-4 regarding the extent to which residents (who are interested in participating in programs such as ECS) are willing to pay fees for services received. For example, of the 565

respondents included in Exhibit 4-4 (above), 73% would be willing to participate in ECS. Of these 412 respondents, about 52% would be willing to participate in ECS only if offered free-of-charge, and 48% would be willing to pay a small fee ($30-60). However, as reported above, about 60% of the general population feel that, in general, "fees for service" are appropriate.

Therefore, it may be concluded that residents' general beliefs about fees for service may not truly reflect their willingness to pay for services (when they are interested in taking advantage of them). However, these two findings are not significantly different from one another to over-ride the general conclusion that there appears to be (a) a significant belief in fees for services among the general population, and (b) a significant willingness to pay for such services among the portion of the population who is willing to use these services.

4.1.11 Likelihood of Using Energy Efficiency Services

The survey also addressed the level of interest in various energy efficiency services across the general population, as well as within specific segments. Specifically, all respondents were asked about their likelihood of using the following variety of energy efficiency services:

- Information about how to buy and install energy saving measures and equipment
- Assistance in finding and contracting with reliable companies who install energy saving measures and equipment
- Financing assistance for improving the energy efficiency of the home
- Mortgages that provide favorable terms for homes that are more energy efficient
- Customized energy analysis of the home

Exhibit 4-5 presents the results of these questions. As shown, generally respondents indicated that they were most likely to use the "how to" information service and the customized audit service. A significant portion also indicated that they were likely to use the contractor arranging, financing, and favorable mortgage services. However, a greater percentage were unlikely, as opposed to likely, to use these services.

Exhibit 4-5

Interest in Various Energy Efficiency Service Offerings

Likelihood of Using Energy Efficiency	Percent of Respondents Reporting: (Base=597)				
	Very Likely	Somewhat Likely	Neither Likely nor Unlikely	Somewhat Unlikely	Not at all Likely

Services					
"How to" information	25%	29%	7%	10%	29%
Contractor assistance	16%	26%	6%	14%	38%
Financing assistance	22%	19%	6%	11%	42%
Energy efficient mortgages	26%	19%	6%	7%	42%
Customized audits	27%	28%	6%	8%	30%

For nearly all service types, there was little difference between the level of interest reported by specific segments of the population and the overall level of interest reported by the general population as a whole. Summarized below, by service type, is a discussion addressing differences in specific segments of the population:

- **Information Services** -- Most segments of the population were just as interested as the general population as a whole in information services, a few findings regarding the segments of the population who were least likely to be interested in information services may shed some light on appropriate targeting approaches (findings that are significant are marked with an "*"[5]): electric heat, multifamily renters, multifamily home owners, lower-income households (*), and current nonparticipants (*).

[5] Hereafter, the "*" notation indicates statistical significance at the 95% confidence level.

- **Installation Assistance Services** -- In addition, most segments of the population felt about the same as the general population as a whole with respect to their interest in installation services. However, certain segments were more interested than others:
  - most interested: other heating fuels (e.g., propane, wood), moderate-to-high per capita income group(*), and previous ECS participants(*)
  - least interested: oil heat(*), electric heat, multifamily renters, multifamily owners, moderate-to-low per capita income(*), and current nonparticipants(*)
- **Financing Assistance Services** -- Generally, segments of the population who were interested in financing assistance services did not differ from the average

resident. However, there were two segments that differ in that they were the least likely to be interested in financing assistance services: single family renters, and high per capita income households. In addition, customers who are most interested in financing options also represent customers who (at least perceive to) have the greatest need for and interest in making energy efficiency improvements. And, those who are not interested in financing options are also likely to (at least perceive themselves to) have virtually no need for energy efficiency improvements and/or no interest in making energy efficiency improvements. Therefore, it can be concluded from the results of the survey that, if appropriately targeted, financial assistance services may be effective in encouraging energy efficiency improvements among segments of the population who have the greatest need and the greatest likelihood of "taking action".

- **Energy Efficient Mortgages**. There was only one distinct segment that was significantly different from the general population with respect to their interest in energy efficient mortgages -- residents who are currently renting single family homes have less interest than the typical resident.
- **Customized Energy Audits.** Generally, few specific segments of the population differed from the average resident with respect to their interest in customized energy audits. However, certain segments were more interested than others:
    - most interested: gas heat(*), single family renters, and moderate per capita income(*).
    - least interested: electric heat, multifamily owners, and high per capita income(*).

4.1.13 Delivery Preferences

The needs assessment survey also addressed preferences for delivery methods that could be used to offer the various energy efficiency services previously described (e.g., "how to" information, installation/financial assistance, customized audits). Specifically, respondents were asked to "assume" that these services were made available to Massachusetts residents, and to indicate which delivery methods they would be likely to make use of. The specific delivery methods included in this question series included: 1-800 telephone number, in-home delivery, computer access, libraries, retail stores, radio/television programming, and videos.

Exhibit 4-6 presents the results. As shown, residents appear to favor delivery of energy efficiency services through retail outlets, in-home delivery mechanisms, 1-800 telephone numbers, and general mass media programming.

Exhibit 4-6

Preferences for Various Delivery Options

Energy Efficiency Service Delivery Methods:	Percent of Population Reporting Delivery Preference:
Retail stores	69%
In-home delivery	68%
1-800 telephone number	63%
Radio/TV programming	61%
Libraries	46%
Videos	44%
Computer access	38%

Specific segments of the population who had preferences for delivery methods that were significantly different (at the 95% confidence level) than the general population as a whole are summarized below:

- **Retail Stores.** Only one segment differed significantly from the general population with respect to their interest in delivery of energy efficiency services through retail locations. Previous ECS participants(*) were more likely to report their preference for this delivery method as compared to the average resident.
- **In-Home Delivery**. Few trends were noted across different segments of the population, except that single family renters(*) preferred this delivery method much more frequently than the average resident.
- **1-800 Telephone Number.** A wide variety of segments preferred this delivery method more frequently than the average resident. These include: electric heat, multifamily renters, single family owners(*), low per capita income(*), and previous ECS participants(*).
- **Radio/Television Programming.** There was a clear and significant trend across household per capita income levels in that as income levels increased, interest in this delivery method decreased. Residents using oil heat were least likely to report this as a preferred delivery method, whereas residents using "other" fuels (e.g., propane, wood, etc.) were most likely to prefer this method. Previous ECS participants(*) preferred this option more frequently than the average resident.
- **Libraries.** There was similar trend across household per capita income levels with respect to interest in this delivery method. As household income levels(*)

increase, interest in this option decreases. Although not significant, electric heat customers preferred this option less than the average resident, and customers using "other" fuels (e.g., propane, wood) preferred this option the most.

- **Videos.** Again, as household incomes(*) increase, interest in video delivery options decreases. Single family renters(*) were also more likely to prefer these methods as compared to the average resident, as were customers using "other" fuels.
- **Computer Access.** The trend in income reverses for this delivery method. That is, as household per capita income levels(*) increase, interest in this method increases. In addition, gas heating customers(*) prefer this method more often than the average resident.

4.1.14 Preferences for Energy Efficiency Service Providers and Overseers

Preferences for specific delivery agents, as well as roles for the state and other entities, were also explored through the needs assessment survey. Specifically, three issues were discussed: (1) preferences for delivery agents, (2) whether or not the state should be involved in ensuring that energy efficiency information and services are available to Massachusetts residents, and (3) whether or not utilities should be required to provide energy audits to Massachusetts residents.

Keeping in mind the somewhat leading nature of these questions, as well as the limited knowledge among the general population of potential delivery agents in the "future" (i.e., post-restructuring), the results of these questions are summarized below:

- **Preferences for Providers.** When specifically asked "who" they thought should be the provider of these energy efficiency services, over half (55%) indicated that utilities or their representatives should provide these types of services. Another 20% reported that independent energy service companies (ESCOs) should provide these services, and 19% felt state agencies should provide these services. Finally, 11% indicated that fuel oil companies should provide these services, and 3% said other entities (e.g., landlords/property owners, the federal government, manufacturers, etc.) should be involved in providing these services. (Respondents were allowed to provide more than one response and, as a result, these percentages add to more than 100%.)

  A few segments of the population differed from the average with respect to their preferences for providers:

  - **Utility and Representatives.** The following segments felt the most strongly that utilities and their representatives should provide these services: gas heat(*), "other" heating fuels, multifamily owners, and moderate-to-high income(*). Respondents using oil heat(*) and low-income households(*) were the least likely to prefer utilities/representatives as delivery agents.

- **State.** Only the highest income category(*) differed significantly from the average with respect to their interest in state-provided services; this group had a greater preference than the average. Other (insignificant) trends include: electric heat customers and multifamily renters preferring state oversight more likely than the average resident, and those using "other" fuels to heat their homes preferring state oversight less frequently than the average.
- **ESCOs.** As household income levels rise, interest in services delivered by ESCOs increased significantly. Although not significant, respondents heating their homes with electricity and "other" fuels were more likely than the average respondent to prefer ESCO-delivered services. Finally, gas heating customers(*) were least likely to prefer ESCO-delivered services.
- **Oil Companies.** While very few preferred services delivered by oil companies overall, gas heating customers(*) were the least likely to report this preference (7%), whereas oil heating customers(*) and electric heating customers(*) were more likely (12% and 14%, respectively).

- **Role for State.** Again, when specifically asked, exactly three quarters of all residents (75%) reported that they felt the state government should be involved in some way to ensure that energy efficiency information and services are made available to Massachusetts residents. There were no significant differences across different segments of the population with respect to their interest in state oversight.
- **Role for Utilities.** Similarly, when specifically asked, 78% indicated that gas and electric utilities should be required to provide energy audits to Massachusetts residents. The following segments felt less strongly than the average resident that utilities should be required to provide energy audits: single family home owners(*), higher income households(*), and current nonparticipants(*).

4.1.15 Awareness of and Preferences for Energy Efficiency Charges/Credits

Respondents were asked a number of questions during the needs assessment survey which were designed to gain an understanding of their awareness of and preferences for energy efficiency "charges" and "credits". Generally, few respondents (28% of 595) were aware (before the survey) that they are currently being charged a small monthly fee to cover the cost of energy efficiency programs[6]. Additional findings from the survey shed some light on the views of Massachusetts residents with respect to program funding mechanisms. These findings are presented in Exhibit 4-7 and summarized below.

[6] This question was virtually the last question in the telephone survey (although before household demographic questions). Therefore, respondents' answers regarding preferences for "energy efficiency charges" was not biased based on the fact that most of the respondents indicated that they had learned for the first time, through the survey, that they are currently being charged small monthly fees for energy efficiency programs.

When initially asked, a significant portion of the population (52%) reported that they are opposed to the "concept" of monthly surcharges on electric and gas bills to cover any portion of energy efficiency program cost. However, the remaining 48% are not opposed to this concept. In fact, 23% of the general population feel surcharges covering part of the costs are appropriate and another 23% are supportive of surcharges which cover the full costs. (Previous participants are only slightly more likely to advocate surcharges of any kind as compared to nonparticipants.)

Exhibit 4-7

Opinions on Program Funding Mechanisms

	Overall	**Participants**	**Nonparticipants**
Opinions on the "Concept" of Monthly Surcharges:			
Surcharges on electric & gas bills to cover **full costs**	23%	23%	24%
Surcharges on electric & gas bills to cover **partial costs**	25%	30%	21%
No surcharges	52%	47%	55%
Base	566	231	335
"Willingness to Pay" by Surcharge Amount [1]:			
$0.00	23%	20%	26%
Greater than $0, but less than $0.20/month [2]	5%	6%	4%
$0.20/month	17%	20%	14%
$1.00/month	23%	22%	24%
$2.00/month	33%	33%	33%
Average "Dollar Value" of Monthly Surcharge	*$0.91*	*$0.91*	*$0.92*

Base	568	231	337

[1] The base for this data is all respondents, regardless of their opinions on the "concept" of surcharges.

[2] Due to limitations in the survey length, respondents were given only three choices with respect to the amount they would be willing to pay (i.e., $0.20, $1.00, and $2.00 per month). To compute the average across the population, those respondents indicated they would be willing to pay something (i.e., greater than $0.00 but less than $0.20) were assumed to be willing to pay at least $0.01. Therefore, the average amount of the surcharge respondents would be willing to pay could be slightly higher than $0.91, but not less.

It should be noted that, although about half of the general population indicated through the survey that they do not advocate surcharges, 67% of this group of residents reported elsewhere in the survey that they feel the state should be involved in ensuring that energy efficiency information and services are made available to all Massachusetts residents.

In addition, some of these respondents (despite the fact that they reported being opposed to surcharges) indicated that they would be "willing to pay" through surcharge mechanisms. At first glance this appears somewhat inconsistent. However, it is likely that these respondents may have reacted negatively - at least initially - to the "concept" of being charged. But then, when asked if they would be willing to pay $0.20, $1.00, or $2.00 per month, these respondents offered specific surcharge amounts that they would be willing to pay.

Therefore, it can be concluded that a much larger proportion of the general population (i.e., 77%, as opposed to the 48% reported above) is likely to be (a) in support of the "concept" of monthly surcharges and (b) willing to contribute some amount of money via monthly surcharges to fund energy efficiency programs.

Again, looking across the general population, the average surcharge respondents would be willing to pay is $0.91/month. This average takes into account the issues discussed above (i.e., some respondents do not support the "concept" of charges, but indicated they would be willing to pay some small amount). However, this average does not take into account the limitations in the survey interview length, which resulted in respondents being given only three choices with respect to the amount they would be willing to pay (i.e., $0.20, $1.00, and $2.00 per month). To compute the average, those respondents who indicated they would be willing to pay something (i.e., greater than $0.00 but less than $0.20) were assumed to be willing to pay at least $0.01. Therefore, the average amount of the surcharge respondents would be willing to pay could be slightly higher than $0.91, but not less.

Finally, in a separate question, respondents were asked how they felt about "tax credits" for residents who make energy efficiency improvements to their homes. The overwhelming majority of respondents (81%) felt a tax credit to cover the costs of installing energy conservation measures would be appropriate.

4.2 ECS Participant Profile vs. General Population

As mentioned above, 41% of the general population reported that they participated in the ECS program since 1980. This section profiles important characteristics of these participants in comparison to the general population as a whole. As such, we can develop an understanding of the status of the energy efficiency awareness and needs among participants relative to the general population. It would appear that, generally, the participant population does not differ significantly from the general population with respect to a number of issues related to energy awareness, perceptions and interests. For example:

- Participants tend to perceive their homes to be "extremely energy efficient" about as likely as the average resident (17% v. 15%).
- Participants are "extremely concerned" about energy efficiency in their everyday life about as frequently as the average resident (41% v. 39%).
- Participants are just as likely to agree with the following statements as the average resident:
    - I understand how energy is used...
    - I know where to purchase measures...
    - I can self-install measures...
    - I am interested in learning more about energy efficiency...
    - I think more can be done...
    - I believe in the importance of energy efficiency...
- Participants are just as likely to perceive their homes to be energy efficient, due to the presence of:
    - adequate levels of insulation
    - energy efficient windows
    - efficient heating systems
- However, participants are somewhat more likely have energy efficient lighting installed, as compared to the general population.

4.3 Segmentation Results

The needs assessment survey was used to assess the extent to which there is remaining need for and interest in energy efficiency services among residents of the state, as well as within specific segments of the population. The results of this segmentation analysis[7] suggest that future programs should incorporate more targeted marketing efforts to attract participation from two distinct segments of the residential population.

[7] Details on the two-stage segmentation analysis completed as part of this evaluation can be found in Volume III. More detailed results from the analysis are presented in Volume II, Chapter 4: Needs Assessment.

The first group was identified as "those with the greatest need and interest in assistance" for improving the energy efficiency of their homes. We have named this group *"Help Wanted (and Needed)"*, and it is generally concluded that this group may represent an appropriate target for the current program. However, certain characteristics of this group may preclude cost-effective delivery of the current package of ECS services to this group (see discussion below).

The second group was categorized as those who may or may not have the "greatest need", but have otherwise shown significant interest in assistance to help them improve the energy efficiency of their homes. This group could be targeted with new, specialized services that can address their somewhat different needs in the most cost-effective manner. The characterization of this group, as well as a discussion of the services they are most interested in, was presented above in Section 4.1, Key Findings (see Sections 4.1.7 through 4.1.15 for findings regarding segments of the general population who are most interested in, and in need of, specialized services and delivery options).

The remainder of this section identifies important characteristics of the first target group, "Help Wanted (and Needed)". First, Exhibit 4-8 compares some of the demographic characteristics of this target group.

Exhibit 4-8

Selected Demographic Characteristics of the

"Help Wanted (and Needed)" Target Group

	Target Group: "Help Wanted (and Needed)" (n=209)	**General Population (n=597)**
Housing Stock/Ownership:		

SF Owners		
SF Renters	56%	72%
MF Owners	30%	18%
MF Renters	4%	3%
	10%	7%
Average Number of Years of Residency in:		
Current home	11	14
Massachusetts	32	36
Average Age of Home:	55	50
Space Heating Fuel Type:		
Oil	44%	46%
Gas	39%	39%
Electric	12%	11%
Other	5%	4%
Average Annual Per Capita Household Income [1]:		
<$11,000	25%	20%
$11,000 to < $18,000	23%	24%
$18,000 to < $30,000	29%	31%
$30,000 +	23%	25%
Average Annual Household Income:	$54,000	$55,000
[1] "Per capita" income was derived from responses to two questions in the needs assessment survey: (1) number of household occupants, and (2) annual household income in 1995 before taxes and after		

deductions. Annual household income was recorded in ranges, and the mid-point of each range was used to calculate the average annual household income level and the average per capita income level.

As shown:

- **Housing Stock/Ownership:** While still predominantly single family homeowners, there is a higher than average percentage of **single family renters and multifamily renters** in the target segment.
- **Length of Residency and Age of Home:** While this group would not be characterized as "new to the state", their **residency in Massachusetts is somewhat shorter** than the total population, as is **occupancy in their current residence.** Additionally, their homes are somewhat older than that reported by the total population.
- **Space Heating Fuel Type:** Generally, the space heating fuel characteristics of this group do not differ significantly from the general population. However, when one looks only at **Massachusetts residents who use electricity for space heating, nearly half are represented in this group**[8]. This may suggest that efforts to target the "Help Wanted (and Needed)" segment with future programs may result in serving a significant portion of the electric heat market. However, since the electric heat market is so small in comparison to other fuel markets, special design considerations to focus on the specific needs of electric heating customers may not be appropriate.

[8] In the general population sample, a total of 62 respondents reported using electricity for space heating. Of these, 44% are in the target group, whereas the target group represents only 37% of the total sample. This indicates that residents using electricity for space heating are more significantly represented in the target group as compared to other segments of the population.

- **Household Income.** While the average household income of members of the target group (as reported by respondents) does not significantly differ from the average income among the general population, there is one notable difference when comparing per capita[9] income. That is, **households reporting less than $11,000/year in per capita income** are somewhat more likely to be represented in this group as compared to the general population. Again, this may suggest that efforts to target the "Help Wanted (and Needed)" segment with future programs may result in greater participation from low-income households. While the low-income sector represents a larger portion of the total target segment (as did the electric heat sector), it is not clear whether the current package of ECS services could be cost-effectively targeted to low-income residents because of the lack of financial assistance available to participants to encourage measure installations.

[9] "Per capita" income was derived from responses to two questions in the needs assessment survey: (1) number of household occupants, and (2) annual household income in 1995 before taxes and after

deductions. Annual household income was recorded in ranges, and the mid-point of each range was used to calculate the average annual household income level and the average per capita income level.

Finally, there are a number of other distinguishing characteristics within the target group that shed light on some of the key design and delivery options that might be more or less appropriate for this group, as compared to the total population. For example:

- **Energy Efficiency Needs.** Generally, this group perceives their homes to be somewhat less efficient than the general population in the following areas: (1) their heating systems are believed to be far less efficient, (2) they do not normally use programmable thermostats, (3) their attics/ceilings are not insulated at all or at least not adequately, and (4) they do not have energy efficient windows. In addition, this group identified specific measures that could be installed to improve their homes' energy efficiency far more frequently than any other group.
- **Barriers to Measure Implementation.** In addition to the barriers of lack of time and money, a higher percentage of respondents from this group (as compared to the total population) noted that they are renters or their landlords would not allow them to install energy efficiency measures.
- **Interest in and Willingness to Pay for Audit.** A higher percentage of respondents from this group were interested in and willing to pay for audit services (e.g., $30-$60). This group is slightly less likely than the average respondent to be aware that they are currently being charged for these services.
- **Likelihood of Using Services.** This group is more interested than the general population in: (1) assistance in finding and contracting with reliable service providers, (2) financial assistance, (3) favorable mortgages, and (4) customized energy audits.
- **Preferences for Delivery Approaches.** Generally, this group does not differ from the general population in terms of their preferences for specific delivery approaches (e.g., 1-800#, computer access, libraries, retail stores), except that they have a greater preference for in-home delivery of audit services.
- **Participation in and Awareness of ECS Program.** Respondents in this group have participated in the ECS program less frequently than the overall average for the total population. In addition, among nonparticipants, respondents in this group were generally less aware of the availability of audits than the general population of nonparticipants.

Volume 2, Chapter 5 - Technical Assessment of ECS Audits

5.1 Introduction

This chapter summarizes the results of the technical assessment of the ECS audit. This review was primarily completed by Energy Research Group, Inc. (ERG), under subcontract to Hagler Bailly. In reviewing the status of the ECS auditing tools and ECS auditing tool validation procedures, ERG's role was to assess whether the current ECS procedures utilize state-of-the-art:

- energy-saving technologies, and
- procedures to review and approve new audit tools or enhancements to approved audit tools.

To address the first objective, a review of the ECS program measures required by Regulations CMR 4.00 and 5.00 was conducted to determine whether they are currently valid and technically state-of-the-art. In conducting the review, ERG evaluated material specifications and installation standards, and conducted literature research on new energy efficient technologies. A set of recommendations has been developed for improving the technical validity and status of the ECS Program measures.

To address the second objective, recommendations have been formulated for developing a process and set of procedures through which to review new audit tools and/or enhancements to existing tools. These recommendations have been built upon a review of the current regulations, as well as the results of ERG's technical review of current measures/tools.

The remaining sections of this chapter discuss the results of these activities. Section 5.2 analyzes the appropriateness of the current measures, and Section 5.3 identifies some guidelines for validating proposed new audit procedures.

5.2 Are the Required ECS Measures Currently Valid and Technically State-Of-The-Art?

To answer this question, ERG conducted a review of the ECS program measures that are required by regulation to determine whether they are currently valid and technically state-of-the-art. Drawing upon available technology literature from the Electric Power Research Institute (EPRI), Department of Energy (DOE), National Laboratories and other sources, as well as ERG's energy conservation technology expertise and its knowledge of other residential conservation programs in Massachusetts, each measure was assessed in terms of its validity given current state-of-the-art. The following sections discuss the results of this assessment.

5.2.1 Status of ECS Required Measures

For the most part, almost all of the required measures were found to be standard, tried and true energy efficient technologies and therefore, should remain ECS program measures. A few measures were categorized as standard, but having limited applicability. A few were identified to be "not current" or out-of-date given current marketplace conditions (based on current equipment designs and efficiencies, energy savings practices, equipment and installation costs, available measure alternatives, and infrastructure practices). Some were categorized as "progressive," or advanced in that they are technically more complex than standard measures and typically require greater expertise and technical knowledge to assess their energy savings potential. A summary of the status of all required ECS measures is presented in Exhibits 5-1 and 5-2 and discussed in the sections that follow.

Standard Measures

In the Residential 1-4 Program, the following measures were categorized as being "standard" in that they are typical energy conservation measures proven by the industry to have energy conservation properties and are common to most utility and state energy conservation programs: caulking; clock thermostats; furnace efficiency measures; insulation; replacement air conditioning systems; storm and thermal windows and doors; and weatherstripping.

In the Multi-Family Program, standard measures were identified to be: replacement air conditioning systems; automatic energy control systems; caulking; domestic hot water system modifications; thermostatic control devices; replacement burners; furnaces and boilers; distribution system modifications; insulation; lighting; weatherstripping; window and door system modifications; and high efficiency motors.

Exhibit 5-1

Status of ECS Program Measures - Residential 1-4 Family

Measure	Status
Caulking	Standard
Clock Thermostat	Standard
Domestic Hot Water Indirect-Fired Tank	Standard/Progressive
Electrical Load Management Devices	Not Current(1)
Furnace Efficiency Measures	

Replacement Furnace, Boiler, or Heat Pump	Standard
Furnace Replacement Burner	Standard
Vent Damper	Standard - Although Not Often
Modulating Aquastat	Standard - Mostly Multi-Family
Heat Reflective and Heat Absorbing Window or Door Material	Not Current[2]
Insulation	
Ceiling	Standard
Duct	Standard
Floor	Standard
Pipe	Standard
Wall	Standard
Water Heater	Standard
Replacement Central Air Conditioner (Same Fuel Type)	Standard
Storm Door	Standard
Storm Window	Standard
Thermal Door	Standard
Thermal Window	Standard
Weatherstripping	Standard
Window Heat Gain/Loss Retardants	Progressive

[1] A DSM measure is typically promoted by utilities to improve load factor, or shift energy usage to off-peak periods. Typically does not reduce overall energy usage. Economics dependent upon utility off-peak rates.

[(2)] Typically not applied to the residential 1-4 market, as confirmed through program vendor discussions. Adhesive films are more commonly applied to commercial buildings with high solar heat gain.

Exhibit 5-2

Status of ECS Program Measures - Multifamily

Measure	Status
Central Air Conditioner Replacement (Same Fuel) Central Air Conditioner Replacement (Different Fuel)	Standard Standard - Although Just Recently Being Considered
Automatic Energy Control System	Standard
Caulking	Standard
Domestic Hot Water System Modifications Replacement Domestic Hot Water Unit (Same Fuel) Replacement Domestic Hot Water Unit (Different Fuel) Clock Timer Point-Of-Use Water Heater (Different Fuel)	 Standard Standard Standard Standard
Energy Recovery System	Progressive
Furnace, Boiler or Utility Plant Modifications	Often Recommended,

Intermittent Pilot Ignition Device	Seldom Performed
Vent Damper	Standard - Although Not Often
Thermostatic Control Devices	Standard
Replacement Burner (Gas)	Not Current[1]
Replacement Burner (Oil)	Standard
Replacement Furnace, Boiler, or Heat Pump (Same Fuel)	Standard
Replacement Furnace, Boiler, or Heat Pump (Different Fuel)	Standard
Distribution System Modifications	
Glazing Heat Gain/Loss Retardants	Progressive
Insulation	
Ceiling	Standard
Duct	Standard
Floor	Standard
Pipe	Standard
Wall	Standard
Water Heater	Standard
Lighting Systems Replacement or Modification	Standard

Passive and Active Solar Space Heating and Cooling Systems	Progressive
Solar Domestic Hot Water Systems	Progressive
Weather Stripping	Standard
Window and Door System Modifications Storm Window Thermal Window Storm or Thermal Door	 Standard Standard Standard
Economizers	Seldom Recommended
Turbulators	Standard - Although Not Often
Modulating Aquastat	Standard
High-Efficiency Motors	Standard
[(1)] New gas-powered burners tend to not have much higher efficiencies than older units. Not much motivation to replace since there is little savings potential.	

Standard Measures with Limited Applicability

Some measures were identified to be seldom encountered due to their limited applicability, but have valid conservation potential. These included: economizers (limited application because central cooling in multifamily buildings is usually not by forced warm air); turbulators (fire tube boilers are not often found in multi-family buildings); vent dampers (most newer heating systems have a vent damper in place). Intermittent pilot ignition is often encountered, but seldom performed due to market barriers (as many systems no longer have pilot lights, this measure will continue to be recommended less frequently). While having limited market applicability, these measures should remain valid at least in the near-term.

Progressive

A few measures were found to be "progressive," or advanced. These included: energy recovery systems (MF); window heat gain/loss retardants (1-4, MF); indirect-fired hot water tanks (1-4) (when boiler water temperature and burner nozzle size are reduced or when coupled with a low water volume or post-purging boiler); and passive and active

solar heating, cooling and water heating systems (MF). These measures require greater technical expertise in determining their applicability and calculations of energy savings.

Not Current

Only a few measures were found to be out-dated or not current. These included: electrical load management devices (1-4) (typically utility promoted and auditors are not addressing as part of ECS); heat reflective and heat absorbing window/door material (1-4) (using film adhesives is not common or popular in the residential 1-4 market); and replacement burners - gas (MF), as new gas-powered burners tend not to be much more efficient than older ones.

5.2.2 Matrix Comparing Required ECS Measures

As a means of assessing the current validity and status of required ECS measures, a detailed matrix was prepared rating the relative energy savings potential of each measure (negligible, minimal, moderate, significant), market barriers to installation (cost, replacement versus retrofit situations), and its status as a conservation measure (not current, standard, progressive). This matrix also provides, for information purposes only, some examples of new or emerging technologies within the measure categories.[1]

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[1] ERG did not attempt to catalog and compare all possible new and emerging technologies in this matrix. Technologies described in this report as "new and emerging" are provided for information purposes only and do not represent the entire inventory of not-yet-commercially available but potentially appropriate technologies for the residential sector.

In addition, ERG conducted a cursory review of the ECS audit technical criteria for required ECS measures. This information was obtained from:

- Demonstration Material Installation Specifications and Bulk Purchase Materials Specifications provided by Mass Save, Bay State Gas Company and Peabody Municipal Light Plant; and
- ECS Installation Standards for Residential Energy Conservation Measures;

The insights gained from this limited study have been used to assist in developing this matrix and complete the assessment of the technical validity and status of current ECS measures. In summary, this matrix, contained at the end of this chapter in Exhibit 5-6, is designed to be used as a tool to effectively evaluate and compare the value of each measure. Provided below is a summary of information contained in the matrix.

Measure Descriptions

Descriptions for each measure contained in the matrix were derived from CMR 225 Section 4.02 and/or 5.02 of the Energy Conservation Service Program, augmented with clarifications where needed.

Energy Savings Potential

For most measures, a range is provided, particularly for the more complex Multifamily measures that require specific case-by-case analysis. Justification for the ranges are provided where warranted.

Market Barriers to Installation

Barriers to installing each measure were noted. Typical barriers included high cost, lack of contractor awareness, lack of participant interest or motivation, or lack of applicability. These barriers, derived from ERG audit experience, informal discussions with vendor auditors, and Electric Power Research Institute conservation measure literature, provide an indication of how likely a program participant would be to install the measure with or without the program.

Status as Conservation Measure

As discussed above in Section 5.2.1, almost all of the required ECS measures were found to be standard energy efficient technologies. This section of the matrix identifies the "status" of each measure as shown above in Exhibits 5-1 and 5-2.

New or Emerging Technologies

Examples of new or emerging technologies in each measures category, if applicable, were noted for informational purposes.[2] This information was obtained through literature searches of information available from the Electric Power Research Institute (EPRI), the Department of Energy (DOE), the National Laboratories, and other sources such as the Alliance to Save Energy and the American Council for an Energy-Efficient Economy. In addition, these technologies were identified through informal discussions with program vendors and based on ERG's residential auditing expertise.

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[2] See footnote 1.

5.2.3 Recommendations

Significant modifications to the measures do not appear to be needed. However, summarized below are recommendations that would improve the technical validity of the ECS Program measures.

Recommended Measures to be Added/Modified

While the current list of required ECS measures is generally regarded as technically valid, some modifications to existing measures are recommended. In addition,

recommendations for some additional measures appear warranted. These recommendations are presented in Exhibit 5-3 and summarized briefly below.

Exhibit 5-3

Recommended Measures (or Changes) to be Added to ECS Program

Measure	1-4	Multifamily	Description
High-Efficiency Heating System	**X**	**X**	The present replacement heating system specifications need to be clearly defined - the assumption seems to be that the new unit should have an AFUE of ~ 80%. High-efficiency heating systems should be defined as units with AFUEs over 90% (condensing units) or low mass and/or post-purging (i.e., not temperature maintaining) hot water boilers. Thus, a comparison of the two replacements can be made. Similar efficiency clarification for heat pumps should be made as well.
Replacement Water Heater	**X**	**X**	There are many possible configurations as follows: <u>Present Condition Recommendation</u> Tankless Coil Direct-Fired High-Efficiency Direct-Fired Indirect-Fired Instantaneous Since this analysis has many different options, it is a bit complex. Recommendations for effective efficiency improvements for domestic water

			heating have not been thorough in the past and this should be corrected.
Weatherization Measures	**X**		The use of blower-door directed air sealing techniques and measures has been successfully offered via utility DSM programs. Its feasibility for inclusion within ECS should be given adequate consideration and, if warranted, should be added to the residential 1-4 list of measures.
High-Efficiency Appliances	**X**	**X**	High-efficiency appliances such as refrigerators and washing machines could be added. For refrigerator replacement, default values based on age and type can be used for existing consumption. Possibly a couple of options for the replacement unit could be used - average current efficiency versus most efficient unit readily available - either way, assumptions should be clearly spelled out so the homeowner can compare the audit data to what is in the marketplace.
Compact Fluorescent Lighting	**X**		Appropriate for high usage lighting in any residential application such as lights on timers or outdoor lighting. Analysis is fairly simple using hours of use and wattage displaced.
Swimming Pool Covers		**X**	Though swimming pools are not frequently found in Multifamily settings, this is a very cost effective measure for situations

			where: no cover is present; the pool is not used for several hours per day; and the cover can be operated on a reliable schedule.
Heat Recovery Ventilation		**X**	Also seldom appropriate, but very cost effective where continuous ventilation is occurring, such as in a pool area.

- **Replacement heating system (1-4, and MF).** A clear definition of replacement heating system specifications is required. For example, the general assumption that new, energy efficient units should have an AFUE of ~80% may not be technically valid.
- **Replacement water heater (1-4, and MF).** A more thorough assessment of the multiple options and possible configurations for replacement water heating should be provided.
- **Weatherization measures (1-4).** Blower door testing for leak detection and air sealing measures are offered by many utility DSM programs. The feasibility of formally incorporating these procedures and measures into ECS should be assessed.[3]
- **Efficient appliances (1-4, and MF).** High-efficiency appliances, such as refrigerators and washing machines, could be added so customers can compare the audit data to what is currently (and becoming more widely available) in the marketplace.
- **Compact fluorescent lighting (1-4).** This measure is appropriate for high-usage lighting in any residential application, and analysis would be fairly simple to incorporate into the audit process (e.g., using hours of use and wattage displaced).
- **Swimming pool covers and heat recovery ventilation (MF).** Although these measures have limited applicability, they are typically cost-effective in multifamily situations (e.g., where swimming pools are not used for several hours per day and can be operated on reliable schedules, where continuous ventilation is occurring as in pool areas and recreational facilities).

[3] This measure was also recommended for similar reasons by several program "stakeholders" (e.g., utility staff, vendors) who were formally interviewed as part of this evaluation.

Potential Future Measures to be Considered for Addition to ECS Program

A number of measures could potentially be integrated into ECS, as discussed above (e.g., blower-door directed air sealing, compact fluorescent lighting, efficient appliances, and multifamily swimming pool covers and heat recovery ventilation). In addition, ERG has identified a number of new and emerging energy efficiency technologies that could be added to the ECS Program.

Summarized below and presented in Exhibit 5-4 is a listing of potential products that have either recently become available (and currently have limited residential market penetration) or are under development and will become available over the next few years:

- **Lighting Products:** smaller compact fluorescent lamps, dimmable compact fluorescent lamps, and compact fluorescent lamp fixtures.
- **Windows:** double-paned, low-e, argon-filled windows with foam-filled vinyl frames; windows with electrochromic glazings, and "superwidows."
- **Insulation:** "Super Batts," higher R-value fiberglass insulation for walls and ceiling joists.
- **Controls:** newer programmable thermostats for baseboard heating systems and electric water heaters; and unified temperature and indoor air quality control.
- **Duct Sealing:** "Aerosol Duct Sealer," a new process that pressurizes ducts and sprays in an aerosol sealer.
- **Appliances:** Super Efficient Refrigerator (SERP); and horizontal axis washing machines.

In addition, advanced electric heat pumps (air-, water-, and ground-source), gas-fired heat pumps, and heat pump water heaters could be formally added to future programs. These measures, however, tend to high cost barriers, may have low to moderate market applicability, and are perhaps most appropriate for new construction applications. In addition, the expense required to upgrade existing and future audit tools, procedures and training programs to include these measures in the program may not be justified.

Regulatory Considerations

It should be noted that the implementation of the recommendations discussed above, such as adding, dropping or modifying ECS measures, would require DOER to undertake regulatory change.

Exhibit 5-4

Potential New Residential Energy Efficiency Products

Category	Product	Description	Availability	Information Sources
Lighting	Dimmable Compact Fluorescent Lamps	Control units that allow CFLs to be dimmed.	Currently in use in commercial sector but limited residential application to date.	RAM Sylvania (800) 842-7010 Phillips

	CFL Fixtures	Fixtures actually designed for compact fluorescent lamps.	Commercially available but in limited residential use.	Lighting (800) PLC-BULB General Electric (800) GE-LIGHT
Windows	Windows with electrochromic glazings Superwindows	Windows that can change color and light transmission qualities when a small electrical charge is passed through them. Windows that use various methods to decrease heat loss, including multiple panes, multiple selected coatings, inert gas such as argon between panes, and improved frames and edge seals.	Approaching commercialization within the next year or two. Some models commercially available (with U-factor of .15 to .20). The next generation is expected to improve glazing, frame and edge efficiencies.	National Fenestration Rating Council (301) 589-6372
Insulation	"Super Batts," higher R-value fiberglass insulation	This insulation provides R-15 (versus the traditional R-11) in 2 x 4 wall construction or R-38 in 10-inch ceiling joists.	Currently available, but not in widespread use.	North American Insulation Manufacturers Association (703) 684-0084
Controls	Programmable thermostats for baseboard heating systems and electric water heaters (timers with up to four on-off cycles to tailor water heater operation to	These thermostats are better at maintaining even temperatures and ease of use.	Currently available, but not in widespread use.	Honeywell, Inc., Home and Building Division (612) 954-6081

	household needs) Unified temperature and indoor air quality control (smart house feature)	 These units which look like and perform all the functions of programmable thermostats but also control home ventilation and humidity.	 Under development	EPA's Energy Star Program (202) 233-9024
Duct Sealing	Aerosol Duct Sealer	A new process that pressurizes ducts and sprays in an aerosol sealer. As the sealer moves out of the leaky ducts, it seals the cracks and holes. This method has been found to eliminate 80 - 90% of air leakage in a typical distribution system.	Under development	Lawrence Berkeley Laboratory (510) 486-4678
Appliances	Super Efficient Refrigerator (SERP) Horizontal Axis Washing Machine	Whirlpool's SERP refrigerator is 30% more efficient than the DOE's 1993 energy efficiency standard for refrigerators and uses no CFCs. These models save energy by minimizing the amount of water, detergent and other laundry products needed. Clothes instead of being constantly immersed in water, circulate through a smaller amount of water (less energy is also required for drying) (widely used in Europe).	Available in some markets Available in limited markets	Whirlpool (800) 253-1301 Frigidaire, Lawrence Berkeley Laboratory (510) 486-4678

Sources:

"New Generation of Efficiency Products Coming to a Store Near You," Alliance to Save Energy Update, Summer 1995.

"Emerging Technologies to Improve Energy Efficiency in the Residential and Commercial Sectors," American Council For an Energy Efficient Economy, February 1993.

5.3 Defining a Process for Reviewing Proposed New Audit Tools and Program Enhancements

In addition to reviewing the ECS program measures and educational approach, ERG was asked to define an efficient and valid process for reviewing proposed program enhancements. Before this process can be addressed, however, it is necessary to recognize an important "first step" which is needed to facilitate the redefinition of the current review process. In the following sections, we have outlined an appropriate path to be taken to (1) complete the evaluation of audit tools and measure validity, and (2) develop a process for reviewing proposed changes to the audit tools.

5.3.1 Further Evaluate the Need for Standardization/Consistency Across Current Audit Tools

Although a complete and thorough assessment of the methods, algorithms and assumptions incorporated into the different audit tools was beyond the scope of this project, it is apparent that such a review is required in order to fully ascertain the current technical status of the ECS audit process. There was some, yet not widespread, disagreement among the vendors interviewed (as well as some of the other stakeholders) regarding: (a) which measures were formally included within ECS, and (b) which measures were deemed inappropriate for residential 1-4 and/or multifamily applications (and, hence, seldom used). For example, a number of stakeholders offered suggestions for including measures that were already included (at least in some way, i.e., heat pumps), and others recommended deleting/modifying certain measures because "they are seldom recommended" or "often over-ridden by the auditor" as inappropriate for the customers' situation.

In addition, based on ERG's review and Hagler Bailly's interviews with different program stakeholders (e.g., utility staff, vendors), different algorithm assumptions and/or energy saving methodologies are being used in the three audit tools for many of the measures. For example, to calculate energy savings resulting from a clock thermostat installation, one audit tool assumes a 10% savings of the space heating portion of the annual fuel bill. Another audit tool calculates savings by assessing the number of degrees of and number of hours of temperature setback. In addition, efficiency specifications or guidelines for major end-use measures such as air conditioning, space heating and water heating vary and there does not appear to be any ECS "standard" efficiency level for replacement measures.

While these findings lend support for increased standardization of assumptions and methodologies across audit tools, this recommendation should be interpreted with some caution for a number of reasons. "Standardization" of assumptions and methodologies in this sense refers to making consistent certain key elements of the audit process (e.g., "high efficiency" equipment specifications, calculational methodologies and algorithms, etc.). It does not necessarily imply that increased "standardization" of inputs and values is required beyond what is currently being implemented. For example, attempts should be made to maintain as much site- or region-specific information as possible in the calculation of measure costs, savings and payback.

Given these findings, further research is needed to fully ascertain the current technical status of the ECS audit process. This research should involve the following:

- **Review and Update List of Required ECS Measures**. In light of the recommendations for changes to the list of required ECS measures presented above, meetings with relevant parties and stakeholders should be held to review each measure and gain consensus on current validity for both residential 1-4 and multifamily applications. The required ECS measure list should be updated based on the results of these meetings.
- **Review and Make Consistent ECS Audit Technical Criteria**. The energy saving algorithms, assumptions and/or measure specifications of each audit tool should be formally compared for each specific measure to evaluate the need for and extent of increased standardization and consistency. This assessment is appropriate given the lack of consolidated information on ECS technical criteria pertaining to the current audit tools. In addition, this review would be particularly useful at this stage in the program's life cycle in the sense that it would leverage the current wide degree of experience and expertise gained from delivering ECS over the past 16 years.

5.3.2 Define Process for Review of Future Program Enhancements

Current ECS regulations require utilities to submit proposed ECS audit procedures and enhancements to DOER for review, validation and approval. In addition, under the current regulations, vendors are not permitted to submit ECS audit proposals directly to DOER for review and approval. Instead, they must seek a utility "sponsor" for their proposals. While this eliminates "unbacked" proposals, it also presents significant barriers to competitive bidding for delivery of ECS audit services. Thus, regulatory change would be required to eliminate this barrier.

The approach taken by DOER in the past to review ECS audit procedures and enhancements proposed by utilities/providers included several options (each of which is in accordance with the regulations):

- The establishment of a Technical Review Committee
- Internal Assessments
- Independent Assessments

The first two approaches produced considerable delays and internal resource burdens at DOER. The third approach, which has been most recently utilized, requires that each utility/provider submit an independent assessment of the proposed changes for DOER for review and consideration. This approach shifted the resource burdens to the utility/provider in an effort to access additional technical resources and reduce the overall approval time compared to past approaches.

In light of the findings discussed in Section 5.3.1, defining a new process (or modifying existing approaches) is still somewhat pre-mature since a formal evaluation of the current

audit tools has yet to be conducted. As discussed in Section 5.3.1, this would be the logical first step to defining new procedures to assess the validity and appropriateness of new audit tools and/or program enhancements. Recommendations for defining a process and establishing criteria for review should be re-visited after a formal evaluation has been completed. In addition, substantial future program changes may impact the definition of any new audit review process and, as a result, periodic review of and adjustment to the process and technical criteria may be required.

It is important to recognize that any process of instituting and validating technical program enhancements, such as measure standardization and measure addition or deletion, is a very complex task. It is dependent upon several criteria, the most important of which include the actual types of enhancements and methodology to be proposed, and the impact on utilities, program vendors, DOER and customers. To help guide the development of a future "audit review process" the following key considerations should be used when developing criteria for reviewing ECS audit proposals:

- **Ensure Compatibility with Program Objectives.** Require that all proposals for change/enhancement are consistent with but perhaps more effective in achieving the program's objectives. Implementing this criteria, however, will require a consensus among a variety of groups (as opposed to, for example, a technical assessment of proposed measures).
- **Ensure Program Changes/Enhancements are Currently Valid.** It is important to ensure that all proposed technical enhancements have been successfully implemented in other residential programs. Again, the implementation of this criteria will require input from a variety of relevant parties/stakeholders. At a minimum, it might be necessary to identify other states/utilities that have used a similar enhancement. If experience is limited, change might be considered on a pilot basis.
- **Ensure Compatibility to Marketplace.** Proposed measures should also be assessed to determine whether they are currently compatible with industry practices in different residential market segments (e.g., residential 1 - 4, multifamily, low-income, new construction, new construction v. retrofit, etc.)
- **Ensure Cost-Effectiveness of Implementing Program Enhancements.** In light of the program's objectives, this criteria would also most likely involve consensus among different groups. It is important to consider the cost/benefit of change, taking into account any additional costs associated with both utilities/providers (e.g., including such items as new audit tool development, review/approval costs, auditor training, and associated implementation costs) and DOER (e.g., review/approval costs, implementation costs).
- **Ensure No Duplication of Effort Between ECS and Existing DSM Programs.** It will be important, as utility DSM offerings (and non-DSM offerings) change to assess the type and level of service currently being offered to identify redundancy and areas for potential coordination.
- **Ensure that Program Changes/Enhancements Are Timely.** Proposed changes/enhancements should be reviewed to determine whether or not they can be implemented within a reasonable time frame. This time frame should include,

but not be limited by, the time required to complete the review and approval process itself.

Again, once program enhancement/changes have been approved, a process for conducting periodic reviews of the measures, tools and audit processes should be required to ensure that the program stays within existing industry standards.

Exhibit 5-6

Matrix of ECS Program Measures

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

Description [1]	***Energy Savings Potential*** [2]	***Market Barriers to Installation*** [3]	***Status as Conservative Measure*** [4]	***New or Emerging Technologies*** [5]
HVAC				
Replacement Central A/C (1 - 4, 1) **Air Conditioner Replacement (same fuel) (MF, 1)**				
A central A/C which replaces an existing central A/C of the same fuel type and which reduces the amount of fuel consumed due to increased efficiency. For Multifamily buildings, replacement unit may be a rooftop packaged or split system, or a central chiller.	Minimal to Moderate. Due to the relatively low number of cooling degree days in this climate, the payback for replacing central air conditioning is usually very long (20 years or more) except under unusual circumstances.	High Cost. However, operating cost savings are sometimes sufficient to provide a reasonable payback. For MF installations, lack of space in the mechanical room and difficulty getting the equipment into the building or onto its roof are barriers to replacement.	Standard. Almost all major air conditioning manufacturers offer high-EER systems and are widely available. Although rarely are replacement A/C systems installed for energy conservation reasons alone. For MF buildings, the CFC issue has complicated matters: if a chiller upgrade is under consideration to use a new refrigerant, a useful measure could include the incremental savings and cost of a high efficiency versus a standard efficiency replacement chiller.	Some new technologies include alternative refrigerants and the equipment that uses them and some modest improvements in design and efficiency.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Air Conditioner Replacement (different fuel) (MF, 2)				
Air conditioner replacement (different fuel) means any central air conditioner which replaces an existing air conditioner of a different fuel type and which reduces the amount of energy consumed due to an increase in efficiency.	Significant potential energy and cost savings (especially cost savings by switching to a cheaper fuel purchased at an off-peak summertime rate). However, economics can be very site specific.	Fossil (gas or steam) → electric barriers include potential for negative savings and concern about safety and environmental regulations of refrigerants. Electric → fossil barriers include higher capital costs, lack of experienced maintenance technicians, potential maintenance problems due to the sensitivity of the equipment, complexity of equipment and lack of physical space for the larger equipment needed.	Standard, although the electric to fossil system switch is often influenced by CFC refrigerant issues. This measure has been considered much more in recent years.	New technologies include double-effect absorption systems (more efficient than single-effect). Gas heat pump technology may be appropriate for condo/townhouse market (one system per dwelling unit).

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Clock Thermostat **(1 - 4, 2)**				
A device which is designed to reduce energy consumption by regulating the demand on the heating or cooling system in which it is installed and uses: a temperature control device for interior spaces incorporating more than one temperature control level; and 1. a clock or other automatic mechanism for switc	Moderate to Significant. When operated properly with significant temperature setbacks of several degrees or more for several hours per day, savings of 10% or more are achievable.	Limited/Somewhat. Setback thermostats are readily available in retail and hardware stores for do-it-yourself installations. Heating contractors can and do install these devices but tend to be reluctant due to a high percentage of call backs. Lack of customer understanding of unit operation and the perception that these devices are complex limits their installation and can result in negative savings in some instances.	Standard.	New thermostats are better at maintaining temperature and are easier to use. Programmable units are now available for electric baseboard heating systems. Some of these units use room light levels and/or an occupancy sensor to determine what temperature to maintain.

hingfrom onecontrollevelto another.				

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Automatic Energy Control System **(MF, 3)**				

Automatic energy control system means devices and associated equipment which regulate the operation of heating, cooling or ventilating equipment based on time, inside and/or outside temperature or humidity or utility load management considerations in order to reduce energy demand and/or consumption.	Significant savings potential possible if facility maintenance people understand operation of unit and maintain maximum heating and minimum cooling temperatures. If building personnel have a stake in the energy savings, greater savings are more likely. Often these systems do not live up to their savings potential due to the lack of some or all of the above conditions.	High Cost. Decision to install can be discouraged by confusion over complexity of control strategy and function. Adequately trained staff.	Standard, although computer controlled EMSs are not encountered often due to the reasons cited.	Some progress towards a standard protocol for HVAC controls to allow different brands of controls to work with one another. Automatic light and/or occupancy sensing setback thermostats are sometimes installed in Multifamily buildings - these devices have only recently come on the market and are appropriate for certain applications.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

***Description*[(1)]**	***Energy Savings Potential*[(2)]**	***Market Barriers to Installation*[(3)]**	***Status as Conservative Measure*[(4)]**	***New or Emerging Technologies*[(5)]**
Replacement Furnaces				

or Boilers (1 - 4, 3) **(MF, 5, 4)**				
1 - 4 Unit: A furnace or boiler, including a heat pump, which replaces an existing furnace or boiler of the same fuel type and reduces the amount of fuel consumed due to an increase in combustion efficiency, improved heat generation or reduced heat losses. Multifamily: Replacement furnace or boiler (same fuel) means a furnace or boiler, including a heat pump, which replaces an existing furnace or boiler of the same fuel type and provides reduced fuel consumption due to higher energy efficiency of the heating system.	Moderate (sometimes significant) depending on the condition and efficiency of the existing heating system. Savings of up to 35% are achievable.	Cost can be a barrier, particularly when exacerbated by distribution system changes or asbestos removal.	Standard, although most boiler/furnace replacements are performed primarily because the old equipment has worn out; rarely are they replaced solely for the purpose of conserving energy.	High-efficiency condensing systems with AFUEs (Annual Fuel Utilization Efficiency) of 90% or more are gaining acceptance as reliable products as well as boilers with low water volumes and/or those that have post-purging cycles to effectively utilize heat in the boiler when the call for heat from the thermostat ends.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Replacement Furnaces or Boiler (different fuel) (MF)				
Replacement furnace or boiler (different fuel) means a furnace or boiler, including a heat pump, which replaces an existing furnace or boiler of a different fuel type and provides reduced fuel consumption due to higher energy efficiency of the heating system.	Moderate to Significant. (Similar to same fuel furnace/ boiler replacement.) Additional monetary savings can be very significant, depending on the end cost per Btu of existing and proposed heating fuels.	Same as previous measure.	Same as previous measure.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Furnace Burner Replacement (oil) **(1 - 4, 4) (MF, 6)**				

1 - 4 Unit: A replacement burner that achieves a reduction in oil consumption from the former burner. Multifamily: Replacement burner (oil) means a device which atomizes fuel oil, mixes it with air, and ignites the fuel-air mixture: is an integral part of an oil-fired furnace or boiler (including the combustion chamber); and which, because of its design, achieves a reduction in the oil used from the amount of oil used by the device which it replaces. Note: This measure is appropriate for either furnaces or boilers that lack efficient burners; therefore the word "furnace" should be removed.	Moderate (in most case where appropriate). Savings are limited by the fact that the entire heating system is not being upgraded, but 5 to 10% fuel savings are possible.	Limited. Although this measure can cost several hundred dollars (more for Multifamily) it is considerably cheaper than the alternative of a replacement of the entire heating system.	Standard. Since efficient flame retention head burners have been on the market for a number of years now and are the standard, if not the only product being installed today. Older less efficient burners are not seen as frequently.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Replacement Burner (gas) (MF, 7)				
Replacement burner (gas) means a device designed for installation in an existing gas-fired boiler which uses a fan and control mechanisms to supply and control combustion air to achieve an optimal fuel-to-air ratio for maximum gas combustion efficiency and which, because of its design, achieves a reduction in the gas used from the amount of gas used by the device which it replaces.	Minimal. New gas-powered burners tend to not have much higher efficiencies than older ones.	Not much motivation to replace gas burner since there is little savings potential.	Not current.	N/A.
Energy Recovery System (MF, 8)				

Energy recovery system means equipment designed primarily to recover building waste energy from sources such as refrigeration or air conditioning for some useful purpose such as heating water.	Savings vary greatly and must be analyzed on a case by case basis, but can be moderate.	Not very applicable for MF buildings. Seldom performed because heat recovery from a cooling cycle is risky to install unless the system was originally designed for it.	Progressive - in the (very) limited number of cases where this is possible/advisable.	Heat recovery ventilation (which is actually neither new or emerging) is a form of energy recovery that is seldom seen but can have an excellent energy savings where appropriate, such as when installed in a swimming pool area that needs ventilation.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

***Description*[(1)]**	***Energy Savings Potential*[(2)]**	***Market Barriers to Installation*[(3)]**	***Status as Conservative Measure*[(4)]**	***New or Emerging Technologies*[(5)]**
Economizers (MF, 9)				
A device that introduces outdoor air into an air conditioning systems ductwork when the outside air temperature is below the building's internal temperature and cooling is required (due to internal thermal gains). "Wet Side" economizing (also called chiller-bypass) uses the cooling tower to provide cooling to the building without running the chiller whenever the outdoor dew point temperature is low enough to allow it.	Reasonably good in those limited cases where it can be installed, such as the cooled common areas on the top floor of a Multifamily building. Savings difficult to predict but can be good; although more appropriate for drier climates.	Not many opportunities for this measure to be installed because central cooling in multifamily buildings is usually not by forced-air rooftop packaged units. Complicated measure to carry out so contractors tend to shy away from retrofits.	Seldom recommended (but appropriate in those cases where it is applicable). Even less frequently appropriate than the previous measure.	N/A. N/A.
Turbulators (MF, 10)				
Turbulators means a baffle device installed in a fire tube boiler which keeps hot gases in the firebox long enough to allow for maximum transfer of heat from the combustion gas to the	Moderate savings possible depending on the heating system these devices are being installed on.	Fire tube boilers are not often found in Multifamily buildings. Contractors are reluctant to install due to potential for maintenance	Could be considered not current or progressive, depending on perspective.	N/A.

water being used to provide heat, thereby increasing efficiency.		problems. Relatively inexpensive measure compared to other methods of increasing boiler efficiency (such as boiler replacement).		

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

***Description*[(1)]**	***Energy Savings Potential*[(2)]**	***Market Barriers to Installation*[(3)]**	***Status as Conservative Measure*[(4)]**	***New or Emerging Technologies*[(5)]**
Intermittent Pilot Ignition (1 - 4/MF, 11)				
Intermittent pilot ignition device (IID) means a device which, when installed in a gas-fired furnace or boiler, automatically ignites the pilot or burner and replaces a continuously burning pilot light.	Minimal.	Moderate. Modest savings for cost of installation. Also contractors are reluctant to install these devices due to their complexity of operation and potential for call backs. Since most new heating systems and other gas burning appliances no longer have pilot lights, this measure will continue to be recommended less frequently in the future (this is particularly true for 1 - 4 unit buildings). More frequently seen in Multifamily buildings than in 1 - 4	Often recommended, seldom performed due to issues mentioned.	Most new 1 - 4 unit residential heating systems and some new larger heating systems for Multifamily buildings have pilotless ignition and will tend to make this measure obsolete as they take over the market.

		unit buildings.		

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Vent Damper (1 - 4, 5) (MF, 12)				
Vent damper is an automatically operated damper installed in a gas-fired furnace that saves energy by reducing the off cycle chimney losses of the heating system and/or by reducing the loss of heated air up the flue when the burner is off. Note: The definition for vent damper in 1 - 4 unit buildings should include gas-fired boiler. In fact savings for a standard boiler installation will, in most	Minimal to Moderate. Greatest savings are had with heating systems that maintain temperature (such as a boiler with a tankless coil) and are located within the heated space of the building. Motor driven dampers tend to save more because they tend to seal the flue more effectively. Various literature indicates that savings of up to 5% are possible. Savings may be much smaller if located in an unheated space.	Moderate. Locating a technician who is certified to install a vent damper and who is interested in the task may take some effort since these add-on devices are seldom encountered in the field. Installers are leery of call backs and potential liability.	Standard, although not seen very often in the field as an add-on measure since most new heating systems have a vent damper in place or are designed such that they don't need one. Note: Vent dampers are most effective when integrated into a new heating system.	High efficiency heating systems with induced draft and condensing of flue gases are incompatible with vent dampers and will tend to make them obsolete as they take over more of the market.

cases, be greater than for installation in a gas furnace.				

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Thermostat Control Device (MF, 13)				
Thermostatic control devices means thermally activated valves and dampers which are installed to provide individual control of energy output from radiators and duct work.	Moderate to significant, especially where lots of overheating is occurring. These devices are appropriate for steam or water systems but more common with steam systems since most water systems already have electrically operated zone valves. Note: There are few, if any, thermally activated dampers for ducted heating distribution systems available on the	High cost is a barrier, especially for installation in forced water distribution systems. Piping configurations in some forced water systems can make installation too expensive, too difficult or inappropriate in some instances.	Standard and appropriate for a large percentage of the steam systems encountered.	N/A.

	market.			

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

***Description*[1]**	***Energy Savings Potential*[2]**	***Market Barriers to Installation*[3]**	***Status as Conservative Measure*[4]**	***New or Emerging Technologies*[5]**
Modulating Aquastat **(1 - 4, 6) (MF, 14)**				
A device also known as a variable aquastat that automatically monitors and correspondingly modulates the temperature to which the water in a hot water boiler is heated in relation to outside temperature resulting in reduced energy consumption.	Minimal for a modern, properly-sized boiler in a single family residence. MF: Moderate to significant, especially when overheating is a problem.	Moderate for 1 - 4 unit buildings since these devices are not encountered very often in the field. Increased complexity of heating system controls is a deterrent to the installation of these devices in 1 - 4 unit buildings. MF: Limited. These devices are more commonly found in Multifamily buildings.	Standard, although seldom seen in smaller residences due to increased complexity of boiler control, limited savings and customer ignorance about their existence. More prevalent at larger Multifamily facilities where increased savings and (often) the presence of a maintenance person justifies and assists in the successful application of this measure.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Distribution System Modifications (MF, 15)				
Distribution system modifications means modifications to an energy distribution system and associated components that increase the energy efficiency, such as: •improved flow control devices; •improved pipe or duct routing to reduce pressure drop and/or heat losses; •flow balancing mechanisms; or •point of use water heaters of the same fuel type. Note: It is unusual that point of use water heater installation of the same fuel type is considered a distribution system modification. See section entitled point of use water heaters. The same information given there applies whether or not fuel switching is involved.	Potentially significant but very site specific. The different options of the term "Distribution System Modifications" make it extremely difficult to model on a computer, since it could mean a number of changes/improvements.	Limited access to distribution system and potential high cost will limit the application of this measure in some instances; however, commonly installed measure (for comfort reasons) in many cases.	Standard.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Duct Insulation (1 - 4, 7) (MF, 16)				
Installed on heating or cooling supply and return ducts in an unconditioned area of a building.	Reduces space conditioning loads. Savings are directly proportional to the length of exposed duct and ambient air temperature differential. Moderate Saving Potential: Greater savings had with long duct runs located in colder spaces. Ducted systems are less commonly found in Multifamily buildings but savings are good when they need to be insulated.	Limited. Low-cost measure with high acceptance. Site-specific option. May be difficult to install in retrofit situations.	Standard. Recommended R values vary from R-2 to R-7 depending upon the design temperature difference between conditioned air and duct surface.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Pipe Insulation (1 - 4, 8) (MF, 17)				
Pipe insulation is installed on a heating or cooling pipe or a pipe used for domestic hot water purposes in an unconditioned area of a building. Multifamily: Pipe insulation is installed on pipes and fittings carrying hot or cold fluids for space conditioning purposes or hot water pipes and fittings with continuous recirculating systems.	Moderate. Greatest savings for higher temperature pipes (such as steam) flowing through unconditioned areas (such as a leaky crawl space).	Limited. This work is usually performed by insulation contractors, who are quite plentiful. Unfortunately, installing pipe insulation in locations where the greatest savings potential exists (such as leaky crawl spaces) can be difficult/impossible due to limited access.	Standard, although not as common as wall and ceiling insulation.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
DHW Pipe Insulation **(1 - 4/MF)**				
Installed on pipes used for domestic hot water purposes in an unconditioned building area. Note: This is not actually a separate measure but is actually a subset of pipe insulation (which includes space heating and cooling and DHW pipe insulation. See section entitled "Pipe Insulation").	Minimal (in most cases) to Moderate. For locations where there is a large volume of DHW being used, the distance from the boiler to the water heater is relatively long and/or the temperature of the water is relatively high (>140°F), savings can be moderate. Quick payback due to low measure cost. Note: Insulating the DHW pipes from where they leave a water heater that continuously maintains temperature can result in moderate to significant savings.	Limited. Most insulation contractors will install pipe insulation as part of an overall insulation package.	Standard.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Air Sealing				
Caulking (1 - 4, 9) **(MF, 18)**				
Pliable materials used to reduce the passage of air and moisture by filling small gaps which may be located: - at fixed joints on a building - under baseboards inside of building - in exterior walls at electric outlets - around pipes and wires - around dryer vents and exhaust fans in exterior walls Caulking includes, but is not limited to, materials commonly known as sealants, putty and glazing	Major sources of air leakage are attic bypasses, fireplaces without dampers, leaky ductwork, window and door frames and holes drilled in framing in framing members for plumbing, electrical and HVAC equipment. Wall pathways account for 18 - 50% of total air leakage, ceiling HVAC and fireplace paths can account for as much as 30%; windows and doors can contribute 6 - 22% and vents up to 2 - 12% of total leakage. Generally <u>moderate</u> although in older homes, air leakage can account for up to 50% of the total heat loss of the building; in these cases, savings can be <u>significant</u>.	Limited. Caulking and weather stripping are suitable for almost all retrofit applications. There are some market barriers to hiring an air sealing contractor due to the fact that there are not a lot of them in the business; however, there are increasing numbers of insulation contractors who are getting into the business.	Standard caulking and weather stripping projects are generally inexpensive and easily undertaken by homeowners. However, hiring an air sealing contractor with a blower door to systematically locate and seal leaks would be considered a <u>progressive</u> measure (and is generally much more effective than do-it-yourself work).	Under development - use of an aerosol sealing process to seal cracks and holes, eliminating 80 - 90% of air leakage in a typical distribution system. Though not available yet, this process holds considerable promise as a cost-effective measure.

compounds.				

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Weather-Stripping **(1 - 4, 10) (MF, 19)**				
Narrow strips of material placed over or in movable joints, windows and doors to reduce the passage of air and moisture. Weather stripping materials include felt, wool, rubber, fiberglass, foam and tape. These materials can fill larger cracks, providing seals between framing members and wraps to seal joints. Preformed door sweeps and threshold gaskets are used to seal the bases of exterior doors as well as retrofit edge seal kits that are used to cut and fit around doors.	Minimal due to the fact that most air leakage occurs in the basement and attic areas of the house rather than at windows and doors in the living space. An exception: tightening leaky windows and doors that generate drafts near occupied areas can increase occupant comfort such that they will lower their thermostats in some cases; in this situation, savings can be moderate or even better.	Limited. Materials are readily available and inexpensive. In addition, many insulation contractors will also perform weather stripping.	Standard.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Window/Door Measures				
Storm Window (MF, 20)				
A window or glazing material placed in addition to an ordinary or prime window creating an air space to provide greater resistance to heat flow than the prime window alone. Storm windows have an approximate R-value of 1.0 in addition to the R-value of the existing window. Multifamily: Storm window means a window or glazing material placed outside or inside a prime window, creating an insulating air space, to provide greater resistance to heat flow than the prime window alone. The definition of storm	Minimal to moderate depending on the condition of the existing window and whether or not the existing air infiltration directly effects occupant comfort.	Limited. Although not as cost effective at saving energy as many other measures, storm windows are often installed to reduce maintenance costs of the prime window, to allow for ventilation and to increase comfort.	Standard. Storm windows and doors and replacement doors and windows are generally accepted measures for saving energy and increasing comfort levels.	N/A.

window is similar for 1 - 4 unit and Multifamily buildings. The Multifamily definition includes that the storm window may be interior or exterior. The same is true for 1 - 4 unit buildings, although exterior storm windows are more commonly found there.				

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Window Heat Gain/Loss Retardants (1 - 4, 11) **(MF, 22)**				
Mechanisms which signi-ficantly reduce summer heat gain or winter heat loss through windows by use of devices such as shutters, awnings, insu-lated roll-up shades, metal or plastic solar screens, or movable rigid insulation. R values for thermal shades range from R-2 to R-5; for thermal curtains R-1 to R-2; and for thermal shutters R-4 to R-7. Solar screens typically block 50 - 70% of solar heat gain. Multifamily: Glazing heat gain/loss retardants means those fixtures such as insulated shades, drapes, movable rigid insulation, awnings, external roll-up shades, metal or fiberglass solar screening, or heat absorbing films which significantly reduce winter heat loss and heat reflective films which significantly reduce summer heat gain through windows and doors.	Moderate window treatments can reduce heating and cooling costs by 5 - 15%. Effective performance is based on diligence in adjusting for maximum benefit. Although moderate savings are possible, payback can be very long (>10 - 15 years) due to high cost of shades.	High cost for quality materials. Low customer acceptance, limited infrastructure (education, lack of utility programs, limited number of installers).	Progressive though not in widespread use, thermal shades are appropriate for specific applications, such as rooms with lots of glass area.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Heat Reflective and Heat Absorbing Window or Door Material (1 - 4, 12)				
A window or door glazing material or reflective or absorptive films and coatings, applied to an existing	Reflective films and solar screens are normally beneficial mainly in summer, therefore savings are	High cost and low savings make them not appropriate for this climate, except in very specific	Not current for 1 - 4 unit buildings, possibly appropriate for some Multifamily buildings (although not on the list	Electrochromic glazings are being developed with a multilayer coating that changes color and light transmission qualities when a small electrical charge is passed through them. Prototypes of

window or door which results in exceptional heat absorbing or heat reflecting properties. Reflective window films are available with shading coefficients ranging from 0.58 to 0.23, indicating that 42 - 77% of incident solar heat is blocked by the film.	minimal in this climate.	circumstances.	of required ECMs). May be appropriate for high-rise multi-families with much glazing.	these windows have demonstrated the ability to block 5 - 60% of light.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Storm Door (1 - 4, 13)				
A second door installed in addition to a prime door creating an insulating air space. Storm doors with single glazing add an approximate R-value of 1.0 to the existing installation. Storm doors with double glazing add about 1.9.	For a single-family house (1,500 ft2) with single-pane glass and no storm doors, typical energy savings from the installation of storm windows and doors are estimated to range from 7 to 12% of annual space conditioning energy consumption. Minimal, with a relatively long payback due to moderate cost.	Limited. Although relatively expensive for the energy savings they generate, storm doors are readily installed for a variety of other reasons, including reduced maintenance of the prime door, ventilation, and increased comfort.	Standard. Storm windows and doors and replacement doors and windows are generally accepted measures for saving energy and increasing comfort levels.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Thermal Door (1 - 4, 14)				
A door with enhanced resistance to heat flow through the glass area by affixing two or more sheets of glazing material; or a prime exterior door with an R-value of at least 10. Note: A more detailed and more inclusive (and slightly different) definition of thermal door is provided in CR225 5.02 for Multifamily buildings.	Minimal with a long payback due to high cost.	Limited. The public considers storm and replacement windows and doors significant energy saving measures despite their high cost and relatively long payback, in part due to these measures' visibility and comfort benefits.	Standard.	N/A.

Thermal Window **(1 - 4, 15) (MF, 21)**				
A window unit with improved thermal performance through the use of two or more sheets of glazing material secured to a window frame to create one or more insulated air spaces. It may also have an insulating frame and sash.	Minimal with a long payback due to high cost.	Limited. Although cost is high and paybacks tend to be long, replacement windows are one of the first measures people think of because they are highly visible and can improve comfort.	Standard.	Consumers can now buy double-paned, low-e, argon-filled windows with foam-filled vinyl frames (saving about 50% over common double-glazed windows).

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description [1]	***Energy Savings Potential*** [2]	***Market Barriers to Installation*** [3]	***Status as Conservative Measure*** [4]	***New or Emerging Technologies*** [5]
Insulation				
Ceiling Insulation **(1 - 4, 16) (MF, 23)**				
Installed on the ceiling or roof of a building between a conditioned area and an unconditioned area. Also applies to such materials used either on the interior or the exterior of the roof.	Significant, especially when no insulation exists presently and the cavity to be insulated is deep enough to allow for up to R-38 to be added (10 - 12 inches of insulation). Insulation reduces both heating and cooling loads but reductions are usually proportionally higher for heating than for	Limited. Insulation is generally recognized as an energy saving measure. It can be added to almost any building, but it is easiest to install in new buildings or spaces where structural framing is exposed. Large number of insulation contractors in business, cost is usually not	Standard. Typical insulation standards for ceilings - R-19 to R-38.	Higher R- value fiberglass insulation. In order to increase insulation levels without increasing the thickness of walls or ceilings, these "super batts" provide R-15 (vs. traditional R-11) in a 2 x 4 wall construction, or R-38 in 10-inch ceiling joists (especially useful in cathedral ceilings where 2 x 12 joists would be required to accommodate R-38 fiberglass insulation).

	cooling. Energy savings for whole-house insulation typically range from 20 to 40% depending upon the amount of insulation and the climate.	prohibitive. Payback of 5 years or less is possible.		

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Wall Insulation **(1 - 4, 17) (MF, 24)**				
Installed within or on walls of a building between conditioned areas and an unconditioned area.	Significant, provided cavity to be insulated is at least 3-1/2" deep (the typical situation) such that R-11 minimum can be added. Deeper cavities provide greater savings potential. Insulation reduces both heating and cooling loads but reductions are usually proportionally higher for heating than for cooling. Energy savings for whole-house insulation typically range from 20 to 40% depending upon the amount of insulation and the climate. Note: Usually there is no wall cavity to	Minimal Barriers. Insulation is generally recognized as an energy saving measure. It can be added to almost any building, but it is easiest to install in new build-ings or spaces where structural framing is exposed. Large number of insulation contractors in business, cost is usually not prohibitive. Payback of 5 years or less is possible. Also, wood siding (clapboards and shin-gles) are cheapest to retrofit; aluminum, vinyl and asbestos siding can cost up to 35% more. Paybacks	Standard (effective exterior/ interior applications are not very common and could be considered progressive). Typical insulation standards for walls - R-11 to R-19.	Higher R-value fiberglass insulation for open wall cavities. In order to increase insulation levels without increasing the thickness of walls or ceilings, these "super batts" provide R-15 (vs. traditional R-11) in a 2 x 4 wall construction. Wet spray cellulose is installed on open wall cavities with an adhesive and water and is very effective at filling gaps in irregular shaped cavities, providing complete coverage around plumbing and electrical services and at reducing infiltration.

	insulate in MF structures. As in single family, savings are significant where wall insulation can be installed.	of 5 - 7 years are possible. MF: In many cases wall insulation is not possible due to lack of a wall cavity. Sometimes exterior or interior insulation can be installed in conjunction with residing or interior remodeling, but this is often cost prohibitive.		

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

***Description*[(1)]**	***Energy Savings Potential*[(2)]**	***Market Barriers to Installation*[(3)]**	***Status as Conservative Measure*[(4)]**	***New or Emerging Technologies*[(5)]**
Floor Insulation **(1 - 4, 18) (MF, 25)**				
Floor insulation is installed between the lowest conditioned level of a building and an unconditioned basement, a crawl space, or the outside. Where the lowest conditioned level of a building is on a ground level concrete slab, the term "floor insulation" also means such material installed around the perimeter of or on the slab. For a structure with an open crawl space, the term "floor insulation" also means skirting to enclose the space between the building and the ground.	Moderate to significant for unheated crawl spaces directly exposed to the weather (i.e., with lots of air infiltration). Minimal to moderate for basements/crawl spaces where the temperature does not fall under 50° and little or no air infiltration is occurring.	Limited. Insulation is generally recognized as an energy saving measure. It can be added to almost any building, but it is easiest to install in new buildings or spaces where structural framing is exposed. Large number of insulation contractors in business, cost is usually not prohibitive. Payback of 5 years or less is possible. Some crawl spaces have minimal clearance between the floor and the ground and thus cannot be insulated due to limited access.	Standard measure. Typical insulation standards for floors, R-11 to R-22.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Domestic Hot Water Measures				

Indirect-Fired Hot Water Tank (1 - 4, 9)				
A separate, fully-insulated (R-6) minimum tank with an aquastat, circulator, and internal high-recovery heat exchanger through which boiler water is circulated to heat the water in the tank, which is installed where a conventional oil- or gas-fired tankless coil domestic hot water heating system is in use, and which reduces energy consumption by allowing for a reduction in boiler water temperature, boiler cycling and standby losses. Note: The above definition is somewhat misleading since an indirect-fired water heater does not necessarily replace a tankless coil, although that is usually the case.	Moderate to significant with greatest savings had when boiler water temperature and burner nozzle size are reduced or when coupled with a low water volume or post-purging boiler.	Cost can be a barrier - these DHW tanks will cost $500 to over $1,000 installed, depending on the type purchased, whereas a tankless coil on a boiler only adds $100 to the cost of the boiler. More often than not, an indirect water heater is installed due to a lack of quantity of hot water from a tankless coil rather than for energy conservation reasons.	Standard/progressive when performed with a high-efficiency boiler as mentioned.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Replacement Hot Water Unit (MF, 26)				
Replacement domestic hot water unit (same fuel) means a hot water unit, including a hot water heat pump, which replaces an existing domestic hot water unit of the same fuel type and results in decreased energy consumption. Note: All information is the same for a replacement water heater - different fuel with the additional monetary and/or energy savings possible by a less expensive fuel source.	Minimal to Moderate. Replacing one type of DHW tank of a particular fuel with the same type (e.g., direct-fired electric with direct-fired electric) will generally have a minimal effect on energy consumption.* However, changing the type of water heating method (such as a tankless coil in a boiler to an indirect-fired) can generate significant savings, particularly in a high usage application. *Note: There are a small number of very high-efficiency non-electric condensing water heaters which will save considerably compared to other DHW tanks of the same type using the same fuel.	Limited. Plumbers and heating contractors usually perform the work although the replacement unit is not likely to be particularly energy efficient unless a particular model is specified by the customer. However, appliance standards have eliminated most inefficient units.	Standard. Water heaters are routinely replaced by plumbers and heating contractors, although rarely for energy conservation reasons above - more often they are replaced due to failure or insufficient hot water supply.	Some high-efficiency condensing water heaters are available on the market. Heat pump water heaters, while having several market barriers, are also an efficient option.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Water Heater Insulation (1 - 4, 20) (MF, 27)				
Installed around the exterior surface of the water heating casing to reduce heat loss.	Minimal savings since most electric tanks are already well-insulated and gas and oil-fired units lose the bulk of their heat through the flue, not out the sides of the tank. Total water heating energy can be reduced 4 - 10%. MF: Moderate or better savings are possible in instances where the existing DHW tank is poorly insulated, such as with an "Everhot" tankless sidearm water heater. Quick payback in almost all circumstances due to minimal cost of measure.	Limited. Installation of water heater blankets is commonly excepted as a low-cost energy saving measure.	Standard. However, many newer tanks recommend against outer insulation wraps which will void their warranties.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Clock Timer (for DHW) (MF, 28)				
A mechanical or electronic timer that allows a hot water unit to operate only during periods of hot water demand. Used almost exclusively on electric water heaters, although units are available for gas water heaters.	Minimal due to relatively low thermal losses of most modern, well insulated electric DHW tanks. Energy cost savings are greatest when customers use timers in conjunction with off-peak rates.	Limited. Clock switches cost between $15 and $50 and customer acceptance is widespread.	Standard.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Point of Use Water Heater (MF, 29)				
Point of use water heater (different fuel) means a small, high-efficiency or instantaneous water heater that can augment or replace an existing domestic hot water system. Note; It is unclear why point of use water heater is specified as "different fuel" since there are a number of applications where there would be good energy savings using the same fuel. See section entitled "Distribution System Modifications".	Varies greatly. Can generate moderate savings depending on fuel type, length of pipe run from existing water heater, frequency of hot water, and temperature requirements at end-use location. (A common installation is in a large kitchen where very hot water (180°F) is needed. By installing a point of use water heater as a booster, the main tank can be kept at a more reasonable 120 - 140°F, thereby reducing standby and piping losses.	Limited. Contractors are familiar with point of use water heaters. Physical space limitations will prevent installation of point of use water heaters in some applications.	Standard.	N/A.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Lighting and Motors				
Lighting System Replacement or Modification (MF, 30)				
Lighting system replacement or modification means devices or actions which reduce overall lighting energy consumption and/or demand while maintaining satisfactory lighting levels. These devices and actions include: - Reducing light to levels cited in existing applicable guidelines in each area of the building, and may include installation of task lighting and reduction of overhead task lighting; - Controlling lamp operating time to limit lighting operation to periods of area use, and may include the installation of local manual switching, time	Significant with good paybacks in the correct applications.	Contractor awareness of appropriate light sources for maximum effectiveness and efficiency; customer lack of acceptance of some light sources (compact fluorescent or low pressure sodium). Also, many contractors shy away from control technologies (daylighting in particular).	Standard.	T-6 technologies for fluorescent lamps are being developed. Induction lamps, LED exit signs, dimmable and 3-way screw-in compact fluorescent lamps have all recently become available or will be shortly.

control devices and space use sensing devices; - Replacement of lamps with more efficient sources, including, but not limited to, replacement of incandescent and fluorescent lighting with				

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	***Energy Savings Potential***[2]	***Market Barriers to Installation***[3]	***Status as Conservative Measure***[4]	***New or Emerging Technologies***[5]
lumen equivalent low				

energy lamps, replacement of old fluorescent lighting ballasts with new energy saving, energy efficient or electronic ballasts, or replacement of any fixture type with one of greater lumens per watt efficiency such that total lighting demand can be reduced; and - Use of Daylighting by automatically switching off or reducing electric lights in areas where satisfactory lighting levels can be maintained using either existing windows and/or skylights in a Multifamily building.				
High-Efficiency Motors (MF, 31)				
Replacement electric motors that more efficiently convert electrical energy to mechanical energy than standard electric motors.	Significant for motors with long run times such as those used in heating and cooling water circulation and air handling applications.	Limited.	Standard.	Though not new, variable speed drive controls for motors that are under part load conditions a significant amount of the time can be very cost effective.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description [1]	***Energy Savings Potential*** [2]	***Market Barriers to Installation*** [3]	***Status as Conservative Measure*** [4]	***New or Emerging Technologies*** [5]
Solar Systems				
Passive & Active Solar Space Heating & Cooling Systems (MF, 32)				
Passive and active solar space heating and cooling systems means systems that make the	Significant in the proper application.	Moderate/High. Cost can be high.	Progressive.	N/A.

most efficient use, or enhance the use, of natural forces (including solar irradiation to the night sky) to heat or cool space by the use of conductive, convective, or radiant energy transfer including, among many others, the Thermosyphon Air System, i.e., a solar daytime heater attached to the south-facing (+/- 45° of true south) wall of a building which operates either through natural convection or through use of a fan of low power to draw air from near the floor, to expose the air to a solar-heated surface, and to discharge heated air near the ceiling, and which is able to be closed off from the conditioned area at night and on cloudy days.		Limited number of contractors with the knowledge to do this work. Retrofits are limited by the physical structure and orientation of the building - best application is when designed into a new structure.		

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Description[1]	*Energy Savings Potential*[2]	*Market Barriers to Installation*[3]	*Status as Conservative Measure*[4]	*New or Emerging Technologies*[5]
Passive systems use no pumps or motors and can be as simple as lots of south-facing glazing and a high mass floor that the sun strikes and heats up.				
Solar Hot Water Heating (MF, 33)				
Solar domestic hot water systems means equipment designed to absorb the sun's energy and to use this energy to heat water for use in a structure other than for space heating. Systems vary for new or retrofit applications. A typical system consists of solar collectors, storage tank(s), circulating pumps, piping and valves, electrical controls and sensors, and a heat exchanger. Buildings must allow for proper mounting and orientation of solar collectors, which must not be shaded.	Customers can potentially save 25 - 70% of the energy used by standard water heaters.	High cost ($2,000 to $5,000 installed). Also, system failures often caused by improper specification and installation. Additionally, there are many fewer installers in business now compared to when tax credits were available.	Progressive, though rarely installed due to high cost.	Other solar technologies, in particular photovoltaics (the direct conversion of sunlight into electricity), have become increasingly more cost competitive in the past decade and are expected to continue to become more so into the future.

MATRIX OF ENERGY CONSERVATION SERVICE PROGRAM MEASURES

(Continued)

Notes:

Derived from Energy Conservation Service Program CMR225 4.02 and 5.02.

(10 ERG insight.

(20 ERG insight on likelihood of participant installing measures.

(30 ERG insight.

(4) ERG insight, industry literature, discussions with program vendors.

Volume 2, Chapter 6 - Educational Assessment of ECS Audits

ERG reviewed the current ECS audit process to determine whether the educational procedures and approaches are appropriate given the educational objectives of the ECS Program. This involved conducting a brief review of auditor training curricula and accompanying ECS energy auditors in the field in performing the audits to observe the procedures being implemented. The results of these efforts are summarized below.

6.1 Auditor Training Curriculum

A key component of the ECS Program is customer education which plays an important role in motivating participants to install conservation measures and implement conservation practices. Several national studies have also demonstrated that the incorporation of energy education into traditional conservation auditing programs can help participants increase their energy savings and maintain those savings over time.[1]

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[1] "Annotated Bibliography of Research - Verified Energy Education Programs", Professional Association for Consumer Energy Education, July 1, 1994.

Section 4.10 of 225 CMR 4.00, Energy Conservation Service Program, contains qualification and training requirements for ECS program auditors. Courses are required for auditor trainees which vary in length from five to ten days according to level of auditing experience (in addition to several days in the field). Auditors are then required to pass a certification examination. Once certified, auditors must attend quarterly workshops for purposes of: conducting additional training in technical issues; discussion of field problems; and additional training relative to changes in program delivery and content as approved by DOER.

ERG was provided with curriculum outlines for ten-day training programs from the following program vendors: Mass-Save, Inc., Conservation Services Group (CSG) and Honeywell/DMC (DMC). Condensed versions of those curricula are contained in Exhibit 6-1.

Exhibit 6-1

Condensed Curriculum Outline of Auditor Training Programs

(Ten-Day Programs)

Content Area:	Mass-Save	CSG	DMC
Program Overview/ **Introduction**	Overview and Objectives of ECS	Overview of ECS Training Discussion of ECS	ECS Program Overview History of ECS Program DSM Program Introduction
Construction Issues, **Energy Basics, Other**	Construction Principles and Energy Flow Basic heat transfer and heat load calculations	Energy basics and theory of heat loss House construction and conservation materials Math review	Basic thermodynamics and heat load calculations Basic construction principles and styles Door and window types
Thermal envelop measures	Insulation and ventilation Air movement, leakage control, moisture and indoor air quality Windows and doors	Introduction to the thermal envelop Materials for reducing heat loss Moisture control and ventilation	Insulation Infiltration reduction Moisture production and control Ventilation
End-Use Training	Heating systems, test procedures DHW systems	Space heating & cooling Combustion	Heating systems DHW systems

	and improvements Electric end-uses (heating, cooling, heat pumps & lighting)	testing DHW systems Electricity Lighting	Cooling systems Heat pumps
Other Measure **Training**	Renewable energy application for residences		Introduction to solar energy Active solar systems Passive solar energy Wood heat
Data Collection, **Data Entry,** **Calculations**	Data collection, computer use and data entry	Data collection form Audit package forms Estimating fuel usage House diagraming The Portable Audit	Data collection Computer input Costs and savings Applicability criteria
ECS Service **Descriptions/** **Training**	Appliance Efficiency Education Service (AEES)	Appliances & the AEES Equivalent Services	Equivalent service training, including: Air sealing

		Fuel Bill Analysis Overview of Energy Saving Measures	DHW conservation Work orders Contractor arranging Post-inspections AEES State-mandated energy assistance programs
Educational **Training**	Implementation services and customer motivation	Client interview practice Client education "A Day in the Field"	Auditor/homeowner relationships The auditor as a motivator

ERG reviewed the curriculum outlines to determine how auditors are being taught to educate and motivate customers to implement energy saving measures (as opposed to assessing the technical content of the training which would gauge the technical knowledge of the auditors).

It was found that the three curricula offer different approaches to training auditors on educating and motivating program participants. The Mass-Save, Inc. curriculum was found to be comprehensive in that it contains training on the role of the advisor (or auditor) including educating customers and motivating customers to act. Also included are training sessions on the psychology of energy conservation - value of understanding behavioral tendencies, consumer behavior models and strategies for overcoming customer objections. This training appears to equip auditors with the information and knowledge to both educate and build credibility with program participants to motivate them to act on audit recommendations.

The CSG curriculum was less academic but included practice sessions in which the auditors can practice client interviews and education. In the "client interview practice session," the instructor provides an overview of the rationale for the customer interview and fundamental information to be attained during the interview. Auditor trainees are then paired off to practice the interview process while the instructor observes and coaches

the process. In the "customer education practice session," the instructor reviews program practices. Trainees are then paired off and, working from a pre-determined list of energy saving measures, practice presenting the information to customers, while the instructor monitors and coaches the exercise. These role-playing practice sessions provide an opportunity for the auditors to grasp important educational and motivational techniques and practice them prior to working in the field.

The DMC curriculum contains a session titled "History of the RCS Program," training on "auditor/homeowner relationships" and "the auditor as a motivator." However, unlike the Mass-Save and CSG curricula, these sessions are conducted at the beginning of the training program - during the first day of training - and the information is not formally reinforced at the end of the training program. Educational and motivational concepts, however, are reinforced during both the technical training modules on specific technical tasks and the field training.

In summary, all three training curricula that were reviewed contain training sessions on customer education and motivation. However, the training approaches vary. The Mass-Save program offers a comprehensive academic approach; the CSG program offers more of a "role-playing," "hands-on" approach. The DMC curriculum contains introductory sessions on educational/motivational issues and includes educational/motivational issues within each technical training module.

6.2 Observation of Auditor Educational Approach

ERG staff accompanied six ECS auditors in the field to observe the educational techniques being implemented. Auditors from the following program vendors were observed:

- Mass-Save, Inc. (observed two different auditors);
- Conservation Services Group (CSG);
- Honeywell/DMC;
- CET (Berkshire Gas Company); and
- Merge, Inc.

In observing the auditors, emphasis was placed on the auditor's explanation of measures (what they are, how they are installed, their benefits, etc.), how recommendations are presented, how well the auditor responds to participant questions, as well as how successful the auditor is in motivating the participant to take the next step.

Prior to accompanying the auditors in the field, ERG prepared an observation form in order to evaluate each auditor on a consistent basis. ERG also developed a brief auditor survey form to obtain auditor feedback on the ECS program, ECS training programs and measures. These forms are contained in Volume III, as are summary tabulations of the observations and auditor responses. Key findings of the effort are summarized below.

6.2.1 Audits Observed

ERG accompanied auditors on seven different ECS audits as summarized in Exhibit 6-2.

Exhibit 6-2

ECS Audits Accompanied by ERG

Vendor	ECS Provider	Audit Location	Type of Residence	Date of Audit
CSG	MMWEC/Belmont	Belmont	Single	10/1/96
CSG	Boston Edison	Belmont	Single	10/1/96
Mass-Save	New England Electric	Melrose	Two-Family	10/4/96
Honeywell/DMC	Boston Gas	Woburn	Two-Family	10/1/96
Merge, Inc.	South Hadley Electric Light	South Hadley	Condo	10/11/96
Mass-Save	Massachusetts Electric	Lynn	Single	9/24/96
CET	Berkshire Gas	Pittsfield	Single	10/11/96

These audits were conducted for a variety of different program providers between September 24 and October 11, 1996. Four, single-family homes were audited in addition to two, two-family homes and one condominium. Each audit lasted between 1 and 1.75 hours, with the exception of one of the two-family audits which lasted approximately 2.5 hours.

Upon arrival at the residences, all of the auditors adequately established rapport and explained the purpose of the visit. Exhibit 6-3 provides a listing of the applicable ECS measures identified by the auditors during the visits.

Exhibit 6-3

ECS Measures Identified by Auditors

	No. Times Identified		No. Times Identified
HVAC Measures		**Air Sealing Measures**	
Replacement Central A/C	0	Caulking	1
Replacement Furnaces or Boilers	3	Weather-Stripping	3
Furnace Burner Replacement	1	Bypass (chimney, etc.)	0
Vent Damper	1	Outlet	1
Modulating Aquastat	1	**Window/Door Measures**	
Thermostatic Control Devices	1	Window Heat Gain/Loss Retardants Glazing	2
Distribution System Modifications	0	Heat Reflective and Heat Absorbing Window or Door Material	0
Pipe Insulation	1	Storm Door	0
Insulation		Thermal Door	1
Ceiling/Roof	5	Storm Window	0
Wall	3	Thermal Window	
Floor	1	**Lighting**	
Pipe	2	Lighting System or Replacement	3
Duct	1		

Domestic Hot Water Measures		Modification	
Replacement Hot Water Unit	1		
Water Heater Insulation	4		
Clock Timer	1		
Pipe Insulation	4		
Point of Use Water Heater	1		
Indirect-Fired Hot Water Tank	0		
Solar Hot Water Heating	0		

6.2.2 Auditors' Role

All of the auditors that were observed had a minimum of six years auditing experience, with one having fourteen years of experience. Therefore, the auditors, for the most part, were veterans. When asked, all of them defined their role in the ECS Program as "energy educators." A few mentioned that in addition to being "energy educators" they perceive themselves to be "motivators" and "demonstrators."

All of the auditors ranked the training programs they had taken to become certified as excellent with respect to learning about the technical aspects of the job, as well as learning how to educate and motivate participants to implement audit findings. In addition, all of the auditors claimed to keep up-to-date on new energy technologies or energy saving practices by attending regular training programs. In addition, some of the program vendors issue newsletters and memos to keep auditors apprised of new developments.

6.2.3 Educational Criteria Relative to Measures

Educational criteria were developed for each ECS program measure category in order to rank the auditors' educational approach. For each applicable measure, the auditors were ranked using a scale of 1-5, where 1 is poor and 5 is excellent. Exhibit 6-4 contains those results.

Exhibit 6-4

Auditor Education of ECS Measures

Measure	Educational Criteria Evaluated[1]	Average Ranking*	Potential Areas of Improvement[2]
HVAC	Largest Household End-Use Assessment of Existing System (age, efficiency, etc.) Efficiency Testing Efficiency Impact on Energy Consumption Importance of Routine Maintenance on Efficiency Efficiency Improvements and/or Replacement Options (furnace, boiler or central A/C) Costs, Benefits (including payback) (if replacement, importance of AFUE for heating, SEER for cooling) Implementation Options	**4.2**	Better explanation of direct correlation of efficiency savings to dollar savings.
Insulation	Purpose/Benefits of Insulation Types of Insulation Adequacy of Existing Insulation Levels Recommended Levels and Improvements Ventilation Requirements Costs, Benefits (including payback) Installation Options	**4.5**	Better explanation of insulation types and recommended levels.

Air Sealing/ **Weatherization**	Purpose of Air Sealing Measures Explanation of Air Sealing Techniques/Methods Determination of Where it is Needed Types of Caulking/Weather-Stripping Materials Costs, Benefits (including payback) Installation Options	**4.5**	Better explanation of air sealing techniques and benefits.
Domestic **Hot** **Water**	Assessment of Existing System (age, deficiency) Efficiency Improvements and/or Replacement Options (new system, insulation, indirect-fired HW tank, temperature reduction time clocks, solar) Description and Importance of Routine Maintenance Costs, Benefits (including payback) Installation Options	**4.6**	More frequent mention of routine maintenance
Windows/ **Doors**	Assessment of Existing Windows/ Doors (age, condition, infiltration) Efficiency Improvements (storm, replacement) Types of Storm, Replacement Windows/Doors (i.e., heat mirror, low-e, argon gas)	**4.7**	Better explanation of types of applicable measures.

	Costs, Benefits (including payback) Installation Options		
Lighting	Assessment of Existing Lighting System Description of CF Technology/ Applicability Costs, Benefits (including payback) Installation Options	**5.0**	None
Solar **Heating** **Measures**	Assessment of Existing System Description of Solar Technology/ Applicability Benefits of Solar System(s) Design Parameters Operational Characteristics Costs, Benefits Installation Options	**N/A**	N/A
Notes: (1) Developed by ERG for evaluation purposes. * On a scale of 1 to 5, where 1 is poor and 5 is excellent. (2) Identified in a limited number of audits (one or two).			

All of the auditors did an outstanding job of educating program participants on applicable measures. While no specific recommendations for improvement are made based on this limited in-field assessment, several potential areas for improvement are noted when the overall rating for a particular aspect was not "perfect" (i.e., 5.0). Applicable measures included HVAC, insulation, air sealing, domestic hot water, windows/doors, and lighting. None of the auditors educated participants on solar heating and hot water systems because those measures were not found to be applicable.

6.2.4 Educational Criteria Relative to Energy Saving Practices

All of the auditors provided information on energy saving practices such as the importance of temperature control/setbacks and efficient appliance operation. However, during three of the audits, the auditors did not mention the benefits of routine

maintenance on heating and hot water systems. Overall, however, the auditors did a good job of conveying information on energy saving practices and were ranked as shown:

	Educational Criteria	Average Ranking	Potential Areas of Improvement[1]
Energy Saving Practices	Explanation clear, concise and comprehensive Explanation of energy savings potential	**4.8**	Benefits of heating and hot water heating system maintenance
Notes: (1) Identified in a limited number of audits (one or two).			

6.2.5 Educational Criteria Relative to Installation Demonstration

During six of the audits, the installation of measures including hot water heater tank wraps, pipe insulation, weather-stripping, compact fluorescent lamps, and faucet aerators were demonstrated. One of the auditors wrapped a water heater tank that was located in a heated basement, which perhaps did not need to be wrapped and another auditor "v-sealed" a basement door that was also probably not necessary as it was located in a heated basement. Overall, however, the auditors did an excellent job of demonstrating the installation of conservation measures and were ranked as follows:

	Educational Criteria	Average Ranking	Potential Areas of Improvement[1]
Demonstration/ Installation	Demonstration Clear and Concise Explanation of Material/ Tool Requirements	**4.8**	Ensure measure installations are applicable given surrounding environment.

	Description of How to Obtain Materials or Additional Assistance Proper Installation Demonstration		
Notes: (1) Identified in a limited number of audits (one or two).			

The auditors' demonstration/installation skills were also evaluated based on the following criteria as to whether their skills were "good" or whether they "needed improvement":

- determined needs during walk through with or without participant input;
- confers with participants prior to installation;
- refers participants to buying cooperative; and
- neatness of installation.

All the auditors' skills were rated as "good." None of them were identified as needing improvement in these areas.

6.2.6 Equivalent Services

Auditors provided information on the following equivalent (implementation) services:

Equivalent Service	Number of Times Explained
Appliance Efficiency Education	**5**
Bulk Purchase Service (Mail Order)	**5**
Work Order Preparation	**4**
Contractor Arranging Service	**6**
Technical Assistance	**3**

Service	
Post Installation Inspections	**2**

Auditors were ranked according to how well they explained the equivalent services as follows:

Equivalent Service	**Evaluation Criteria**	**Average Ranking**	**Potential Areas of Improvement[(1)]**
Buying Co-op	Explained Links to Energy Savings Fills Out Completely	**4.3**	Greater linkage to energy savings.
Work Order	Explains/Uses Appropriately Fills Out Accurately and Completely Measurements Accurate	**5.0**	None identified.
Appliance Efficiency Education	Explained, Use Appropriately Fills Out Checklist Accurately Demonstrated "Wheel"	**5.0**	None identified.
Contractor Arranging Service	Explained Process and Benefits Completes Referral Form	**4.6**	More comprehensive completion of referral form.

Special Programs	N/A	**N/A**	N/A
Notes: (1) Identified in a limited number of audits (one or two).			

6.2.7 Auditor as a Motivator

In two of the seven audits, the auditors did not need to motivate the participants to install ECS measures (i.e., measures were not applicable, or participants had made up their minds prior to the audit to install the measures).

In the other five instances, the auditors did have to motivate the participants and they were ranked as follows:

Motivational/Educational Criteria	**Average Ranking**	**Potential Areas of Improvement[(1)]**
Demonstration of Cost-Effectiveness Value of Conservation Lower Energy Costs Reduced Maintenance Cost Conservation Resources Implementation Resources Available Technical/Financial Assistance Do-It-Yourself Measures	**4.6**	Greater emphasis on value of conservation.
Notes: (1) Identified in a limited number of audits (one or two).		

Five of the seven program participants asked the auditors questions. The types of questions that were asked included:

- the amount of energy that would be saved from installing measures;
- where measure materials could be purchased;
- how long the measures would last (weather-stripping);
- the cost-effectiveness of replacing windows;
- ways to improve heating system efficiency;
- ventilation requirements;
- setback thermostat energy savings;
- Do-it-yourself installation information;
- information on who could install measures;
- information on the different types of insulation; and
- information about air filters and water quality.

All of the answers implied a general understanding of the measures and the benefits of energy conservation. The auditors were ranked as follows in answering the questions:

Educational Criteria	Average Ranking	Potential Areas of Improvement[(1)]
Accurate Response Easy-to understand Clear, Concise No Additional Clarification Needed	**4.6**	Better clarification of heating system improvement.
Notes: (1) Identified in a limited number of audits (one or two).		

Overall, all of the auditors did a good job of increasing the understanding of major energy uses. All of the approaches to educating and motivating program participants about energy conservation were also adequate.

No significant recommendations for improvement are required. A few minor areas of improvement were noted in some cases. The auditors that were observed were all very

knowledgeable and professional and have been conducting energy audits for several years. In one instance, however, an auditor was not able to present the audit findings to the participant because the auditor had to leave for another audit appointment. This was a two-family audit that was time consuming (2.5 hours). Throughout the audit, however, the auditor provided explanations to the customer and answered questions. However, instead of presenting the audit findings directly to the participant, the auditor mailed the report to the participant.

This approach, while perhaps an isolated case, is not nearly as effective as reviewing the findings directly with the participant. While the auditor did an excellent job, the audit was not brought to closure. Opportunities to motivate and educate the program participant were most likely lost. While these types of situations may be uncommon, the issue of scheduling too many audits per pay per auditor could be detrimental to the program - particularly given the fact that some of the auditors appeared to be under pressure to conduct a given number of audits per day. It is recommended that DOER investigate the guidelines established for the number of audits scheduled per auditor per day per program vendor in order to ensure that by increasing auditor efficiency, the basic educational and motivational objectives of the program are not diminished.

Volume 2, Chapter 7 - Impact Analysis and Results

As described in previous chapters, in FY95 the ECS program incorporated a broad range of services designed to encourage the installation of energy saving measures. In addition, a number of utilities offered DSM programs and services statewide in addition to ECS services, and a limited number of customers were eligible to receive comprehensive weatherization services through DOE's low-income Weatherization Assistance Program (WAP).

This chapter presents an overview of the analysis completed to determine the energy savings impacts that are attributable to the FY95 ECS Program.[1] That is, energy savings impacts have been calculated **for all measures installed by participants using ECS services**. Energy savings impacts associated with measures installed by FY95 ECS participants via ECS/DSM piggyback services, stand-alone utility DSM programs, and/or the WAP program have been calculated separately.

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[1] As mentioned in previous chapters, the focus of this report is the evaluation the FY95 ECS program, and the effectiveness of its coordination during this time period with other residential energy conservation programs (e.g., utility DSM programs, WAP). With the exception of these coordination issues, this evaluation does not address evaluation issues specifically related to utility DSM programs or the WAP program.

It is possible that the ECS program may be partially responsible for some of these DSM/WAP measure installations. In addition, it is generally believed that, if it had not been for ECS, some measures (not all) installed through ECS/DSM piggyback services would not have been delivered cost-effectively through stand-alone utility DSM programs. Therefore, this evaluation has provided a range of energy savings estimates, with impacts credited to the standard set of ECS services alone making up the lower end of this range, and impacts jointly credited to ECS services and DSM/WAP services making up the higher end of this range. Somewhere within this range lies the true estimate of energy savings impacts that can be credited to the ECS program.

In Section 7.1, our approach to assessing the correct "attribution" of measure installations (i.e., to which gross energy savings should be attributed) is presented. For example, measures recommended through the ECS audit could have been installed by participants utilizing services provided through ECS equivalent services (e.g., contractor arranging services, work orders, bulk purchase services, etc.), and/or services provided through other programs (e.g., DSM, WAP). Measures that were "directly installed" in participants' homes during the ECS visit were attributed to either (a) the ECS DMI component, or (b) ECS/DSM piggyback services. (See Chapter 3: Participant Survey Results, Section 3.3, for a more detailed description of the services available to FY95 ECS participants.)

Once the correct attribution was determined in Section 7.1, it was then necessary to establish the relative influence these services may have had on participants' decisions to install energy saving measures. A "net savings factor" was developed to identify those

measure installations that were influenced by ECS and/or utility DSM/WAP programs. Our approach to developing "net savings factors" is presented in Section 7.2.

Finally, once the correct attribution and influence for each measure installation was determined, gross and net energy savings estimates were developed and applied to derive the final energy saving impacts attributable to the FY95 ECS program. Section 7.3 presents the results of this analysis. Appendix G in Volume III of this report contains additional detail on the methodology and assumptions used to develop gross and net energy savings impacts.

7.1 Attribution of Measure Installations

Participant survey results and FY95 ECS Utility Implementation Plans were used to determine the correct attribution for each measure. The assumptions and our approach to assessing measure attribution are described below.

7.1.1 Audit Recommendations

Two categories of attribution were developed for audit measure installations: "ECS Program" and "Utility DSM/WAP Programs". Attribution of measure installations between these two program categories was accomplished through a number of steps, as described below.

The first step was to identify which of the FY95 audit recommendations participants implemented. Using the participant survey data, the specific audit recommendations implemented and still in use by FY95 participants were identified. Exhibit 7-1 presents a listing of these measure installations. It should be noted that, absent on-site verification of audit measure installations, it is possible that participants may have over-reported the actual rate of implementation. However, in conducting evaluations of similar programs across the country, Hagler Bailly has found only slight discrepancies between telephone survey self-reports and on-site verifications. When discrepancies exist, they usually involve differences in the assumed "quantity" of measures installed, as opposed to the overall installation itself.

Exhibit 7-1

Implementation of ECS Audit Recommendations

Measure Name:	Number of Participants for which	Number of Participants Installing Measure	Implementation Rate

	Measure was Recommended[1]		
Insulation Measures:			
Attic insulation	273	70	26%
Floor insulation	270	29	11%
Wall insulation	237	43	18%
Duct insulation	143	22	15%
Rim joist insulation	45	1	2%
Basement wall insulation	38	2	5%
Crawl space insulation	33	4	12%
Summary	*1,039*	*171*	*16%*
Other Weatherization Measures:			
Storm windows	74	11	15%
Window weatherstripping	65	26	40%
Window insulation	43	7	16%
Replace windows	28	7	25%
Storm doors	56	10	18%
Door weatherstripping	36	21	58%
Replace doors	12	1	8%
Insulate doors	5	0	0%
Summary	*319*	*83*	*26%*
Heating System Measures:			
Clock thermostat	441	69	16%
Heating pipe insulation	261	83	32%
New heating system	231	14	6%
Boiler reset	177	8	5%
Flue damper	92	6	7%

Replace burner	92	6	7%
Intermittent ignition device	65	4	6%
Summary	*1,359*	*190*	*14%*
All Measures	**2,718**	**445**	**16%**

[1] This data corresponds to ECS/utility tracking data regarding measures recommended. According to the participant survey results, only about 40% of these recommendations were recalled by participants during the survey (see Chapter 3: Participant Survey Results, Exhibit 3-5). The implementation rate is calculated based on measures recommended, since if a recommendation was not recalled by a participant it is not likely to have been installed.

The second step was to identify specific services utilized by participants to install audit recommendations. During the survey, respondents were asked a number of questions designed to determine the specific programs or services to which to attribute their actions. Specifically, the following questions were asked:

- Who installed the measures?
- If contractors were used to install measures, did the utility arrange for these contractors, or did auditors help find these contractors, or did participants find these contractors on their own?
- If participants or other household members installed measures, did they purchase materials through the ECS bulk purchase catalog, or did they purchase them from other sources (e.g., retail locations)?
- Were work orders prepared and used to install measures?
- Was a post-installation inspection offered and used to check on the quality of measure installations?
- Who paid the cost of installing the measures?
- Did participants receive any other assistance, from utilities or other agencies, to help install the measures? What was the nature of this assistance and who provided it?

Based on responses to these questions, measure installations were assigned to one of two categories: "ECS Program" or "Utility DSM/WAP Programs". Again, this attribution reflects the services **used** by participants to install measures recommended to them through the ECS audit. It does not attempt to determine the level of influence ECS may have had on participants' installation decisions.

For example, if participants indicated through the survey that their utility (a) arranged for the contractor to install the measures, (b) paid all or part of the cost of installing the measures, and/or (c) provided some other type of assistance (i.e., technical, financial, other) to help them install the measures and FY95 program information confirmed that

these services were available from their utility, then the measures installed by these participants were attributable to the category of "Utility DSM/WAP Programs".

Exhibit 7-2 presents a listing of utility DSM services that were actually available to ECS participants during FY95. This information was obtained from FY95 ECS Utility Implementation Plans, or directly from ECS providers.

A few participants indicated during the survey that they used services that were not available to them through their utilities' DSM programs, according to the listing presented in Exhibit 7-2. In these cases, the income level of the participant households was checked and this revealed that these services were most likely provided through WAP. Based on this assumption, a total of 25 audit measure installations were assumed to have been installed through WAP and assigned to the "Utility DSM/WAP Programs" category.

Finally, if participant responses were such that utility DSM or WAP services were not utilized to encourage the installation of audit measures, and/or if participants reported that -- in addition to the audit -- other ECS services were used, then the measure installations were attributed to the "ECS Program" category. Similarly, if participants indicated that -- other than the audit -- no specific ECS, utility or other program services were utilized to complete the recommended measure installations, then the measure installations were attributed to the "ECS Program" category for the purposes of calculating gross energy savings impacts.

Together, these assumptions and the resulting analyses led to the final attribution of installed audit measures as presented in Exhibit 7-3. As shown, of the 445 installed measures: 73% were implemented utilizing partial or full ECS services, and 27% were implemented utilizing services provided solely through utility DSM or WAP programs. Measure installations completed using partial or full ECS services can be further broken down to show that the majority of these installations were implemented without the use of specific ECS services, other than the energy audit itself. That is, of the 445 measures installed, 280 (or 63%) were implemented by participants without the use of specific ECS services, such as contractor arranging, work orders, and post-inspections. In fact, very few participants used these other ECS services: 10%, or 46 of 445.

Exhibit 7-2

Utility DSM Programs/Services Matrix (FY95)

Utility (Provider)	**ECS/DSM Piggyback Measures**	**DSM Program Measures**
Bay State Gas	DHW measures	Attic/Wall Insulation

	Clock thermostat DSM customer offer sheet & work orders	Pipe/duct insulation Clock Thermostat Pilotless ignition Boiler resets Hi -eff Heating System DHW: tank/pipe insulation, flow restrictors, temp reduction
Berkshire Gas	DHW measures Door weatherstrip Blower door DSM measure work orders	Attic/Wall Insulation Crawlspace/Floor Insulation Pipe/duct insulation Vent Damper Air- sealing Clock Thermostats Door weatherstrip DHW: tank/pipe insulation, flow restrictors, temp reduction
Boston Edison	2 fluorescent light bulbs	Rebates for: Efficient A/C, Heat Pumps, water heaters, light fixtures, whole house fan. Electric-Heat Program (comprehensive)

Boston Gas	DHW Measures	Attic Insulation Duct insulation Vent Dampers DHW: tank/pipe insulation, flow restrictors, temp reduction
Colonial Gas (MSI)	DHW measures DSM Work Orders	DHW: tank/pipe insulation, flow restrictors Insulation Heating System Controls
Commonwealth Electric (MSI)	Fluorescent light bulbs DHW: tank/pipe insulation, flow restrictors, temp reduction	Electric heat (comprehensive) DHW: tank/pipe insulation, flow restrictors, temp reduction
Commonwealth Gas	DHW Measures Door & window weatherstripping/caulking Door sweeps	Attic/Wall Insulation Pipe/duct insulation Clock Thermostat Door & window weatherstripping/caulking Door sweeps DHW: tank/pipe insulation, flow restrictors, temp reduction
Danvers	Compact bulb	none

	A/C filters Refrig coil brush	
Eastern Edison (MSI)	Fluorescent light bulbs DHW: tank/pipe insulation, flow restrictors, temp reduction	Bulb rebates Electric Heat (comprehensive)
Massachusetts Electric (MSI)	Fluorescent light bulbs Clean Refrigerator coils Clean & replacing A/C filters	Load Management for large appliances Electric Heat (comprehensive) Efficient lighting discounts Super Eff. Refrigerator
MMWEC	Some utilities offer: compact bulbs DHW measures	none
Middleboro	none	none
Other Municipals (MSI)	None	Compact fluorescent discounts & leasing Watt Meter loans Load Management
Peabody	2 fluorescent bulbs A/C filters Refrig coil brush	none
Taunton	Lease compact fluorescents	Lease compact fluorescents

WMECO (MSI)	Fluorescent light bulbs Clean Refrigerator coils Clean & replacing A/C filters DHW: tank/pipe insulation, flow restrictors, temp reduction	Discount bulbs Electric heat (comprehensive) DHW: tank/pipe insulation, flow restrictors, temp reduction
Sources: FY95 ECS Utility Implementation Plans, and discussions with ECS providers.		

Exhibit 7-3

Program Attribution Results for Installed Audit Measures

Measure Description	Total Number of Participants Installing Measures Attributable to DSM/WAP Programs	Total Number of Participants Installing Measures Attributable to ECS Program	Total Number of Participants Installing Measures	Percent of All Installed Measures Attributable to DSM/WAP Programs	Percent of All Installed Measures Attributable to ECS Programs
Attic insulation	21	49	70	30%	70%
Wall insulation	18	25	43	42%	58%
Floor insulation	6	23	29	21%	79%
Duct insulation	5	18	23	22%	78%
Crawl space insulation	1	3	4	25%	75%
Basement wall insulation	0	2	2	0%	100%
Rim joist insulation	1	1	2	50%	50%
Summary Insulation Measures:	***52***	***121***	***173***	***30%***	***70%***
Window weatherstripping	4	22	26	15%	85%

Door weatherstripping	6	14	20	30%	70%
Storm windows	0	11	11	0%	100%
Storm doors	1	9	10	10%	90%
Window insulation	0	7	7	0%	100%
New windows	2	5	7	29%	71%
New doors	0	1	1	0%	100%
Summary Weatherization Measures:	***13***	***69***	***82***	***16%***	***84%***
Heating pipe insulation	11	72	83	13%	87%
Clock thermostat	32	38	70	46%	54%
New heating system	3	11	14	21%	79%
Boiler reset	1	7	8	13%	88%
Flue damper	2	4	6	33%	67%
Burner replacement	3	3	6	50%	50%
Intermittent ignition device	1	3	4	25%	75%
Summary Heating System Measures:	***53***	***138***	***191***	***28%***	***72%***
All Measures	**118**	**327**	**445**	**27%**	**73%**

7.1.2 Direct Install Measures

The sample of FY95 participants surveyed received 4,000 direct install measures through their participation in either the ECS Demonstration Material Installation (DMI) component or the ECS/DSM piggyback service. Data recorded in the utility tracking databases was used to identify the actual measures received, while the information included within the matrix presented above (Exhibit 7-2) was used to determine whether measures were installed through the ECS DMI component or ECS/DSM piggyback services. Of the 4,000 measures received by the sample of FY95 participants, three quarters (75%) were associated with the ECS DMI service and 25% were associated with ECS/DSM piggyback services. Exhibit 7-4 presents a listing of direct install measure data used in the calculation of energy saving impacts, broken out by DMI and ECS/DSM piggyback components.

Exhibit 7-4

Direct Install Measures [1]

Measure:	Total Number of Direct Install Measures [2]	Number of DMI Measures	Number of ECS/DSM Piggyback Measures
DHW low flow devices	656	494	162
DHW pipe insulation	261	206	55
DHW tank wrap	231	125	106
DHW temperature setback	36	25	11
Clock thermostat	17	6	11
Duct insulation	2	2	0
Compact fluorescent lamps	723	229	494
Lighting fixture adapters	25	23	2
Door weatherstripping	562	535	27
Outlet/switchplate gaskets	428	428	0
Door sweep	299	295	4
Window weatherstripping	257	246	11
Interior plastic storm windows	100	100	0
Caulking	45	45	0
Pulley seals	44	44	0
Glass patch	20	20	0
Attic hatch insulation	4	4	0
Radiator reflector	2	2	0
Refrigerator coil cleaning	263	162	101
AC filter clean/replacement	25	15	10
All Measures:	4,000	3,006	994
Percent of All Measures:		75%	25%

[1] This exhibit represents the number of measures received according to ECS/utility tracking databases. The survey results indicate that 72% of these measures were recalled by participants as having been received during the ECS audit visit. See Chapter 3: Participant Survey Results, Exhibit 3-8.

[2] Numbers shown in this Exhibit reflect the number of households receiving direct install measures, according to ECS/utility tracking databases, but not the actual quantity of measures installed.

7.1.3 "Do-it-Yourself" Energy Saving Materials

During the survey, participants offered reports of *additional* energy efficiency measures that they had purchased and installed after the audit was conducted. Some of these "do-it-yourself" measures were purchased through the bulk purchase catalog, although the majority were purchased through retail sources. Exhibit 7-5 presents a summary of participants' **self-reported** DIY purchases. As shown, only about 7% of all 948 participants reported purchasing DIY materials through the bulk purchase catalog, while just over half (54%, or 512 of 948) reported that they had purchased and installed at least one additional energy saving measure through retail sources.

Exhibit 7-5

Self-Reported Purchases of "Do-it-Yourself" Energy Saving Materials [1]

Measure Purchase	Number of Participants Reporting DIY Purchases Through:		Percent of All Participants Reporting DIY Purchases Through: (n=948)	
	Bulk Purchase Service	Retail Locations	Bulk Purchase Service	Retail Locations
Energy efficient lighting products	24	242	3%	26%
Weatherstripping	21	244	2%	26%
Door sweeps	9	126	1%	13%
Caulking	0	126	0%	13%
Insulation	0	59	0%	6%
Outlet gaskets	7	46	1%	5%
Interior storm windows	8	42	1%	4%
DHW low-flow devices	3	20	0%	2%
DHW pipe insulation	1	15	0%	2%

Clock thermostat	4	2	0%	0%
Draft covers (e.g., window quilts)	6	0	1%	0%
New windows	0	4	0%	0%
DHW tank wraps	0	4	0%	0%
Attic vents	0	2	0%	0%
AC filters	0	2	0%	0%
Pulley seals	2	0	0%	0%
Chimney plugs	2	0	0%	0%
Refrigerator brush	1	0	0%	0%
Duct insulation	1	0	0%	0%
Total Number of Materials Purchased	*89*	*933*		
Number of Participants Purchasing Materials	*71*	*512*		
[1] Numbers shown in this exhibit reflect the number of participants reporting DIY material purchases, not the actual quantity of materials purchased.				

7.2 Net Savings Factors

As discussed in the previous section, participants were offered several interconnected services in order to increase the penetration of energy saving measures. The challenge of determining the correct "service" to which measure installations should be attributed (e.g., ECS bulk purchase, ECS DMI, ECS/DSM piggyback, stand-alone DSM, etc.) is further complicated when assessing the *influence* each of these different yet interconnected service offerings may have had on a given participants' installation decision.

A "net savings factor" was developed to identify those measure installations that were influenced by ECS and/or other program services. Three primary sources of **self-reported** information were used to develop the net savings factors:

- Audit Recommendations -- participants' responses regarding whether or not they would have installed the same quantity of measures at the same time had it not been for the audit and/or its associated services.
- Direct Install Measures -- participants' responses regarding whether or not they would have installed the same quantity of measures at the same time had it not been for the audit and/or its associated services.

- Bulk/Retail Purchase Measures -- participants responses regarding whether or not they would have installed the same quantity of measures at the same time had it not been for the audit and/or its associated services.

Participants who responded that the audit and/or associated services **influenced** their purchase/installation decisions were assigned a net savings factor of 1. Participants who responded that the audit and/or associated services **did not influence** their purchase/installation decisions were assigned a net savings factor of 0. Based on these assumptions, the average net savings factor for each measure was calculated as the sum of each individual measure's net savings factor divided by the total number of measures installed. For example, if 100 door sweeps were installed, and 75 were installed as a result of the audit's influence, and 25 were installed regardless of the audit's influence, then the average net savings factor for door sweeps was estimated at 75%. The overall average for all measure installations was calculated in the same way.

Exhibit 7-6 presents the net savings factor results by measure and overall. As shown, the survey results indicate that, overall, 67% of the measures installed would not have been installed had it not been for the ECS program and/or related services (e.g., DSM, WAP).

Exhibit 7-6

Net Savings Factors by Measure

Measure:	Net Savings Factor:	Measure:	Net Savings Factor:
Glass patch	100%	Crawl space insulation	66%
Radiator reflector	100%	Duct insulation	65%
Chimney plug	100%	Door weatherstripping	64%
Lighting fixture adapter	100%	AC filter clean/repl	63%
Attic vents	100%	Basement wall insulation	62%
Pulley seal	94%	Door sweep	61%
Storm windows	88%	Clock thermostat	59%
Compact fluorescent	88%	Storm door	55%

bulbs			
Outlet/switch plate gasket	86%	Attic insulation	52%
Intermittent ignition device	83%	Heating pipe insulation	52%
DHW tank wrap	80%	New window	52%
DHW temp. set back	80%	Burner replacement	50%
DHW low-flow device	80%	Rim joist insulation	50%
Refrig. coil cleaning	80%	Wall insulation	49%
Draft covers	79%	Floor insulation	49%
Attic hatch insulation	78%	Flue damper	48%
Boiler reset	78%	Caulking	44%
DHW pipe insulation	77%	New heating system	29%
Window weatherstripping	74%	Window insulation	8%
Interior plastic storm window	72%	New door	0%
Overall Average: 67%			

7.3 Estimates of Gross and Net Energy Savings

This section describes the sources from which energy savings estimates were derived, as well as the application of the results presented above to quantify the final savings estimates for the FY95 ECS program.

7.3.1 Derivation of Energy Savings Estimates

Estimates of gross energy savings were developed by reviewing a number of different sources, including:

- ECS/Utility tracking databases (Baystate Gas, Berkshire Gas, Commonwealth Electric, and Boston Edison)[3];
- Wisconsin Center for Demand-Side Research: Measure Database;

- Other, Northeast region utility measure savings estimates; and
- Hagler Bailly estimates of energy savings from various sources.

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[3] Many utility databases were obtained for the purposes of developing samples to be used in administering the participant telephone survey. These four utility databases were found to have the most complete documentation and data regarding energy savings estimates and, as a result, were considered good sources for the impact analysis.

The first step in arriving at measure-specific energy savings estimates was to review the estimates contained in the ECS/utility tracking databases. Where sufficient data existed, average energy savings estimates were calculated at the per-unit and per-household level. These averages were compared across the different ECS/utility databases to determine the range of estimates incorporated within these databases.

This range of estimates was then compared to other sources, such as the WCDSR measure database, other Northeast region utility databases, and Hagler Bailly internal databases, to determine the appropriate per-unit and/or per-household energy savings estimate to use in this analysis. For the most part, the average energy savings estimates derived from the ECS/utility tracking databases were found to be fairly reasonable. Appendix G in Volume III contains more details on the assumptions used to derive energy savings estimates for each of the ECS measures installed.

7.3.2 Gross and Net Energy Savings Impacts

Results for FY95 ECS Evaluation Sample

Exhibit 7-7 presents a summary of the gross and net energy savings impacts resulting from measures installed by FY95 participants included in the evaluation sample[4]. As shown, first-year[5] net energy savings impacts attributable to the standard ECS program represent about 65% of the total net energy savings calculated for the evaluation sample, or about 3.9 billion BTUs of 5.9 billion BTUs. Net energy savings attributable to ECS/DSM piggyback services account for another 21%, or about 1.3 billion BTUs, and another 14%, or 0.8 billion BTUs, in net energy savings is attributable to the DSM/WAP programs.

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[4] Savings presented in this exhibit are representative of the evaluation sample. See discussion under "Extrapolation of Evaluation Results to FY95 ECS Participant Population" for energy savings estimates that are representative of the entire FY95 ECS participant population.

[5] Savings are presented for first-year impacts only. The effects of persistence should be taken into account when estimating savings over the life of the measures installed.

Exhibit 7-7

First-Year Energy Savings Impacts for FY95 ECS Evaluation Sample

(100,000 BTUs)

Program Category:	Gross Energy Savings:	Net Energy Savings:	Percent of Total Gross Energy Savings:	Percent of Total Net Savings:
Standard ECS	**59,322**	**38,572**	**65%**	**65%**
ECS/DSM Piggyback	16,081	12,719	18%	21%
DSM/WAP	15,581	8,154	17%	14%
All Programs:	90,984	59,445		

Exhibits 7-8 and 7-9 summarize the first-year net energy savings results for the FY95 ECS evaluation sample according to different fuel types, measure/end-use types, and program/service categories[6].

[7] Savings estimates do not account for interactivity between measures.

As shown in Exhibit 7-8, of the nearly 4 billion BTUs in first-year net energy savings attributable to the standard ECS program, nearly half (48%) is associated with measures that save natural gas, and a significant portion (28%) is associated with measures that save oil. Only about 11% is associated with measures that save electricity, and another 13% is associated with measures that save other fuels (e.g., propane, wood).

Exhibit 7-8

First-Year Net Energy Savings Impacts By Fuel Type and Program/Service Category

for FY95 ECS Evaluation Sample (100,000 BTUs)

Fuel Type:	Electricity		Natural Gas		Oil		Other Fuels (e.g., propane, wood)		All Fuels
Program Category:	**Net Savings**	**Percent of Total Net Savings**	**Net Savings**	**Percent of Total Net Savings**	**Net Savings**	**Percent of Total Net Savings**	**Net Savings**	**Percent of Total Net Savings**	**Total Net Energy Savings**
Standard ECS	**4,063**	**11%**	**18,624**	**48%**	**10,786**	**28%**	**5,098**	**13%**	**38,572**
ECS/DSM Piggyback	3,343	26%	9,376	74%	0	0%	0	0%	12,719
DSM/WAP	32	0%	7,360	90%	762	9%	0	0%	8,154
Total Net Savings by Fuel Type:	7,439	13%	35,360	59%	11,548	19%	5,098	9%	59,446

Exhibit 7-9

First-Year Net Energy Savings Impacts By Measure/End-Use Type and Program/Service Category

for FY95 ECS Evaluation Sample (100,000 BTUs)

Measure/ End-Use Type:	Electric Appliance Efficiency Measures:		Lighting Measures:		Space Heating Measures:		Water Heating Measures:		All Measures
Program Category:	**Net Savings:**	**Percent of Total Net Savings:**	**Net Savings:**	**Percent of Total Net Savings:**	**Net Savings:**	**Percent of Total Net Savings:**	**Net Savings:**	**Percent of Total Net Savings:**	**Total Net Savings:**
Standard ECS	**449**	**1%**	**722**	**2%**	**24,636**	**64%**	**12,764**	**33%**	**38,572**
ECS/DSM	276	2%	1,691	13%	1,031	8%	9,721	76%	12,719

Piggyback									
DSM/WAP	0	0%	0	0%	8,154	100%	0	0%	8,154
Total Net Savings by Measure/End-Use Type:	726	1%	2,413	4%	33,821	57%	22,485	38%	59,446

Exhibit 7-9 summarizes the first-year net energy savings results for the FY95 ECS evaluation sample according to different measure/end-use types and program/service categories. As shown, of the nearly 4 billion BTUs in net energy savings attributable to the standard ECS program, about two-thirds (64%) is associated with space heating measures and 33% is associated with water heating measures.

Overall, the results presented in Exhibits 7-7 through 7-9 suggest that only modest levels of energy savings have been achieved through the standard FY95 ECS services. In fact, when looking only at ECS audit recommendations (i.e., excluding direct install measures and other DIY purchases), only about 10% of the potential energy savings from audit recommendations has been realized. This finding does not vary significant according to the "level" of energy savings potential for specific audit recommendations. That is, audit recommendations with "high savings potential" were implemented only slightly less frequently than audit recommendations with "low savings potential"[7]. Therefore, across all audit measure types, relatively few measures were implemented and only modest levels of energy savings have been achieved through the standard ECS program. Exhibit 7-10 presents "realization rates" by measure type for first-year energy savings from ECS audit recommendations.

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[7] Audit measures were grouped according to their level of potential energy savings, such that measures with potential energy savings greater than 100 therms were assigned to the "high savings potential" category, measures with potential energy savings greater than 30 therms but less than 100 were assigned to the "moderate savings potential category", and measures with energy savings greater than 0 therms but less than or equal to 30 were assigned to the "low savings potential".

Exhibit 7-10

Realization of First-Year Energy Savings from ECS Audit Recommendations

(100,000 BTUs) [1]

ECS Audit Recommendations:	Number of Audit Recommendations:	Number of Installations:	Potential Energy Savings from	Realized Energy Savings from	Realization Rate:

			All Audit Recommendations:	Installed Recommendations:	
Attic insulation	273	49	30,862	5,496	18%
Wall insulation	237	25	23,884	2,499	10%
Clock thermostat	441	38	44,585	3,833	9%
New heating system	231	11	48,690	2,339	5%
Summary: High Savings Potential Measures [2]	*1,183*	*123*	*148,020*	*14,167*	*10%*
Heating pipe insulation	261	72	13,328	3,666	28%
Duct insulation	143	18	6,713	824	12%
Crawl space insulation	33	3	3,101	289	9%
Floor insulation	270	23	11,793	1,020	9%
Flue damper	92	4	5,342	255	5%
Intermittent ignition device	65	3	3,704	172	5%
Burner replacement	92	3	6,788	227	3%
Rim joist insulation	45	1	1,766	22	1%
Summary: Moderate Savings Potential Measures [2]	*1,001*	*127*	*52,535*	*6,476*	*12%*
Door weatherstripping	36	14	240	97	40%
Window weatherstripping	65	22	1,036	352	34%
New windows	28	5	916	154	17%
Window insulation (window quilt)	43	7	659	109	17%
Storm windows	74	11	1,971	295	15%
Storm doors	56	9	400	58	14%
New doors	12	1	154	15	10%
Basement wall insulation	38	2	1,008	46	5%

Boiler reset	177	7	3,168	124	4%
Door insulation	5	0	62	0	0%
Summary: Low Savings Potential Measures [2]	*534*	*78*	*9,613*	*1,249*	*13%*
All Recommendations:	2,718	327	210,169	21,891	10%

[1] This exhibit summarizes results for the evaluation sample only. In addition, the potential energy savings results reflect ECS audit recommendations only, and only those recommendations implemented **outside of** utility DSM programs, the ECS/DSM piggyback services, and the WAP program are included in the calculation of realization rates.

[2] Audit measures were grouped according to their level of potential energy savings, such that measures with potential energy savings greater than 100 therms were assigned to the "high savings potential" category, measures with potential energy savings greater than 30 therms but less than 100 were assigned to the "moderate savings potential category", and measures with energy savings greater than 0 therms but less than or equal to 30 were assigned to the "low savings potential".

Extrapolation of Evaluation Results to FY95 ECS Participant Population

A total of 55,822 residents of Massachusetts participated in the ECS program during FY95 according to DOER year-end production data. In order to extrapolate the evaluation results to this participant population, the average energy savings estimate per ECS participant was derived. Looking only at first-year net energy savings attributable to the standard ECS program, this would amount to about 4 million BTUs per participant, or 40.69 therms. This is equivalent to the installation of, for example, a low-flow showerhead and a DHW tank wrap. Extrapolating this average to the entire FY95 ECS participant population produces about 227 billion BTUs in first-year net energy savings that are attributable to the standard ECS program.

Some ECS participants, however, also received measure installations via ECS/DSM piggyback services. The average first-year net energy savings for participants receiving ECS/DSM piggyback services in addition to the full set of standard ECS program services is about 5 million BTUs, or 54.10 therms. Extrapolating this average to the entire FY95 ECS participant population raises the total first-year net energy savings attributable to both the standard ECS program and ECS/DSM piggyback services combined to about 300 billion BTUs.

Finally, some participants also received additional measure installations via DSM/WAP services. The average first-year net energy savings for participants receiving DSM/WAP services, the full set of standard ECS program services, and ECS/DSM piggyback services, is about 6 million BTUs, or 62.71 therms. This brings the total first-year net energy savings results for all program categories up to about 350 billion BTUs.

The extrapolation of evaluation results to the FY95 ECS participant population is summarized in Exhibit 7-11. Appendix G in Volume III presents additional tables displaying the energy savings impacts by program/service category, fuel types, and measure/end-use types.

Exhibit 7-11

Extrapolation of First-Year Net Energy Savings Impacts

to FY95 ECS Participant Population (100,000 BTUs)

Program/Service Category	Net Energy Savings for Evaluation Sample:	Average Net Energy Savings Per Participant [1]:	Net Energy Savings for FY95 Participant Population [2]:
Standard ECS	38,572	40.69	2,271,272
Standard ECS, and ECS/DSM Piggyback	51,291	54.10	3,020,218
Standard ECS, DSM/WAP and ECS/DSM Piggyback	59,445	62.71	3,500,357
[1] FY95 Evaluation Sample Size = 948. [2] FY95 ECS Participant Population = 55,822.			