Fitchburg Gas and Electric Light Company, Massachusetts Electric Company, NSTAR, and Western Massachusetts Electric Company

The Remaining Electric Energy Efficiency Opportunities in Massachusetts

Final Report

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1 Executive Summary

The Massachusetts electric utility distribution companies have been leaders in the delivery of successful energy-efficiency programs since the late 1980's. The electric utilities have worked in cooperation with the Massachusetts' Department of Telecommunications and Energy (DTE) and other interested non-utility parties in the design and delivery of this important demand-side resource. The funding horizon for the current energy-efficiency charge sunsets in 2002 and the Division of Energy Resources (DOER) is mandated to assess whether funding should continue beyond 2002. This assessment is based upon barriers customers face to investing in energy efficiency, the economic and environmental impacts of such activities, and the extent to which the competitive energy-efficiency market is providing energy-efficiency services to customers. The focus of this study is to provide information that will support DOER's recommendation. Specifically, the RLW project team sought to answer the following key questions:

#1. What are the remaining electric energy-efficiency opportunities in the residential and commercial and industrial (C&I) customer sectors in Massachusetts[1]?

#2. What portion of these remaining electric energy-efficiency opportunities is likely to be achieved over the five-year period (2003-2007) absent further ratepayer funding[2]? Conversely, what proportion is likely to be achieved given continued ratepayer funding[3]?

#3. What market barriers prevent further development of competitive markets for electric energy-efficiency products and services, and how might these barriers be addressed?

#4. What is the current role of the evolving competitive energy service market in providing electric energy-efficiency products and services to customers, and how might that role change in the near future?

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[1] Specifically, we estimated the remaining economic potential savings. Economic potential is that portion of the energy savings available that is societally cost effective to install (i.e., all cost benefits were included). Economic potential between 2003-2007 indicates societally cost effective savings opportunities that are available during this period of time. It was important to bound the economic potential over a specific time horizon to accommodate the analysis of measures under replacement on failure and new purchase situations.

2 Specifically, we estimated 'Without Funding' savings. Without Funding is that portion of economic potential savings that would be achieved if energy-efficiency funding were to be discontinued; i.e., this potential is equivalent to naturally occurring energy savings. The impact of standard and code changes during the forecast horizon is captured in this scenario.

3 Specifically, we estimated 'With Funding' savings. With Funding savings is the portion of the economic potential savings that could be achieved given the continuation of recent DSM expenditure levels. Recent ratepayer funding for energy-efficiency programs is mandated to continue through 2002 at decreasing levels of 3.3 mills3/kWh in 1998, 3.1 mills/kWh in 1999, 2.85 mills/kWh in 2000, 2.7 mills/kWh in 2001, and 2.5 mills/kWh in 2002.

Project Overview

The directive for this study was to complete as much of the analysis as possible with secondary information. Primary data collection was reserved for customer surveys directed at identifying and classifying barriers. Table 6 presents the key questions and sectors studied in this evaluation, along with the data sources utilized to inform the team's response to each key question. These methods were adapted to each sector involved in the study to ensure that resources were utilized efficiently and in a way that best met the evaluation objectives. The spreadsheet analysis performed for the residential and small C&I sectors included identifying the relevant energy efficiency measures for analysis, determining which market events (retrofit, replacement, etc.) were appropriate for analysis, and determining remaining efficiency opportunities through use of secondary information. Data sources used in this analysis included, but were not limited to, impact evaluation savings estimates, the proportion of treated homes in programs for individual measures, market share results from previously performed Delphi panels, and past free ridership rates.

Table 1: Summary of Data Sources Used in Analysis of Sectors

	Sector			
Key Question #	**Residential**	**Small C&I (< 100 kW)**	**Medium & Large C&I (100 kW- 5,000 kW)**	**Very Large C&I (>5,000 kW)**
1	Spreadsheet Analysis of Secondary Data	Spreadsheet Analysis of Secondary Data	Triangulation of 'expert panel' and 'bottom-up' methods[4]	On-site Visits with Facility Walkthroughs
2	Spreadsheet Analysis of Secondary Data	Spreadsheet Analysis of Secondary Data	Triangulation of 'expert panel' and 'bottom-up' methods	On-site Visits with Facility Walkthroughs
3	Telephone Customer Surveys	Telephone Customer Surveys	Telephone Customer Surveys and Focus Groups	Telephone and on-site Customer Surveys and Focus Groups
4	Competitive Retail Supplier and Energy Service Company Interviews, and Secondary research on international experience and other U.S. experience			

The following sections present our answers to aforementioned questions.

Key Question #1: Remaining Economic Potential

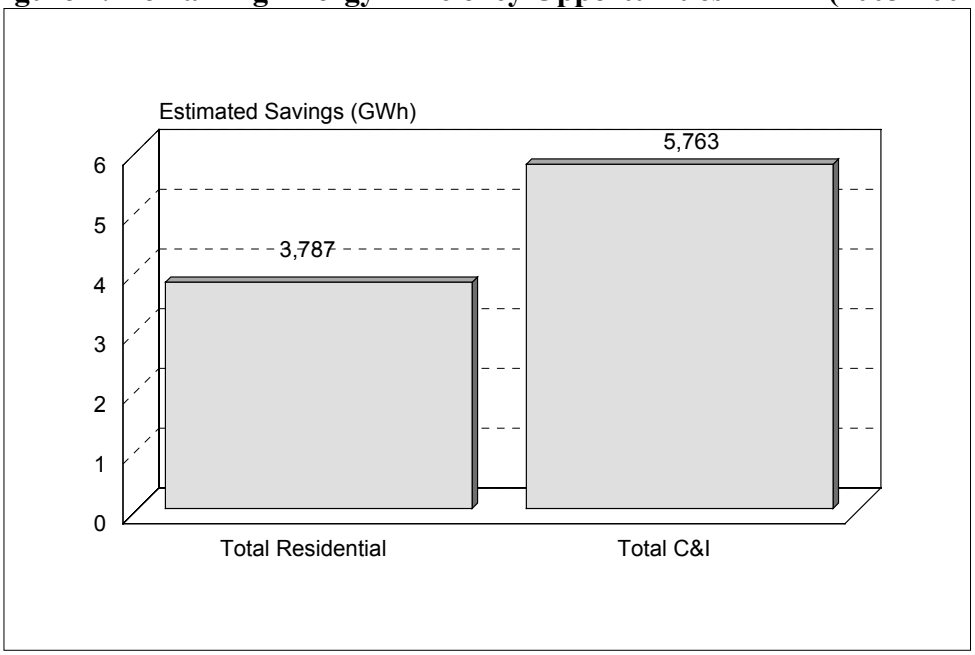
What are the remaining electric energy-efficiency opportunities in the residential, and the commercial and industrial (C&I) customer sector in Massachusetts?

Since the late 1980s, the Massachusetts electric utilities working in cooperation with the Massachusetts' Department of Telecommunications and Energy and other interested non-utility parties have set a high standard in the design and delivery of energy-efficiency programs in the Commonwealth. In spite of this national leading effort, there continues to be a substantial amount of cost-effective energy-efficiency opportunities beyond the cost-effective measures that have been targeted.

[4] The 'expert panel' approach is a 'top-down' method that utilizes the estimates of a panel of experts from both utility and non-utility parties. The 'bottoms-up' approach refers to the estimation of savings based upon group reports of past experience with selected facility improvements.

Figure 1 presents our estimate of the remaining energy-efficiency opportunities[5] (EE opportunities) from 2003 through 2007 by major customer sector. For the residential class, the EE opportunities are estimated to be 3,787 GWh. For the residential class, this is approximately 31 percent of the annual class consumption from billing data from Massachusetts customers in 2000 (12,290 GWh). A relatively small proportion (5%) of these residential EE opportunities are estimated to come from emerging technologies. For the C&I sector, the remaining EE opportunities are estimated to be 5,763 GWh, or 21 percent of the annual class consumption from Massachusetts C&I customer billing data in 2000 (27,656 GWh). In contrast to the residential class, one-third of the C&I economic potential is estimated to be related to emerging technologies. The analysis of both sectors indicates ample opportunity for continued funding to achieve a significant reduction in customer electricity use.

Figure 1: Remaining Energy-Efficiency Opportunities in MA (2003-2007)



Key Question #2: With Funding and Without Funding Potential

What portion of these remaining electric energy-efficiency opportunities is likely to be achieved over the five-year period (2003-2007) absent further ratepayer funding? Conversely, what proportion is likely to be achieved given continued ratepayer funding?

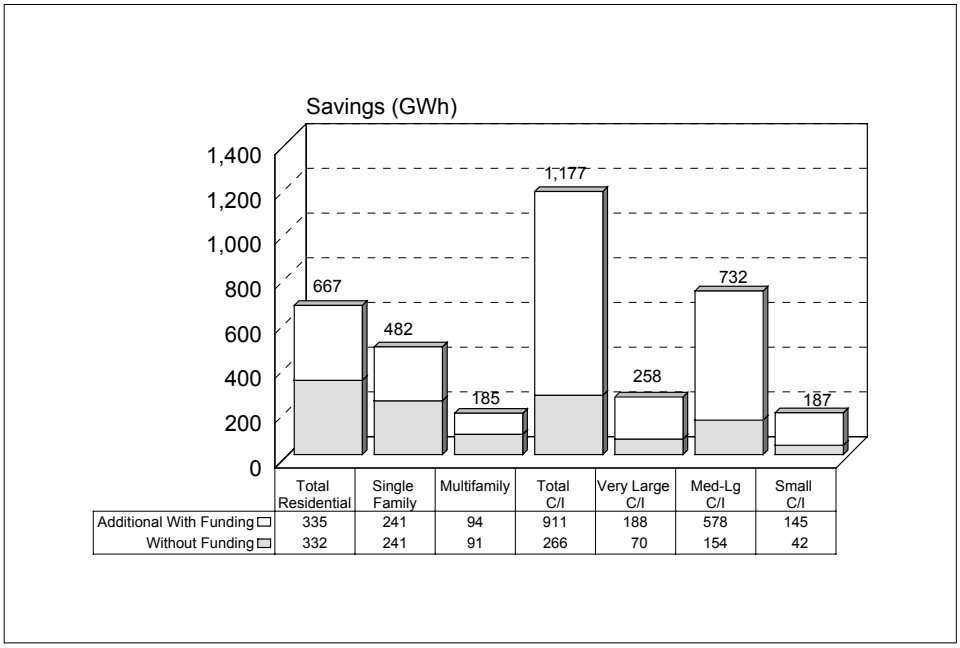
Figure 2 summarizes our estimates under the "without funding" and "with funding" scenarios. This figure presents the results for each class and selected segments within the sector. The "with funding" estimates assume that funding levels would be similar to recent public expenditures.

For the residential sector, in the absence of ratepayer funding we estimate that customers would implement 332 GWh of savings, or approximately 9% of the total residential economic

[5] The "remaining energy-efficiency opportunities" is generally defined as the economic potential of achieving electricity savings that are deemed to be cost-effective from a societal perspective. See technical appendices for further description and limitations of the economic potential analyses.

potential[6]. With continued ratepayer funding[7] (the "with funding" scenario) we estimate additional savings of 335 GWh over what would be achieved without funding, for a total of 667 GWh from 2003-2007. These incremental savings are double what would be achieved without continued funding and the combined savings are equivalent to 18% of the economic potential achieved during the 2003-2007 time period. Figure 2 also presents the total residential savings distributed between the single-family and multifamily customer segments. The majority of the savings (72%) are associated with the single-family segment.

Figure 2: With Funding and Without Funding Savings (2003-2007)



	Total Residential	Single Family	Multifamily	Total C/I	Very Large C/I	Med-Lg C/I	Small C/I
Additional With Funding	335	241	94	911	188	578	145
Without Funding	332	241	91	266	70	154	42

For the C&I customer class, in the absence of ratepayer funding, we estimate savings of 266 GWh or less than 5% of the economic potential during the 2003-2007 time period. In contrast, under the continued funding scenario we estimate that an additional 911 GWh savings would be achieved, for a total of 1,177 GWh from 2003-2007. These incremental savings are nearly three and one-half times greater than the without funding scenario and the combined savings represent 20% of the economic potential. At the segment level, the majority of the savings are associated with the medium to large C&I customers. In addition to this group of customers, the very large C&I customers continue to present opportunities for substantial energy-efficiency savings.

There are some notable differences between the residential and C&I savings estimates. For instance, as noted above, the incremental savings for the residential sector under the "without funding" scenario is roughly equal to what would be achieved absent continued funding. For the C&I sector, however, additional savings from ratepayer-funded programs are estimated to be roughly 3.5 times greater with continued funding compared to without funding. A potential reason for this difference is that recent program activity has focused upon C&I potential savings which might tend to drive up the "with funding" estimate for the C&I sector relative to the

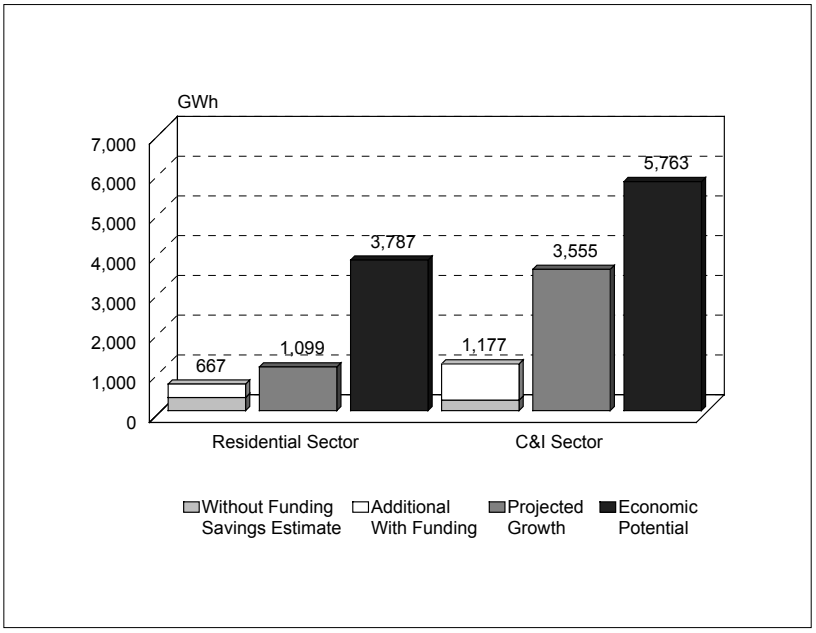
[6] Residential "without funding" estimates in this report do not include savings from low-income programs, for which funding is mandated indefinitely pursuant to the Electric Restructuring Act.
[7] The "with funding" savings estimate assumes funding levels of approximately 2.7 mills per kWh based on historical program expenditures over the period 1995 to 2000.

residential sector. Another potential reason is that the without funding estimate for C&I was thought to be conservative, which could also be producing the observed difference.

Figure 3 illustrates the impact that energy-efficiency savings would have in terms of offsetting projected growth[8] in electricity use over the period 2003-2007. Given 667 GWh of total savings acquired with continued funding in the residential sector, continuation of ratepayer-funded energy-efficiency activities would offset roughly 61 percent of forecasted growth for this sector over the five-year period. Similarly, for the C&I sector, Figure 3 compares potential with funding savings of 1,177 GWh with a forecasted growth of 3,555 GWh, thus offsetting electricity demand growth over this period by an estimated 33 percent. It is clear from the figure that the available savings (the economic potential) far exceeds the forecasted growth, thus showing that if all remaining energy-efficiency opportunities could be captured, they would more than offset growth in electricity demand.

Finally, it is important to note that the savings estimates provided above do not account for additional savings that could be achieved under a "with *aggressive* funding" scenario in which new energy-efficiency programs and emerging technologies are targeted. While the research team estimated the magnitude of these potential savings over the 2003-2007 timeframe, as discussed in Section 4, the focus of this report is on the potential savings to customers under the "with funding" scenario.

Figure 3: Comparison of Savings Estimates with Projected Growth (2003-2007)



Key Question #3: Market Barriers and Strategies

What market barriers prevent further development of competitive markets for electric energy-efficiency products and services, and how might these barriers be addressed?

[8] The projected growth values are based on forecasted sales developed by the electric distribution companies, which include downward adjustments to reflect anticipated energy-efficiency program savings. For the purposes of our analysis, these downward adjustments (based on historical program savings over past five years) have been excluded so as to appropriately reflect forecasted growth absent future funding for energy-efficiency programs.

Historically, the Massachusetts distribution utilities have identified and targeted market barriers in the interest of improving the adoption of energy efficient products and services among their customers. Many elements of program design such as incentive levels and marketing strategies have sought to address identified market barriers and successfully moved particular measures beyond these barriers. While this study suggests that barriers reminiscent of those identified in previous studies remain within and among the various market players examined, it is important to note that they may be applicable to a different set of measures and practices. In this regard, it is important to note that utilities have moved many technologies into common practice by moving them beyond barriers, but new measures and technologies are experiencing the same barriers in the marketplace today.

As part of this study, we analyzed barriers that different types of customers face to investing in energy efficiency, as well as barriers that energy-efficiency service providers (EESP) and competitive retail suppliers (CRS) encounter in selling energy-efficiency products and services to customers.

Residential Customer Barriers. A survey was conducted to identify market barriers that residential customers face to investing in energy efficiency. The survey focused on questions regarding three technologies: compact fluorescent lamps (CFLs), refrigerators, and air sealing. Table 2 below summarizes the primary barriers identified for each technologies, and provides recommended strategies to overcome the highest identified barriers for CFLs and refrigerators, and broad marketing strategies to develop understanding and knowledge about air sealing. These marketing measures are recommended with the assumption that many barriers relate to a lack of education and understanding about the energy efficient product or measure, and recognizes that purchasing decisions are more than just rational economic choices. It is important to note that while the barriers are based upon survey results, the strategies to overcome the barriers are based upon the teams past experience and opinions.

Table 2: Residential Market Barriers and Strategies

Barriers and Strategies to Overcome Residential Barriers	
CFLs – Lack of availability, lack of awareness.	Work with manufacturers to develop retail sales: co-op advertising opportunities, spiffs for desirable shelf placements, and high visibility end cap displays
Refrigerators–Asymmetric information, first cost, and access to financing.	Continue to provide Energy Star marketing campaign to customers Improve and enhance countertop displays and materials that clearly show real-life savings projections for Energy Star labeled refrigerators Provide funding for easy eligibility low-cost/no-cost financing of Energy Star labeled refrigerators
Air sealing – general lack of understanding and knowledge.	Subsidize demonstrations at home improvement centers Create and implement promotional and descriptive newspaper and radio advertising Create first hand knowledge and word of mouth marketing in targeted neighborhoods by giving away free installations at home shows, chamber of commerce events, and other community functions

C&I Customer Barriers. The research team conducted a market barrier survey across a wide spectrum of C&I customers. The following tables summarize the findings of the C&I barrier research. Table 3 highlights specific market barriers encountered along with potential strategies to help overcome these barriers. For this presentation, we grouped these barriers into four categories: 1) Practices and Values, 2) Unavailability and Performance Uncertainty, 3) General Complacency, and 4) Lack of Perceived Need.

Table 3: C&I Market Barriers and Strategies

Barriers and Strategies to Overcome Practices & Value	
Long Payback	Education on long term operating costs, promotion of grants, quantification of non-energy and non-electric savings.
Inadequate time, financing difficulty	Provision of audit services and/or low-cost/no-cost financing may alleviate need for customer to have staff available to perform services on own or to have the money readily available.
Training too costly	Provision vendor of free/low cost group training, promote available low-cost training by non-profits or government agencies.
Barriers and Strategies to Overcome Unavailability & Performance Uncertainty (Risk)	
Some EE equipment is difficult to get	Identify specialized and qualified vendors and bulk purchasing programs. Encourage manufacturers to produce more efficient equipment & reduce unit costs.
Performance Uncertainty	Utilize case studies and testimonials. Facilitate customer-to-customer networking. Conduct emerging technology workshops. Provide performance guarantees. Utility quality control and co-investment increases customer's confidence.
Lack of trust for EE contractors	Develop project standards, facilitate contractor/user breakfast meetings. Provide utility sponsored energy-efficiency 'consumer protection' service, provide contractor training and qualification services (such as teaching how to market higher-end services and how to show customers there is a predictable return and more reliable service associated with those premium services), develop joint utility/contractor projects to define and market premium services.
Barriers and Strategies to Overcome General Complacency	
Reducing electric costs not important	Provide benchmarking services for specific industries.
Does not understand major electric end-uses	Provide quick and easy tools to estimate energy costs.
Does not track energy usage	Educate about value of tracking costs, and promote efficiency based upon societal and environmental performance. Demonstrate to the customer that real-time metering can provide useful information for managing demand and energy aspects of the customer's load. Furthermore, real time metering allows the customer to participate in current and future load management offerings.
Barriers and Strategies to Overcome Lack of Perceived Need	
Happy with current lighting design/HVAC	Promote new lighting and HVAC technologies, provide lighting design workshop, provide newsletters on available technologies, develop case studies showcasing lighting design projects (or testimonials), provide HVAC technology reports.
More important things	Identify links between efficiency improvements and customer priorities.
No additional energy-efficiency opportunities	Provide benchmarking services for specific industries.

Table 4 presents a ranking of each factor based on the survey responses in each C&I sector of interest. The closer the barrier is to "5" the more likely that the barrier still exists within the

particular sector (all scores 3 and above are highlighted in bold). As evidenced by the table, Small C&I perceive more barriers preventing them from pursuing energy-efficiency activities. Generally, barriers appear to be associated with the size of the customer, with most gradually diminishing as customer size increases, although Practices and Value appears to be relevant to all customers surveyed. In fact, no factor received a score above 3 in either the very large C&I sector or the large commercial sector.

Table 4: Barriers by Sector

Factor	Small C&I	Medium Com.	Medium Ind.	Large Com.	Large Ind.	Very Large C&I
Practices and Value	**3.65**	**3.51**	**3.54**	2.98	**3.14**	2.73
Lack of Availability or Performance Uncertainty	2.50	2.47	2.56	2.39	2.38	1.54
General Complacency	2.01	1.87	1.88	1.64	1.68	1.47
Lack of Perceived Need	**3.27**	2.77	2.98	2.90	2.82	2.79

In addition to customer surveys, focus groups were conducted for Large and Very Large C&I customers. When asked about factors that limited or blocked approval of energy efficiency projects, focus group members described and elaborated on issues and concerns consistent with those discussed in the survey results regarding barriers that affect large and very large C&I customers, including the following:

- Many proposals for energy-efficiency improvements in this sector were subject to the same barriers that impede energy-efficiency projects for smaller, less knowledgeable companies, such as limited knowledge about certain technologies and split incentives.
- The most serious barrier for most focus group members was the set of internal practices at their companies. These practices included not only stringent requirements for payback or return on investment, but also strong competition for internal resources against projects offered by other departments.
- As would be expected, hassle or transaction costs as well as concerns about potential inconveniences to customers may act as barriers to energy-efficiency projects. Examples of transaction costs include changes to production facilities or operating hours. Potential inconveniences to customers include such things as changes in lighting quality.

The focus groups also gathered other important information on the large and very large C&I sectors. First, the focus groups indicate that many projects undertaken by these sectors are motivated by factors other than an interest in energy efficiency *per se*. These factors include interest in improved load factors, fuel-switching, and demand reduction. Second, many of the large and very large C&I customers have participated in energy conservation programs in the past, and indeed several have participated more than once. Third, electric ratepayer energy-efficiency funding has been of considerable value to this sector, both with respect to supplementing internal funding and the value of technical assistance provided through the electric utility administered programs. Fourth, large and very large C&I customers generally do not find the current efficiency offerings of competitive retail suppliers to be of high value.

Energy-Efficiency Service Provider and Competitive Retail Supplier Barriers. EESP and CRS virtually ignore the residential and small C&I customers primarily due to the high acquisition or transaction costs, customer education barriers, low gross profitability, and the

separation of motivations between a property owner and renters. EESP and CRS appear to generally follow the 'easy money path'. EESP and CRS cited a litany of internal barriers (i.e., within the company) and external barriers (i.e., outside the company) preventing their firms from offering energy-efficiency services to different types of customers.

The major internal barriers and obstacles to the provision of energy efficiency services include:

- Some CRS firms are too small for EESP and CRS to provide a broad menu of services or to offer energy services,
- The return on energy-efficiency offerings do not meet CRS profitability requirements, and
- Energy-efficiency services are complex and require a degree of expertise or staffing that is beyond a CRS's willingness to invest at this time. Also, EESP do not spend significant time engaging large customers with their services.

The major external barriers and obstacles to the provision of energy efficiency services include:

- The economic climate, as it relates to low perceived energy costs (at least relative to other expenditures),[9,10]
- Requirements to provide supplier credits, ancillary services, and reserves at the front end of CRS offerings (e.g., provision that requires all suppliers to comply with the backup and safety requirements of traditional utilities),
- Considerable time and effort is needed to educate customers contacted by CRS and EESP about energy efficiency (i.e., high transaction costs),
- Financial concerns stemming from corporate practices for C&I customers, e.g., the need to meet mandated payback or rate of return criteria (indicates the loss of momentum for energy-efficiency projects as they move up the corporate ladder),
- Costs involved in shutting down service to accommodate improvements (e.g., shutting down an assembly line) for some industrial customers, and
- Some commercial customers are dependent on access to financing, which requires sellers to bring capital funding to the project.[11]

Other barriers and obstacles to the provision of energy efficiency services include:

- The lack of attention given to energy issues by C&I customers in cases where energy costs are a very small proportion of the budget, 9
- Some industries where energy is a crucial input have their own expert staff and thus a limited need for external resources (a barrier to using CRS/EESP, but is a positive result overall),
- The long decision cycles that characterize some large, complex customers increasing transaction time, and therefore, costs, and
- Difficulty in changing some residential customer behavior/habits regarding electricity use.

[9] It should also be noted that the interviews took place before the effects of any 2001 rate increases.
[10] It was reported by a non-utility party representing medium/large C&I customers that corporate management typically takes notice of energy costs when they exceed 2% of the cost of goods or services.
[11] CRS report that, in contrast to commercial customers, industrial customers typically have ready access to capital.

Key Question #4: Role of the Energy Service Market

What is the current role of the evolving competitive energy service market in providing electric energy-efficiency products and services to customers and how might that role change in the near future?

CRS fail to deliver energy efficiency to a broad customer base. A fundamental reason that CRS are not providing energy-efficiency services to a broad customer base in Massachusetts stems from the fact that a competitive market for electricity services has yet to develop due to low competing standard offer rates[12]. Table 5 presents data[13] on migration of Massachusetts customers from their local distribution company to CRS firms. These migration data support the information collected from the CRS interviews. Only among large C&I accounts have the CRS made any inroads to selling electricity to customers -- and their market share in that sector is well below 10%. In no other sector have more than one percent of the customers switched to CRS firms for power services. Thus, even if energy-efficiency offerings from CRS were successful, they would represent a miniscule portion of the customer base that would be receiving energy efficiency from those providers in the near future.

Table 5: Status of Customers Migrating to CRS

February 2001	Competitive Generation				% Competitive	
	Total Number of Customers Switched to Competitive Generation (A)	GWh of Competitive Generation Used for Month (B)	Total Customers (C)	Total GWh Sales (D)	Customers (A/C)	Energy (B/D)
Residential	2,514	2.91	2,061,164	1,267.19	0.12%	0.23%
Small C/I	145	1.98	247,824	376.09	0.06%	0.53%
Medium C/I	205	13.07	20,733	650.85	0.99%	2.01%
Large C/I	411	180.44	6,164	1,337.26	6.67%	13.49%

It remains to be seen whether involvement of CRS in the market results in any increase in efficiency investment or just a transfer of work from other EESP. In our interviews there were few CRS that believed that efficiency services played a key role in the sale of electricity. It is possible (albeit difficult to predict) that this may change if higher electricity prices persist, as a larger competitive market for electricity sales develops, and as customers master commodity purchasing and therefore have the time to pursue more sophisticated packages that include bundled efficiency/power products. There were several CRS that indicated that they would reassess launching energy-efficiency services when full retail competition occurs in Massachusetts. However, the interviews support the notion that even in states where deregulation has matured there is still limited energy-efficiency services offered by CRS.

The residential, small commercial and industrial sectors are underserved. CRS indicated that residential customers get the least amount of attention because of an education barrier, a lack of interest, and a lack of profitability. There were no CRS that served just residential customers in the sample contacted. Many of the same barriers were reported by EESP as the reasons why they do not target the residential and small C&I market. In the interviews, CRS reported that they

[12] Standard offer rates are set to expire in March of 2005.
[13] These data were provided by MA DOER and are for February 2001.

concentrate on the large commercial, industrial, governmental, and institutional areas for both their sale of commodity and energy services.

Generally, CRS firms seek large customers who are currently inefficient, have a sizeable portfolio of buildings, a corporate commitment to improve energy efficiency, and centralized decision making and control over satellite sites. While it is clear that there are large customers with opportunities according to the very large on-sites, it is difficult to determine the number of customers that meet the criteria of an 'ideal' customer from the CRS point of view. There may be other customers that CRS would provide services to that are less profitable than this 'ideal' customer, but the interviews seem to suggest that they (the CRS) are not aggressively targeting them.

EESP reported they target commercial, government and institutional, but do not target industrial and residential customers. In addition, EESP "ideal" customers were described as having either a project that is at least $1 million, a bill over $100K or more, or a size of at least 100,000 square feet. While it is difficult to assess how many customers in Massachusetts meet these conditions, it is clear that the majority of customers do not appear to be profitable by these standards. This is despite the analysis discussed earlier, which indicates significant energy savings opportunities among the C&I sectors for EESP to target. Both the CRS and EESP ideal customers do not appear to include the residential or small C&I markets.

CRS entrance into the market is seen as positive by EESP. The entry of more competitive retail suppliers is seen as making a positive impact in raising customer awareness and broadening the market, but at the same time some EESP perceive that the entry of such firms may impinge on their own market share. The competitiveness of the standard offer rate in Massachusetts is having a dampening effect on the entry of CRS into the state and therefore the synergy between these market actors.

Many EESP are dependent on energy-efficiency funding. Many EESP are dependent on the energy-efficiency funding and the education and awareness generated by ratepayer-funded programs to sustain their level of project work. In fact, 19 EESP respondents reported that an average of 67% of their projects use MA energy-efficiency funds. Specifically, 70% of the traditional Energy Service Companies (ESCOs) contacted, 100% of the Medium sized EESP contacted, 100% of the design/architectural/engineering firms contacted, and 40% of the Trade companies contacted reported that they use these funds. In addition, it was reported by respondents that an average of 55% of their projects would be negatively impacted if MA energy efficiency were to cease, driven primarily by medium-sized EESP firms and Design/architectural/engineering firms that reported that between 71%-73% of their projects would be negatively affected. It is important to note that it is not known what size projects the 55% estimate would include, nor whether future EESP projects would receive funding due to changing energy-efficiency program criteria.

EESP are optimistic about their growth potential in Massachusetts. EESP are optimistic about their growth potential in Massachusetts, based upon questions regarding expected growth trends over the next 2-3 years. Anecdotally, respondents seemed to feel that continued funding contributed to this optimism. This includes likely opportunities for performing efficiency services outsourced by CRS.

Recommendations

The following recommendations are based predominantly upon the findings of this study. However, this study also included a review of national and international experience, which suggested that information available from other more fully deregulated markets should be considered as part of the process of deciding whether to continue funding to support residential and C&I energy-efficiency programs. Preliminary results from these deregulated markets suggest that public funding of efficiency is paramount to ensuring continued energy conservation following deregulation in some sectors.

Residential Energy Efficiency. Based upon the results from this study, the research team believes that funding of residential sector energy-efficiency programs will be necessary if the policy goal is to capture a considerable portion of remaining energy-efficiency opportunities over the forecast horizon. This recommendation rests on the following points:

1. The projections of economic potential remaining in the residential sector that can be achieved indicate a significant opportunity for continued funding to target. Only 332 GWh of savings would likely be achieved in the absence of such funding, whereas twice that amount would be achieved if funding were to continue at levels consistent with recent expenditures. Under a more aggressive funding scenario, which would target new programs and emerging technologies, an even higher percentage of the estimated savings potential could be achieved.
2. Continued funding for the residential sector appears to be particularly important as EESP and CRS interviews indicate that little activity is being directed to this market with the exception of EESP who participate in ratepayer-funded programs as a vendor (e.g., program implementers).
3. Barriers and obstacles to the adoption of energy efficient alternatives by consumers in the marketplace persist. Programs to overcome these barriers are not likely to be mounted in the absence of public funding.
4. The instabilities seen in other deregulated markets carry the risk of reliability problems and volatile energy prices. The research team believes that continued funding of these programs will help buffer customers from high energy prices.

C&I Energy Efficiency. The research team believes that funding of C&I sector energy-efficiency programs will be necessary if the policy goal is to capture a considerable portion of available electricity savings over the forecast horizon. This recommendation rests on the following points:

1. The projections of economic potential remaining in the C&I sector that can be acquired indicate a considerable opportunity for continued funding to target. Specifically, in the 2003-2007 time period, 1,177 GWh would be saved with funding continued at levels consistent with recent expenditures. However, there is limited likelihood of these savings being achieved in the absence of continued funding, with a mere 266 GWh of savings, or 5% of the economic potential. The Small C&I sector in particular appears to be the least likely to achieve significant savings without incentives.

2. Emerging technologies represent a significant opportunity for energy savings within the C&I sector, particularly within the Very Large C&I sector. This suggests that early promotion of these technologies by the utilities or third parties is necessary to ensure the potential savings arising from these technologies are realized. However, this would require higher funding levels than recent expenditures.
3. Barriers and obstacles to the adoption of energy efficient alternatives by C&I consumers in the marketplace persist, particularly in the Small C&I sector. This report provides suggested strategies to overcome the specific barriers identified.
4. Competitive Retail Suppliers are not providing energy-efficiency services to a broad base of customers. Specifically, interview results indicate that market dynamics such as the competitiveness of the standard offer and associated lack of migration of C&I customers to CRS has slowed the maturation of a competitive market in Massachusetts (one respondent estimated that the actual cost of supplying retail customers is up to 50% higher than what the retail customer can get under default service rate). The CRS market players are still struggling to make money on the electricity commodity with the small margins currently available. This leaves CRS little incentive to embrace added value services such as energy conservation.
5. The extent to which any energy-efficiency services are being provided to customers focuses on the large C&I sector. In addition, the small and medium C&I marketplace continues to show little demand for efficiency services, as customers do not appear to be fully aware of savings opportunities. The education process is still very long and transaction costs are high among C&I customers as well. The reported lack of profitability in certain C&I segments (especially the Small C&I market) is also hindering the provision of efficiency services by CRS and EESP firms alike. Utility intervention and funding still appears to be needed in order to provide small C&I customers the opportunity and means of reducing energy usage.
6. There appears to be strong support among EESP for maintaining existing funding. The majority feels that the success of many of their projects would be compromised if efficiency funding were to be eliminated.
7. Account executives appear to focus a significant amount of their time on energy efficiency rather than including other motivators as well as customer feedback in assessing a company's potential for program participation. Other barriers to success in recruiting participation include turnover of utility account executives and program participation databases that are not structured to help identify the responsible decisionmakers in large and very large companies.

2 Glossary of Terms

This section of the report defines several terms that are utilized throughout this report. They are provided below:

Baseline: The projections of energy efficiency assume certain baseline levels of efficiency. This baseline for this analysis assumes compliance, at a minimum, with current codes and federal appliance standards and also incorporates many advances in the efficiency of purchasing and design practices, which have occurred in part due to prior efficiency programs.

Competitive Retail Suppliers (CRS): Under deregulation of the electric industry, end-use customers are not limited to purchasing power from the traditional utilities providing the commodity in defined service territories. For the purposes of this report, we refer to the set of other market actors licensed to sell power in deregulated states as "Competitive Retail Suppliers" -- collectively, CRS.

Economic Potential: Economic potential is that portion of the energy savings available that is societally cost effective to install. Economic potential between 2003-2007 indicates societally cost effective savings opportunities that are available during this period of time. It was important to bound the economic potential over a specific time horizon to accommodate the analysis of measures under replacement on failure and new purchase situations.

Energy Efficiency Service Provider (EESP): Companies that deliver cost-effective energy efficiency services, including traditional energy service companies (ESCOs) that do performance contracting for large commercial and institutional customers; medium-sized firms that provide energy efficiency services to residential and small/medium C&I customers that do not focus on performance contracting; design/architectural/engineering firms that participate in energy related activities; and trade companies that provide energy related services such as equipment installation (e.g., electrical contractors). For the purposes of this report, we refer to this set of market actors as "Energy Efficiency Service Providers," collectively, EESP.

Energy Service Company (ESCO): ESCO refers to a company that offers to reduce a customer's electricity consumption with the cost savings being split with the company (known as performance contracting).

Market Barrier: The term 'marker barrier' refers to obstacles in the marketplace that hinder the commercial deployment of technologies even when they are technically viable and cost-effective.

With Funding: With Funding savings is the portion of the economic potential savings that could be achieved given the continuation of recent DSM expenditure levels. Recent ratepayer funding for energy efficiency programs is mandated to continue through 2002 at decreasing levels of 3.3 mills14/kWh in 1998, 3.1 mills/kWh in 1999, 2.85 mills/kWh in 2000, 2.7 mills/kWh in 2001, and 2.5 mills/kWh in 2002. It is important to note that With funding savings includes spillover from program non-participants.

[14] A mill is one-tenth of a cent or one-thousandth of a dollar. For definitions of this and other terms throughout this report, please refer to Appendix A: *Glossary of Terms.*

Without Funding: With Funding is that portion of economic potential savings that would be achieved if energy efficiency funding were to be discontinued; i.e., this potential is equivalent to naturally occurring energy savings. The impact of standard and code changes during the forecast horizon is captured in this scenario.

3 Project Introduction and Overview

3.1 Background

The Massachusetts electric utility distribution companies have been leaders in the delivery of successful energy efficiency programs since the late 1980's. The electric utilities working in cooperation with the Massachusetts' Department of Telecommunications and Energy (DTE), formerly the Department of Public Utilities and other interested non-utility parties have set a national standard for the design and delivery of this important demand-side resource. Prior to 1998, funding for energy efficiency programs had been provided through annual conservation cases and conservation charges specific to individual utility companies and customer classes. However, since that time, program funding has been legislatively mandated through an energy efficiency charge collected by distribution companies from all electric consumers. The funding horizon for the current energy efficiency charge sunsets in 2002 (with the exception of low income funding), and the Division of Energy Resources (DOER) is mandated to assess whether funding should continue beyond 2002. This assessment will be based upon current barriers customers face to investing in energy efficiency, the economic and environmental impacts of such activities, and the extent to which the competitive energy efficiency market is providing energy efficiency service to customers. In accordance with this requirement, the focus of this study is to provide information that will be used to support DOER's recommendation.

3.2 Project Overview

The RLW project team sought to answer four questions in support of the DOER decision-making process. These key questions are:

Key Question #1. What are the remaining energy efficiency opportunities in the residential and commercial and industrial (C&I) customer sectors in Massachusetts[15]?

Key Question #2. What portion of these remaining energy efficiency opportunities is likely to be achieved over the five-year period (2003-2007) absent further ratepayer funding[16]? Conversely, what proportion is likely to be achieved given continued ratepayer funding[17]?

Key Question #3. What market barriers prevent further development of competitive markets for energy efficiency products and services, and how might these barriers be addressed?

Key Question #4. What is the current role of the evolving competitive energy service market in providing energy efficiency products and services to customers, and how might that role change in the near future?

To answer these questions, we have used information from a variety of secondary and primary sources. Table 6 presents the key questions and the key sectors studied in this evaluation, along with the data sources utilized to inform the team's response to each key question. These methods were adapted to each sector involved in the study to ensure that resources were utilized efficiently and in a way that best met the evaluation objectives.

[15] Specifically, we estimated the remaining economic potential savings.
[16] Specifically, we estimated 'Without Funding' savings.
[17] Specifically, we estimated 'With Funding' savings.

Table 6: Summary of Data Sources Used in Analysis of Sectors

Key Question #	Sector			
	Residential	**Small C&I (< 100 kW)**	**Medium & Large C&I (100 kW- 5000 kW)**	**Very Large C&I (>5000 kW)**
1	Spreadsheet Analysis of Secondary Data	Spreadsheet Analysis of Secondary Data	Triangulation of 'expert panel' and 'bottom-up' methods[18]	On-site Visits with Facility Walkthroughs
2	Spreadsheet Analysis of Secondary Data	Spreadsheet Analysis of Secondary Data	Triangulation of 'expert panel' and 'bottom-up' methods	On-site Visits with Facility Walkthroughs
3	Telephone Customer Surveys	Telephone Customer Surveys	Telephone Customer Surveys, Focus Groups	Telephone and on-site Customer Surveys, Focus Groups
4	Competitive Retail Supplier and Energy Service Company Interviews, and Secondary research on international experience and other U.S. experience			

The next section of this report presents estimates of the remaining electric energy efficiency opportunities in each sector of interest (Question 1), estimates of savings under the "with funding" and "without funding" scenarios (Question 2) and the market barriers confronting the residential and commercial/industrial customers (Question 3). This section is followed by a discussion of the current competitive market in Massachusetts (Question 4). The report concludes with conclusions and recommendations.

[18] The 'expert panel' approach is a 'top-down' method that utilizes the estimates of a panel of experts from both utility and non-utility parties. The 'bottoms-up' approach refers to the estimation of savings based upon group reports of past experience with selected facility improvements.

4 Sector Results

This section of the report presents the estimates of remaining economic potential by market sector as well as estimates of the energy efficiency gains that are likely to be achieved with no additional funding and with funding at levels similar to recent public expenditures.

4.1 Residential Sector

The residential sector of the MA electric utility customer population was analyzed in single-family and multifamily subsectors. The analytical approaches applied to assessing the savings for each sector are fully detailed in the residential technical appendix that is a companion to this report.

Residential Sector Analytical Methodology

Our approach to assessing the residential savings relied fundamentally on secondary data sources and is fully detailed in the residential technical appendix S-6. The general steps were as follows:

1. Identify the relevant energy efficiency measures for analysis,
2. Assess, on a measure by measure basis, which measures were applicable for retrofit, new initial purchase, and/or replacement at failure scenarios,
3. Determine remaining efficiency opportunities for each measure, primarily through use of historical program data for savings and ratios of installations in participating homes, along with previously performed market share Delphi results in the assessment of some technologies such as appliances,
4. Estimate likely measure penetration absent utility program funding and corresponding energy savings for each measure. Again, much of this was driven through use of market share estimates from Delphi activities, program data, and also limited free ridership estimates, and
5. Estimate likely measure penetration if program funding were to continue at recent levels through Delphi results, impacts evaluations, and other secondary resources.

It is important to note that the residential analysis was based solely upon secondary data. Therefore, we acknowledge that issues such as imprecise data, limitations of available data sources, self selection biases in program participation, the use of past sales trends, and the use of reports based on customer knowledge of equipment in their home, all present some level of uncertainty in the analysis. It is also important to note that the residential analysis was based upon analyzing technologies independently, which could result in some overlap of savings estimates and an aggressive estimate of potential savings. The results of this analysis should only be used with extreme caution in any attempt to assess the relative magnitude of economic potential, with funding, or without funding at the end-use level. Finally, while the residential analysis provides point estimates of savings for the three scenarios, the general bias of the data and analysis was considered by the residential working group to produce estimates that are likely to be the lower bound of estimated savings (i.e., the estimates should be treated as conservative).

Residential Findings

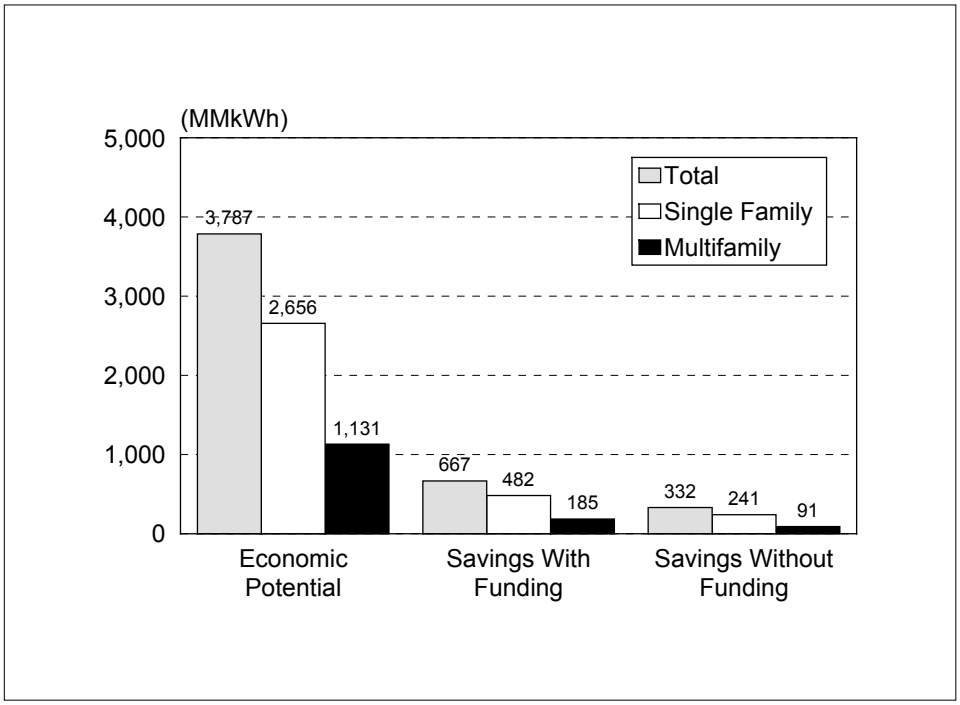
Figure 1 presents the estimated remaining electric efficiency opportunities in the residential sector accumulated over the 2003-2007 forecast horizon. It is important to note that the economic potential savings and the "without funding" scenario savings include forecasted

savings from both current initiatives[19] and potential future initiatives (e.g., emerging technologies). Also, the "without funding" savings do not include savings expected from low income programs, even though these programs will continue beyond 2002 regardless of whether or not other program funding continues. The "with funding" estimates do not include savings calculated from emerging technologies, but do include savings from low income programs.

The total annual consumption of the residential sector is estimated to be 12,290 MMkWh, as based upon actual utility billing data from 2000. The economic potential for the 2003-2007 horizon is estimated to be 3,787 MMkWh, or 31% of the residential sector consumption.

Further, we have estimated that the energy savings that would occur without additional public funding is 332 MMkWh or just 9% of the remaining economic potential. In contrast, the savings estimated should funding continue at its current level with the current portfolio of initiatives, is an additional 335 MMkWh, for a total of approximately 667 MMkWh or 18% of the economic potential. It is important to note that the "with funding" savings estimate presented in Figure 1 is the aggregate total of the "without funding" estimate and the savings that are estimated to be due to program activity. The estimate of savings that could be captured from the analysis of emerging technologies (100 MMkWh) and potential future initiatives (99 MMkWh) is a total 199 MMkWh of savings. The research team feels that adding together this 199 MMkWh with the 667 MMkWh for a total estimate of 866 MMkWh represents the expected electrical savings of an aggressive level of funding in which both current initiatives are continued and the potential future initiatives (with emerging technologies) are added to the portfolio of programs.

Figure 1: Residential Sector Remaining Electric Energy Efficiency Opportunities

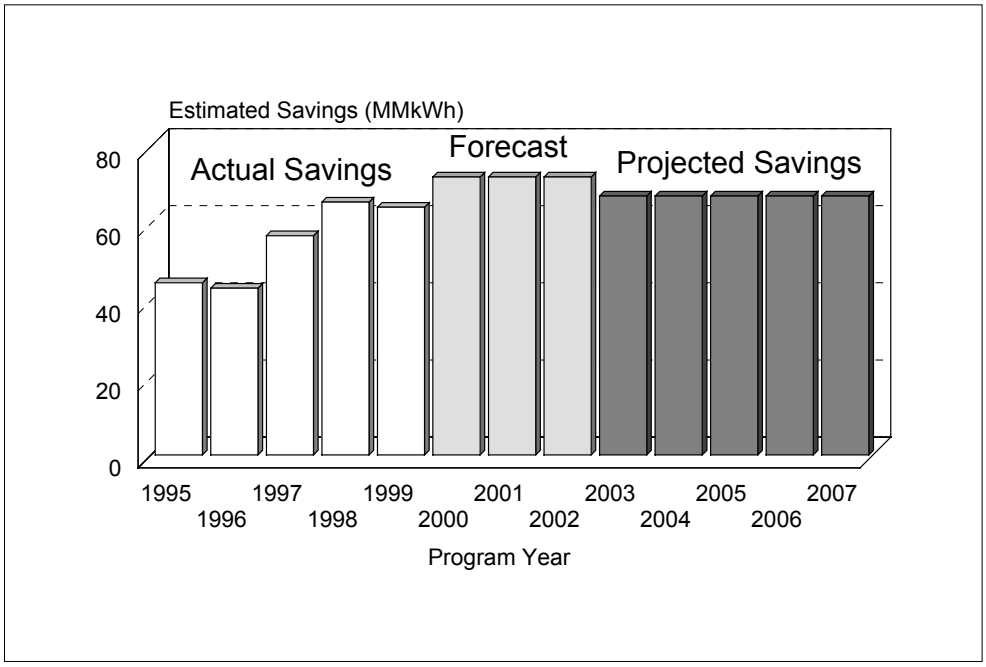


[19] These initiatives include the installation of measures such as CFL's, insulation, fluorescent fixtures, and ENERGY STAR appliances. All measures analyzed can be found in the residential technical appendix to this report.

Residential Program Performance and Potential

Figure 2 presents actual savings generated in the residential sector from 1995 through 1999 as reported annually by distribution companies; forecasted energy savings from 2000-2002; and our projection of "with funding" savings from 2003-2007.[20] Program activity in the late nineties averaged savings of 62 MMkWh per year. Forecasted savings from 2000-2002 average approximately 72 MMkWh each year. Comparatively, the projected residential savings for 2003-2007 average about 67 MMkWh per year, which is lower than the forecasted performance for 2000-2002 by approximately 7%. However, the projected savings from 2003-2007 are approximately 8% higher than the average historical savings in the late nineties. This trend can be explained by the fact that the projected savings are impacted by the expectation that customers will begin to purchase energy efficient alternative equipment more readily on their own as a result of regional market transformation programs (e.g., ENERGY STAR programs). These types of programs were first initiated in Massachusetts in 1997-98, yet the impact of these programs, which are intended to influence the market to adopt energy efficient measures on its own, will cause more consumers to purchase items without utility incentive. This causes the savings that are due to program initiatives to decrease over time, which is placing downward pressure on the estimates as compared to the forecasted savings over the 2000-2002 time period. It is important to note that while emerging technology savings and savings for potential future initiatives are not included in the "with funding" estimate, movement to these measures may occur in the near future as market transformation programs take effect and efficient measures are adopted without program incentives, resulting in the redistribution of money to other measure initiatives.

Figure 2: Historical and Projected Residential Program Savings



[20] The projected savings for 2003-2007 are based upon evenly dividing the total savings over 5 years to each year. In reality, the research team expects the savings to differ from year-to-year due to changing spending levels each year (there may be underspending of funds in some years that results in carry-over to following years.) The forecasted savings were gathered from the utility annual reports and DOER.

Residential Emerging Technologies

This section discusses the methodology and anticipated savings resulting from technologies that are in the early stages of commercialization but promise savings over the study time horizon. Specifically, we analyzed three residential emerging technologies identified as having a medium or high likelihood of commercial success[21] by the American Council for an Energy Efficient Economy (ACEEE),[22] a national organization that monitors technology improvements. To support this effort, we performed interviews with residential utility program managers to assist in predicting actual adoption rates for the various technologies.

The final measures used in the analysis and the economic potential savings, with funding savings and without funding savings are presented in Table 2. These savings are also incorporated in the residential economic potential savings presented in Figure 1 above. In total, the emerging technologies represent 4% of the total economic potential. Because the team only analyzed select emerging technologies thought to be most important, the emerging technology estimates are considered to be a conservative estimate of savings available. The recent success of achieving energy savings through early interventions with technologies such as ENERGY STAR clotheswashers suggests an opportunity for initiatives that could sponsor the emerging technologies analyzed in this report. More detail on this analysis can be found in the residential technical appendix to this report.

Table 7: Emerging Technology Savings Potential in Residential Sector

Emerging Technology Measure	End-Use	Economic Potential MMkWh	With Funding Estimate MMkWh	Without Funding Estimate MMkWh
Improved Efficiency AC Compressors	Appliance	3	0.5	0.3
CFL Floor and Table Lamps	Lighting	143	99	62
Integrated Electric HVAC/DHW Systems	DHW	20	0.1	.05
	Totals	166	99.6	62.35

Residential Market Barriers

This section presents a summary of the survey conducted to identify significant market barriers to customer program participation.

Survey Sampling Methodology

In the residential survey, our sample design included the performance of 272 customer surveys, proportionately representing all service territories in the state. These surveys were comprised entirely of home or condominium owners because renters were not anticipated to be in the position to consider the barriers that the questions posed. In the survey, we explored the barriers to the adoption of energy efficient products and practices that are specific to the residential market through a detailed analysis of three measures intended to represent classes of measures. The measures analyzed were:

[21] Measures not included ranged from those that were not appropriate to MA climate (such as indicate-direct evaporative coolers), those that were covered in the commercialized analysis (such as integrated new home design) and those that where characertized by ACEEE as having a low likelihood of success (such as smart residential HVAC controls).

[22] "Emerging Energy-Saving Technologies and Practices for the Building Sector", authored by Steven Nadel, Leo Rainer, Michael Shepard, Margaret Suozzo, and Jennifer Thorne, dated December 1998.

- Class: Lighting; Measure: Compact fluorescent lamps (bulbs),
- Class: ENERGY STAR appliances; Measure: Energy Efficient Refrigerator, and
- Class: House; Measure: Air Sealing.

These measures were selected to provide information on different purchasing events (compact fluorescent lamps are primarily retrofit measures, ENERGY STAR refrigerators are primarily replacement purchases), as well as measures that required external assistance to install (air sealing) versus those that can be done directly by a homeowner.

Types of Residential Market Barriers

The survey was designed to gauge each respondent's reaction to a stated opinion or perception that would reflect a particular barrier. The barriers identified and tested in this survey were:

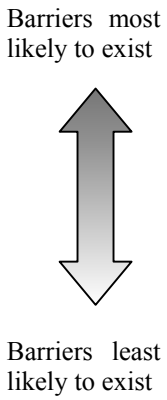
Table 8: Residential Barrier Descriptions

Barrier	Description
Product Availability	The likelihood of finding these products.
Awareness	How aware the respondents are about the products.
Irreversibility	The fear that making a purchasing decision now on these products will forfeit opportunities to make a better buying decision later.
Performance Uncertainties	The lack of trust in product benefits that are marketed.
Hidden Costs	The belief that these products will create other costs not attributable to the "standard" kinds.
Bounded Rationality	A rationalization or belief (either negatively regarding the energy efficient product or positively towards a standard product) that disallows the choice of purchasing these products.
Hassle Costs	What respondents perceive to be a burdensome use of time to learn about or purchase these products.
Asymmetric Information	How much do the respondents perceive that information about these products is not consistent, i.e. how much do they perceive that different sources tell different stories about the product.
Information Cost	The belief that the time and effort to learn about the product is not worth the purchase and use.
First Cost	The perception that the initial cost is the only cost to consider, i.e. a lack of economic rationalization or belief in the energy efficient product's lifetime savings over the standard type.
Personal Reference	The respondent depends on the comments and perceptions from other acquaintances that use the product in making a purchasing decision about the product.
Poor Early Experience	How much the respondents refer back to any poor experiences in the past with a similar product.
Information Access	The perception that there is too little access to information about a product, which prevents the product from being considered for purchase.
Inseparability of Product Features	How much do the respondents feel there are too many features in an energy efficient product model, which are not desired and/or are seen to have raised the price beyond an agreeable amount.

The respondents were asked to score their reaction to each statement between 1 and 6, with 1 meaning "strongly agree" and 6 meaning "strongly disagree". Table 9 below shows the results of barriers tested for compact fluorescent lamps (CFLs - which are an energy efficient alternative to incandescent bulbs):

Table 9: Responses to Barrier Statements for CFLs

Barrier Label	Average
Product Availability	2.28
Awareness	2.48
Irreversibility	3.06
Performance Uncertainties	3.84
Hidden Costs	3.91
Bounded Rationality	4.06
Hassle Costs	4.09
Asymmetric Information	4.24
Information Costs	4.25
First Cost	4.45
Personal Reference	4.50
Poor Early Experience	5.04

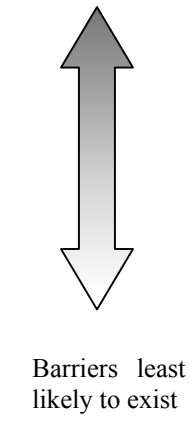


The colored arrow for this and the subsequent tables are shown to indicate the level of likelihood that these barriers exist within the population tested. The results show that the respondents, on average, agreed the most to barrier statements for availability and awareness. There was some agreement on the perceived problem of irreversibility, while the rest of the barrier statements were mostly met with disagreements. When aggregated together, the average for all the barrier statements was 3.85.

Table 10 shows the average responses for barrier statements about refrigerators:

Table 10: Responses to Barrier Statements for Energy Efficient Refrigerators

Barrier Label	Average
Personal Reference	1.34
Awareness	1.60
Asymmetric Information	3.75
First Cost	3.75
Access To Financing	3.83
Irreversibility	4.13
Information Costs	4.17
Product Availability	4.23
Hassle Costs	4.29
Performance Uncertainties	4.44
Hidden Costs	4.55
Bounded Rationality	4.74
Information Access	4.96
Inseparability of Product Features	5.10



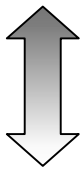
These results show that personal reference and awareness are the most common barriers to buying energy efficient refrigerators. However, agreements on statements regarding these barriers were in the form of simple observations rather than personal opinions, so caution should be made on inferring if these observations predict that the related barriers exist as well. Disagreeable reactions to the other negative barrier statements were much stronger. The aggregate average for all statements was 3.92.

Finally, Table 11 below shows the results for negative statements regarding air sealing (a measure that reduces home heating and cooling costs by mitigating unwanted and uncontrolled air movement from outside).

Table 11: Responses to Barrier Statements for Air Sealing

Barrier Label	Average
Performance Uncertainties	3.25
Access to Financing	3.42
Bounded Rationality	3.73
Hassle Costs	3.78
Inseparability of Product Features	3.81
Information Costs	3.92
Product Availability	4.46

Barriers most likely to exist



Barriers least likely to exist

The prevalence of average responses toward the middle range (neither strongly agreeing nor disagreeing) implies that there may be general ambiguity over the installation of this measure. It suggests there may be a need for better understanding of what this measure entails and the potential energy savings it provides. The aggregate average was 3.77.

In summary, it appears that energy efficient refrigerators had the least amount of market barriers. Air sealing may have the most, but the majority of ambivalent responses may indicate a lack of public understanding on its installation and benefits. CFLs also have few significant public barriers detected, but the lack of availability and the limited public awareness about them may contribute to a constraint on total purchases.

Table 12 below is a chart of recommended strategies that can be used to overcome the highest identified barriers for CFLs and refrigerators, and broad marketing strategies to develop understanding and knowledge about air sealing. These marketing measures are recommended with the assumption that many barriers relate to a lack of education and understanding about the energy efficient product or measure, and recognizes that purchasing decisions are more than just rational economic choices.

Table 12: Suggested Strategies to Overcome Key Identified Residential Barriers

Barrier	Suggested Strategies to Overcome
CFLs – Lack of availability, lack of awareness.	Work with manufacturers to **develop retail sales**: co-op advertising opportunities, spiffs for desirable shelf placements, and high visibility end cap displays
Refrigerators –Asymmetric information, first cost, and access to financing.	Continue to provide **ENERGY STAR marketing campaign** to customers Improve and enhance **countertop displays and materials** that clearly show real-life savings projections for ENERGY STAR labeled refrigerators Provide funding for easy eligibility **low-cost/no-cost financing** of ENERGY STAR labeled refrigerators
Air sealing – general lack of understanding and knowledge.	Subsidize **demonstrations** at home improvement centers Create and implement **promotional and descriptive newspaper and radio advertising** Create first hand knowledge and word of mouth marketing in targeted neighborhoods by **giving away free installations** at home shows, chamber of commerce events, and other community functions

Other Residential Survey Results

As discussed earlier, some policymakers believe that the private market (i.e., competitive retail suppliers and energy efficiency service providers) would increasingly provide energy efficiency services to all customer sectors once the market was deregulated, and would alleviate or eliminate the need for ratepayer-funded energy efficiency programs. One indicator of the degree to which this has occurred was assessed in the residential surveys. Specifically, when asked in the survey, only 3% of customers could recall being contacted by a private company to participate in an energy conservation audit (a company independent of the utility). These results are consistent with results later in this report that indicate that few EESP and CRS target the residential market at this time. To date, then, no evidence supports the hypothesis of private entrants into the market for providing energy efficiency services to residential customers.

Respondents were also asked to report how likely they would be to participate in an audit/retrofit program if it were offered by various organizations. According to their responses, programs offered by utility companies were most likely to generate residential participation. The results further suggest that programs offered by private companies and local contractors were least likely to generate residential participation. Table 13 presents the results by organization types offered to respondents. This data further indicates that the residential market may be a difficult one for the private market to address.

Table 13: Likelihood of Participation if Offered by Various Organizations

Organization (n=272)	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	Don't Know	Total
City where you live	33%	34%	11%	22%	0%	100%
State Agency	27%	31%	18%	23%	1%	100%
Your Utility Company	48%	30%	8%	14%	0%	100%
Private company that offers EE services	8%	21%	31%	40%	0%	100%
A company selling conservation services in conjunction with electric power	9%	23%	22%	45%	1%	100%
Local contractor	4%	19%	29%	47%	1%	100%
Federal Agency	19%	32%	16%	33%	0%	100%
Local community group/organization	16%	35%	23%	25%	1%	100%
Church group or club	16%	24%	22%	37%	1%	100%

4.2 Commercial and Industrial Sectors

For estimating potential, the commercial and industrial (C&I) segments of the MA electric utility customer populations were combined and then stratified into three sectors based on their peak electric demand, as defined below. The analytical approaches applied to assessing the savings for each sector are fully detailed in the C&I Technical Appendix that is a companion to this report.

C&I Sector Analytical Methodology

The methodology for analyzing the remaining potential in each sector is presented below. These sectors include the following:

- Small C&I are commercial and industrial customers with a maximum demand less than 100 kW,
- Medium C&I are commercial and industrial customers with a maximum demand greater than 100 kW but less than 350 kW,
- Large C&I are commercial and industrial customers with a maximum demand greater than 350 kW but less than 5,000 kW, and
- Very Large C&I are commercial and industrial customers with a maximum demand greater than 5,000 kW.

Small C&I: Our approach to assessing the small C&I savings was similar to the activities in the residential analysis. Like the residential sector analysis, the small C&I analysis was based upon secondary data, and included the following activities:

1. Identifying the relevant measures for analysis,
2. Determining remaining efficiency opportunities for each measure,
3. Estimating likely measure penetration absent utility program funding and corresponding energy savings for each measure, primarily through use of audit data of small C&I customers in Massachusetts, and program data, and
4. Estimating likely measure penetration with continued utility funding or involvement and corresponding energy savings for each measure. This was performed primarily through

use of surveys performed with program non-participants and historical free ridership estimates from utility reports (primarily National Grid USA).

The Small C&I analysis was based solely upon secondary data with inherent limitations. Specifically, there were less data available for this analysis when compared to the richness of the data that was available for the residential analysis. Therefore, the small C&I analysis focused more upon opportunities in the retrofit market through utility program information than the replacement market, resulting in a more conservative estimate. In addition, the Small C&I sector has generally been underserved until recently, which also contributes to this being a conservative estimate of projected savings. This analysis also included the estimate of savings that will result from new construction activities.

Medium, and Large C&I: Savings for the medium and large C&I market sectors were estimated by a panel of utility and non-utility experts. A substantial amount of information regarding historical program savings in MA, past free ridership rates and historical statewide economic trends provided the foundation for the expert panel analysis. This panel estimated savings for all Massachusetts C&I customers with consumption over 100 kW for the full forecast horizon. Specifically, this approach provided future savings estimates of economic potential, with funding potential, and without funding potential independently for new construction and retrofit activity from 2003 through 2007. More information on this approach can be found in the C&I technical appendix.

It is important to note that the medium and large C&I analysis was based upon both primary and secondary data. There were two independent primary sources of data that were analyzed to provide a sanity check of the final results. One of these was the 'expert panel' approach described above, which is formally reported in this study. The other was a 'bottoms up' approach that utilized the program experience of utility C&I program implementers to derive the savings estimates based on analysis of a range of existing C&I projects. We anticipate that the 'expert panel' approach provides a conservative estimate of the C&I economic potential and with funding estimates, as evidenced by a comparison to the 'bottoms up' approach. The 'bottoms up' estimate was approximately 12% higher in economic potential and 7% higher than the 'with funding' estimate provided in the 'expert panel' approach reported in this study. These results are very close to one another, and the research team feels that they are supportive of one another, albeit an indication that the team estimates may be conservative overall.

Very Large C&I: Savings estimates for this sector were obtained by conducting an engineering analysis on data secured during twenty on-site interviews with energy management personnel of "large" or "very large" electric utility customer facilities. The interviews were focused on obtaining a direct estimate of the remaining electric energy efficiency opportunities at each of these facilities. These interviews included site walkthroughs to review end-uses and technologies present at the site. Each on-site resulted in individual facility estimates of savings that were expanded to the entire sector population. This was accomplished by applying the ratio of the total annual consumption of the population to that of the twenty sites. In addition to the engineering analysis, we completed complementary analyses for process and O&M (operations and maintenance) measures based on historical measure performance as contained in the utility program tracking systems. It is important to note that the program that provided the basis for the O&M savings estimate is noted to have more of a measure focus than a behavioral focus. For this

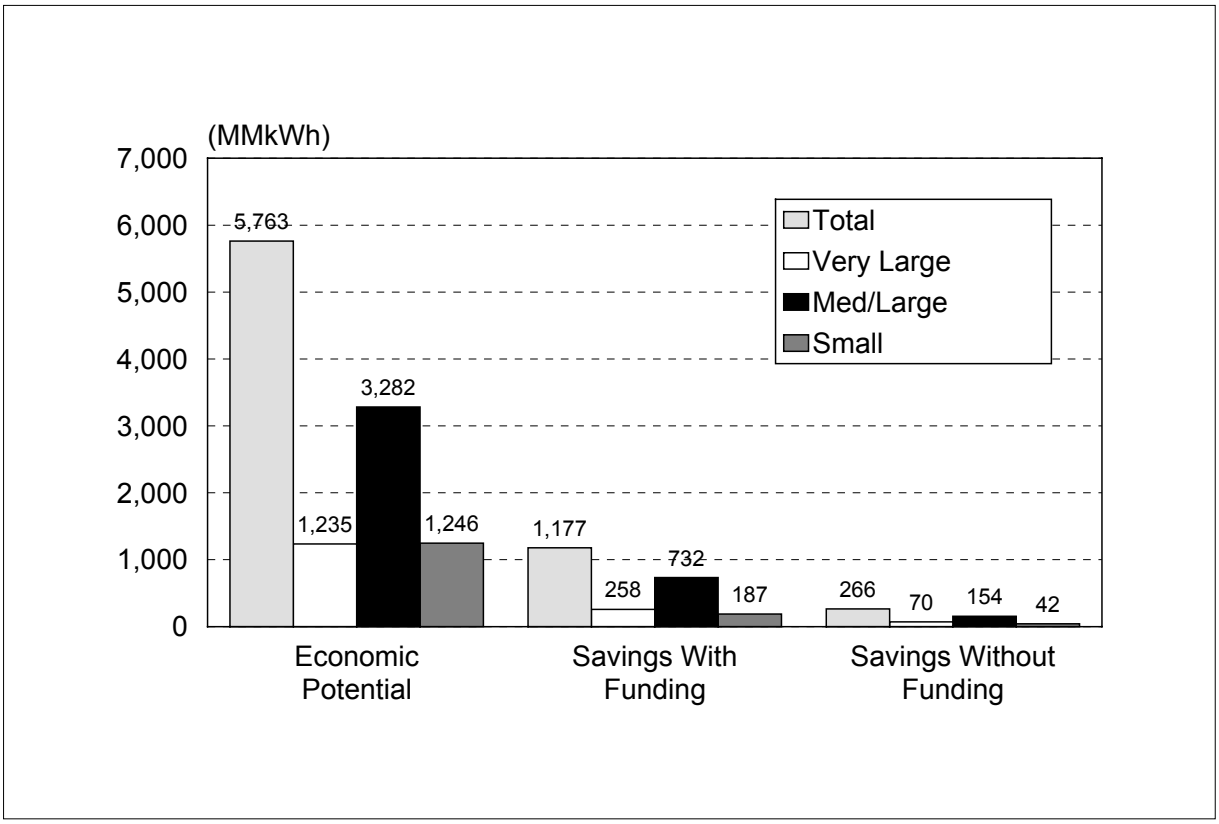
reason, the team feels that the estimate of O&M savings is probably conservative, which would contribute to an overall conservative estimate of savings potential for this sector. More information on this approach can be found in the C&I technical appendix.

Following finalization of the engineering estimates, the 'Very Large' sector savings (accounts greater than 5,000 kW) were taken out of the results from the expert panel approach discussed above to isolate the medium and large C&I estimates. In addition, the new construction savings for the very large C&I sector was apportioned from the medium and large expert panel results (that were generated specifically for new construction in buildings over 100 kW) based upon billing consumption between the two sectors.

C&I Findings

Figure 4 presents the remaining electric efficiency opportunities in the three C&I sectors over the 2003-2007 forecast horizon. Like the residential Figure 1, the economic potential and "without funding" estimates include emerging technology savings estimates, while the "with funding" estimate does not. The total C&I annual consumption is estimated to be 27,656 MMkWh, based upon actual utility billing data from 2000. The economic potential for the 2003-2007 horizon is estimated to be 5,763 MMkWh, or about 21% of the total C&I consumption. The team has further estimated that the market driven savings, or the savings that would occur during this time frame without funding, is less than 266 MMkWh. The additional savings that would occur should funding continue at recent expenditure levels is approximately 911 MMkWh, for total savings of 1,177 MMkWh, or about 20% of economic potential. It is important to note that the "with funding" savings estimate presented in Figure 4 is the aggregate total of the "without funding" estimate and the savings that are estimated to be due to program activity. In a more aggressive funding scenario, where emerging technology opportunities could be targeted, RLW anticipates that an additional 563 MMkWh of savings could be achieved, for a total of approximately 1,740 MMkWh.

Figure 3: Commercial & Industrial Electric Efficiency Opportunities (2003-2007)



From Figure 3, it is clear that over a fifth of the remaining economic potential in the very large C&I sector and the medium/large C&I sector can be obtained if energy efficiency programs continued to be funded at recent expenditure levels. It is also clear that most of the potential savings throughout the forecast years are in the medium/large sector, regardless of the funding scenario. This sector's "with funding" savings potential is 732 MMkWh, or 62% of the total C&I "with funding" potential.

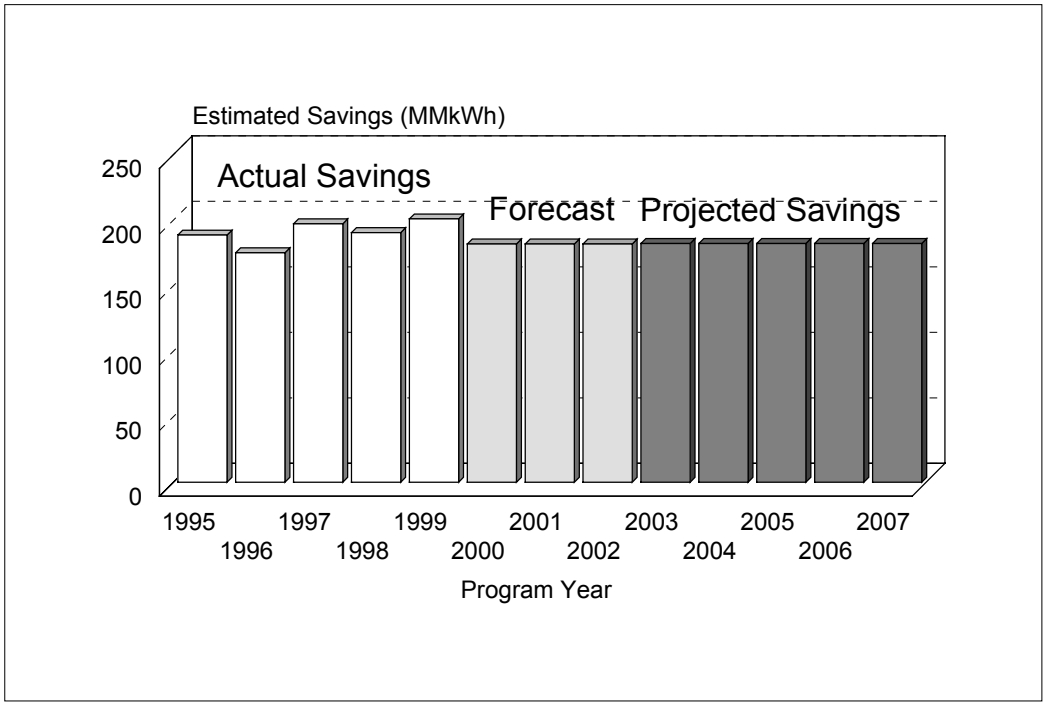
C&I Program Performance and Potential

As in the residential program performance section, the C&I historical program performance is based upon distribution company annual reports and data gathered from DOER. Figure 4 presents savings generated in the commercial and industrial sectors from 1995 through 1999 as reported in these annual reports, forecasted levels of savings for the 2000-2002 program years from energy efficiency plans, and our projection of with funding savings from 2003-2007[23]. Program activity in recent years is estimated to average 181 MMkWh of savings each year, according to utility annual reports. Our projection for the future, including new construction, is for this to remain virtually the same. Any projected increases in savings were negatively impacted by a diminished expectation of lighting savings in future years due to saturation concerns of the expert panel regarding the T8 lighting technology. Again, like the residential results, the with funding estimate in this figure is beyond the savings associated with the without

[23] Like the residential the projected savings for 2003-2007 are based upon evenly dividing the total savings over 5 years to each year. In reality, the research team expects the savings to differ from year-to-year due to changing spending levels each year (there may be underspending of funds in some years that results in carry-over to following years.)

funding estimate and does not include savings associated with the development of emerging technologies such as commercial distribution system air sealing and improved heat exchangers.

Figure 4: Historical & Projected C&I Program Savings



C&I Emerging Technologies

This section briefly discusses anticipated savings resulting from technologies that are in the early stages of commercialization over the study time horizon. Specifically, the team reviewed 58 commercial and industrial emerging technologies in this study identified as having a medium or high likelihood of success from two ACEEE reports[24]. Refer to the technical appendix entitled 'C&I Technical Appendix' for a description of the methodology used to estimate the savings potential for these technologies and a list of all of the technologies analyzed.

The estimates of economic potential savings, with funding savings and without funding savings for the commercial and industrial sectors are presented in Table 14. These savings are not incorporated in Figure 4 above, as they represent savings that are achievable with funding levels that are increased from current levels of funding. Similar to the residential emerging technology results, there appears to be an opportunity among C&I emerging technologies for utility or third party support to assist in their accelerated adoption. Three technologies analyzed that presented significant savings included commercial distribution system air sealing, improved ducts and fittings, and improved heat exchangers.

[24] Commercial emerging technologies was informed the "Emerging Energy-Saving Technologies and Practices for the Building Sector", authored by Steven Nadel, Leo Rainer, Michael Shepard, Margaret Suozzo, and Jennifer Thorne, dated December 1998. The industrial emerging technologies were informed by the "Emerging Energy-Efficient Industrial Technologies, authored by N. Martin, E. Worrell, M. Ruth, L. Price of LBNL and R.N. Elliott, A.M. Shipley, J. Thorne from ACEEE, dated October 2000.

Table 14: Emerging Technology Savings Potential in C&I Sector

Emerging Technology Measure	Economic Potential MMkWh	With Funding Estimate	Without Funding Estimate
Small C&I Emerging Technologies	118	36	5
Medium/Large C&I Emerging Technologies	944	285	44
Very Large C&I Emerging Technologies	803	242	37
Total	1,865	563	86

C&I Market Barriers

Market barriers were an important part of this study as they can provide specific opportunities for targeted funding that can accelerate the adoption of energy efficiency technologies in the marketplace. As noted earlier, while barriers are regularly considered in program design, a renewed look at barriers in the marketplace was performed in this study.

Survey Sampling Methodology

The C&I market barriers surveys were completed across a wide spectrum of C&I customers. Surveys were completed on 78 small C&I customers and 195 medium, large and very large C&I customers. The Small C&I sample size of 78 customers is based upon achieving a minimal a 90% confidence level and a ±10% precision for proportional responses. The medium and large C&I classes, which were the focus of the study, had a total of 175 surveys completed, which achieved a 90% confidence level and a ±6.2% precision for proportional responses. A subsequent analysis was completed across all survey respondents weighted according to the number of accounts represented. A more complete discussion of the sampling methodology and strategies as they relate to specific C&I market segments is contained the C&I market barriers technical appendix.

Types of C&I Market Barriers

The market barrier analysis identified four primary factors across all customers, which characterize barriers confirmed by the study:

1. Factor I – Practices & Value
   - Customer Practices;
   - Availability of Financing;
   - Lack of Perceived Value;
2. Factor II – Availability & Uncertainty
   - Lack of Availability;
   - Performance Uncertainty;
3. Factor III – Complacency
   - General Complacency; and
4. Factor IV - Need
   - Lack of Perceived Need.

The following tables summarize the barriers identified in the survey results and present some general strategies for overcoming them, based upon the opinion of the research team.

Table 15: Practice & Value Barriers

Barrier	Suggested Strategy to Overcome
FACTOR I—PRACTICES, FINANCING AND LACK OF PERCEIVED VALUE	
The payback is too long.	Offer education on lowered long-term operating costs leading to **competitive advantage** and greater profits. Promote any available **grants or financial incentives**. Quantify **non-energy savings** to reduce payback, e.g., water savings, productivity enhancements, e.g., improvements to that increase company productivity, or process improvements, e.g., improvements to industrial process that may make a company more competitive.
Inadequate time and resources to search for energy efficiency services. Financing difficult for energy audits or energy efficiency improvements.	Continue to provide **audit based energy services** to customers. Provide mechanism for **low-cost/no-cost financing** of energy efficiency improvements.
Most training too costly.	Provide free or subsidized **group training**. Promote **available low-cost training** provided by non-profits or government agencies.

Table 16: Availability and Performance Barriers

FACTOR II—LACK OF AVAILABILITY/PERFORMANCE UNCERTAINTY(RISK)	
Some EE equipment is tough to get.	Identify **specialized and qualified vendors** and **bulk purchasing programs** to facilitate the supply chain process. **Encourage manufacturers** to produce more efficient equipment, and reduce unit costs for users.
I tried EE but was disappointed.	Develop **case studies** and **testimonials** from customers that highlight the successful implementation of EE. Facilitate **customer-customer networking** regarding EE through seminars and workshops. Workshops for specific customer-industry types are likely to be most successful. Conduct **emerging technology workshops** highlighting and demonstrating the technology.
Hesitant about EE contractors.	Develop **project standards**, utilizing contractor and end-user advisory boards. Facilitate **contractor/user breakfast meetings**, so users can meet contractors face-to-face, developing a level of trust. Develop a utility sponsored **energy efficiency "consumer protection" service**, where businesses would have a specialized venue for getting assistance and advice. Provide a **contractor training and qualification services** based on empirical data to help inform customers (an example might be teaching how to market higher-end services and how to show customers there is a predictable return and more reliable service associated with those premium services). Develop joint utility/contractor projects to define and market premium services.

Table 17: Complacency Barriers

Barrier	Suggested Strategy to Overcome
FACTOR III – GENERAL COMPLACENCY	
Reducing demand charges not important.	Provide **quick and easy tools** to estimate annual and lifetime energy and demand costs, e.g., spreadsheet tools that can be used to track overall and end-use consumption.
I don't understand the major uses of electricity.	Provide **benchmarking services** for specific industries allowing customers to see how they rate on an energy use intensity basis.
Just pay bill without tracking energy usage.	Educate on **changing energy prices** and **restricted resources.** Promote energy efficiency based on **societal and environmental performance.**

Table 18: Lack of Need Barriers

Barrier	Suggested Strategy to Overcome
FACTOR IV—LACK OF PERCEIVED NEED	
Happy with lighting design/HVAC.	Promote **new lighting and HVAC technologies** and the related benefits. **Provide lighting design workshop**. Provide **newsletters** to customers focusing on lighting and HVAC technologies. **Provide HVAC** technology reports. Develop **case studies** showcasing significant lighting design projects.
There are more important things.	Identify **links between energy efficiency improvements and the customer's priorities.** Examples include talking to: • Manufacturers about reductions in cost of goods sold, • Offices about comfort, • Schools about air quality, • Government and non-profits about meeting environmental goals, • Hospitals about meeting regulations, and • Retailers about improved appearance.
There are no additional opportunities for energy cost reductions.	Provide **benchmarking services** for specific industries allowing customers to see how they rate on an energy use intensity basis.

Table 19 presents a numerical ranking of each factor based on the survey responses in each C&I sector of interest. The closer the barrier is to "5" the more likely that the barrier still exists within the particular sector (all scores 3 and above are highlighted in bold). As evidenced by the

table, the Small C&I perceive many more barriers preventing them from pursuing energy efficiency activities without direct intervention. Generally, the barriers appear to be associated with the size of the customer, with most gradually diminishing as customer size increases. In fact, no factor received a score above 3 in either the very large C&I sector or the large commercial sector.

Table 19: Barriers by Sector

Factor	Small C&I	Medium Com.	Medium Ind.	Large Com.	Large Ind.	Very Large C&I
Lack of Perceived Value	**3.65**	**3.51**	**3.54**	2.98	**3.14**	2.73
Lack of Availability or Performance Uncertainty	2.50	2.47	2.56	2.39	2.38	1.54
General Complacency	2.01	1.87	1.88	1.64	1.68	1.47
Lack of Perceived Need	**3.27**	2.77	2.98	2.90	2.82	2.79

Other Survey Results

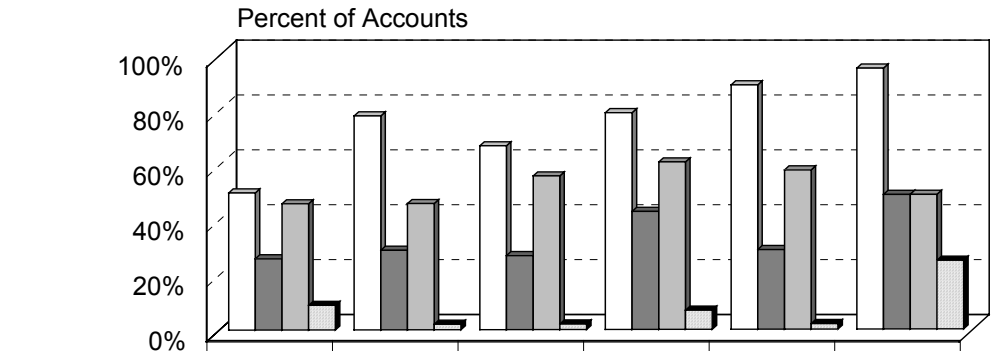
The C&I market barriers survey included additional questions regarding the customer's energy efficiency activities, these included 1) participation in utility sponsored energy efficiency programs over the past three years, 2) unsolicited energy efficiency offerings from third parties, and 3) energy efficiency actions taken on their own. Figure 5 summarizes the customer responses to these questions, along with the question of whether any of these offers were included in a package that included electricity supply. The figure presents responses by the six C&I market segments.

Most of the respondents had participated in at least one earlier Massachusetts utility efficiency program. Of the 272 customers responding to this survey question, 200 indicated that they had taken advantage of such an opportunity. After weighting by utility,[25] this represents just over one-half (52%) of all of the commercial and industrial accounts served by the Massachusetts utilities. Small C&I customers were least likely to have participated and the Very Large C&I customers showed the most aggressive participation. Slightly more than one-quarter of the Small to Medium C&I customers had received unsolicited offers for energy efficiency. Small C&I appear to face the greatest number of barriers in implementing conservation as only 46% of them have initiated such activities on their own, as compared to the other C&I sectors, in which generally 50% have initiated these activities on their own. The Large Commercial customers were the most aggressive when it came to initiating energy efficiency actions on their own, according to the survey data. However, the magnitude of energy savings represented by the unsolicited bids is unknown.

One-quarter of the Very Large C&I customers were offered energy efficiency as part of a broader package that offered electricity supply. Small C&I is surprisingly the second most frequently reported group of customers to receive energy efficiency as part of an electricity supply sale. This is surprising in that earlier results indicate that migration data shows little Small C&I movement to CRS, which is fundamental to the offering of energy efficiency services to this group.

[25] All results presented in this report, unless explicitly stated, are weighted by utility.

Figure 5: C&I Energy Efficiency Activity



	Small C/I	Medium Com	Medium Ind	Large Com	Large Ind	Very Large C/I
Utility Sponsored	50%	78%	67%	79%	89%	95%
Unsolicited	26%	29%	27%	43%	29%	49%
Initiated on Own	46%	46%	56%	61%	58%	49%
Electricity Part of Offer	9%	2%	2%	7%	2%	25%

C&I Large Customer Focus Groups

As part of the overall project, the research team was directed to pay special attention to the Large and Very Large C&I segments in order to better determine not only the extent to which remaining savings opportunities exist for these customers, but also to assess the experience and views these customers have regarding ratepayer funded energy efficiency programs. Specifically, the research team conducted focus groups to explore the factors that influence the energy-efficiency activities of large and very large C/I organizations in Massachusetts, as seen by facility professionals from those companies. Among the factors discussed were perceptions of the value of energy efficiency for the organization, internal decision processes and project requirements, and financing concerns.

Pertinent findings of the focus groups include the following:

- Virtually all the focus group attendees reported that their organization had conducted energy efficiency projects of considerable size over the last several years. Indeed, most were "repeat customers" of relevant utility programs. This is consistent with the team's analysis of participant databases and each utilities billing system, where program penetration in the very large C&I sector was shown to range between 50% and 85% among the three territories.
- Many of the projects were motivated by factors other than an interest in energy efficiency *per se*. These factors include interest in improved load factors, fuel-switching, and demand reduction.
- Despite the magnitude of their organizations' power costs and their own sophistication, many of the discussants' proposals for energy efficiency improvements were subject to

the same barriers that impede energy-efficiency projects for smaller, less knowledgeable companies, such as limited knowledge about certain technologies and split incentives.

- However, the most serious barrier for most focus group members was the set of internal practices at their companies. These practices included not only stringent requirements for payback or return on investment, but also strong competition for internal resources against projects offered by other departments. This is consistent with the C&I market barriers analysis where practices, financing and lack of perceived value were all identified as major barriers to the adoption of energy efficient practices and measures.
- Expertise and contractors appear to be readily available to facility professionals, as are information sources other than utility account executives.
- Several focus group members report the availability of energy efficiency services from competitive retail suppliers as part of larger packages, however, the discussants do not find the current efficiency offerings to be of high value. CRS interviews also indicated a lack of demand for these services.
- Access to financing for energy efficiency projects did not appear to be a major barrier in and of itself, given the strong preference of many organizations—particularly industrial companies—to rely on internal funding. For others, the energy efficiency fund currently alleviates that concern, primarily by helping to reduce the payback period of projects.
- Electric ratepayer energy efficiency funding has been of considerable value, both with respect to supplementing internal funding and through its support of the utility information infrastructure. The great majority of focus group members believe their company has received net benefits from this fund, compared to their own contributions.
- The focus group attendees see considerable additional opportunities for energy efficiency in their facilities, similar to the analysis of economic potential performed for this sector.
- Although many discussants believe their organizations will support additional projects, virtually all believe the energy efficiency fund should be continued. At the very least, this fund provides them with important leverage in competing for the internal resources they need, as well as what many view as valuable technical assistance.

5 Role of Competitive Markets

RLW and SFMC conducted interviews of two key market actor groups to assess the current state of competitive markets in Massachusetts. Specifically, the team interviewed representatives of Energy Efficiency Service Providers (EESP) and Competitive Retail Suppliers (CRS). These are described and summarized in this section of the report.

The extent to which competitive energy markets are currently providing energy efficiency services to customers is a critical component of DOER's assessment of future ratepayer- funding for energy efficiency programs. The legislated mandate to fund energy efficiency programs over the period 1998-2002 was intentionally ramped down in anticipation that the competitive market, as a result of a deregulated electricity industry, would step up and provide energy efficiency products and services to customers as a value added service bundled with competitive power prices. The role of the research team was to assess the degree to which this has happened and the likelihood that positive movement in this area would develop and accelerate.

5.1 Energy Efficiency Service Provider Interviews

Under deregulation, companies that deliver cost-effective energy services are expected to become an increasingly important component in the delivery of *energy efficiency* services. For the purposes of this report, we refer to this set of market actors as "Energy Efficiency Service Providers," collectively, EESP (note: competitive retail suppliers are addressed separately below). The core issue under consideration here is to better understand the current role of EESP in the delivery of energy efficiency services and how that role might be affected if energy efficiency funding were to change. More specifically, the following issues arise:

- What are key characteristics of the EESP now offering energy efficiency services?
- What services do the EESP offer?
- What customer sectors do they serve?
- What is the current volume of work in Massachusetts and how is that expected to change?
- How are customer projects currently financed? What is the role of financing in customer project acceptance?
- How does doing work in Massachusetts compare with EESP experience in other states?
- How do the EESP and competitive retail suppliers (CRS) interact?
- What is the perceived value of the energy efficiency charge to EESP firms?

In addition to the interview results presented, the web sites for five major national energy service companies[26] were examined for the services they offer and what customer segments are targeted. The electricity supplier lists available on the utility regulatory web site for Pennsylvania, New Jersey, and California were also reviewed to find what other services or value-added functions electricity suppliers offered to customers. Several national companies offer integrated energy

[26] The five companies are as follows: Enron Energy Services, Duke Solutions, Sempra Energy Solutions Companies, PG&E Energy Services, and Evantage.

management solutions and services targeted toward large commercial and industrial customers (as evidenced by the case studies or customer lists they have posted). Two other energy service companies specifically targeting services toward large retail chain accounts where automated load reading, analysis, and specific efficiency services can be offered on a mass scale. None of the firms reviewed promote similar services to small commercial or residential customers. Other energy service companies examined through the supplier lists yielded similar results.

The first part of this section addresses each of these issues in turn, and then provides a summary discussion of the results and their implications. Before turning to these issues, however, we provide a brief summary of the data source.

Research Methods

The research team conducted 25 in-depth interviews with Presidents, Principals or owners of energy service companies. The typical interview lasted between 30 minutes and one hour. All interviews were conducted in February and March 2001. We obtained company names and, where possible, names of contact persons from lists of firms from the utilities, DOER, NEEC and from a web site operated by the National Association of Energy Service Companies.[27]

The population of EESP was divided into four mutually exclusive groups, based on the best information available to the team prior to interview performance. These groups included:

- **Group 1** consisted of large, traditional energy service companies (ESCOs) that do performance contracting, mostly for large commercial and institutional customers (10 interviews).
- **Group 2** included medium sized firms that provide services to residential and small/medium commercial and industrial customers (5 interviews).
- **Group 3** consisted of design/ architectural/engineering firms (5 interviews), and
- **Group 4** included trade companies that provide energy related services, such as equipment sales and installation (e.g., HVAC, electrical contractors) (5 interviews).

A discussion guide was constructed prior to the interviewing, so as to provide a consistent framework for data collection and analysis. This discussion guide and a summary of interview attempts are provided in the Technical Appendix entitled 'Energy Efficiency Service Provider Interviews'.

Interview Results

Sample Members and their Characteristics

Just over one-half of the firms contacted were independent with the remainder split between subsidiaries of a larger non-utility corporation and a subsidiary of a utility. The median firm contacted had been in business for more than sixteen years. Nearly all of the firms do work in

[27] www.NAESCO.org .

Massachusetts (84%) with nine of the firms identifying the New England area as their primary place of business[28].

Services Offered and Customers Addressed

The firms represented provide a variety of customer offerings, including audits, project identification, system design and analysis, design control system, construction and installation and other value-added services other than energy efficiency. Table 20 summarizes these services and the number of firms in each group offering each service.

Table 20: Services Offered by Respondents, by Group

Service	Group 1 (n=10)	Group 2 (n=5)	Group 3 (n=5)	Group 4 (n=5)	Total Responses (n = 25)
Audits and analysis	10	5	5	2	22
Project identification	10	5	4	3	22
System analysis and design	9	2	5	0	16
Design control systems	7	3	4	0	14
Equipment selection and purpose	10	4	4	1	19
Construction and installation of HVAC, lighting, drives, or insulation	10	5	3	3	21
Installation of building controls	9	2	1	0	12
Power brokering/consultation/aggregation	5	0	1	0	6
Contracting and coordination	3	0	1	0	4
Aggregation	10	3	2	0	15
Financing	10	3	1	1	15
Maintenance and operations of facilities	7	3	1	0	11
Monitoring and verification services	10	3	3	0	16

Table 21 summarizes the primary market sectors addressed by the various EESP groups. The table presents the market sectors reported to make up at least 25% of the revenues for each of EESP types. As will be noted, the Group 1 ESCOs concentrate on the commercial, governmental, and institutional areas. The residential, small commercial and industrial sectors are not served by this group. Reading the tables by columns, it will be noted that the residential sector is only served by Groups 2 and 4 EESP, and very few of those interviewed target the industrial sector. It is noted by the research team that nationally, SESCO and various related firms have offered performance contracting to Massachusetts residential customers in the past (not recently), but predominantly through utility or otherwise subsidized transactions.

Table 21: EESP Reports of Market Sectors Constituting 25% or more of Revenues

Sectors Served	Residential	Commercial	Industrial	Governmental	Institutional
Group 1	0	4	0	4	4
Group 2	3	3	0	1	1
Group 3	0	5	2	0	0
Group 4	3	1	1	1	0

[28] Fifteen of the firms indicated a national or worldwide reach, nine of which were group 1 ESCOs, and the remainder of which were evenly distributed across the remaining three groups

High transaction costs, low profit margins, and split incentives (the separation of motivations between a property owner and renters) were cited as the main deterrents in doing residential and small commercial sector projects. One respondent from Group 2 stated that a residential customer has to have a monthly utility bill over $400 a month to make it worthwhile to do business with them. Another pointed out that the only viable residential work is either new construction or homes at least 30 years old or older. Small commercial and small institutional customers, especially small retail and independent motels, were cited (by nine respondents) as not profitable targets.

Profitable customers were cited most often as being institutional and large commercial customers. These customers were seen as offering considerable benefits with respect to size, overall project size (there were two mentions from Group 1 that the size of the project has to be $1 million or more), customer bill size (two from Group 1 mentioned a certain bill threshold – one said $100,000 or more, the other $500,000 and above), or customer size (there was one mention from Group 1 that the building size has to be 100,000 SF or more). While it is difficult to assess how many customers exist in Massachusetts that meet these conditions, it is clear that the majority of Massachusetts customers do not appear to be profitable by these standards.

Volume of Work

An important component of this work was to benchmark the level of activity currently being conducted by EESP. The reader is cautioned that these volume dollars are not directly comparable to utility program dollar volumes. The volumes in this report may contain the cost of basic construction that is not typically in utility programs, installation of measures which are considered baseline by utility programs, other fuels, and so on. However, they do provide a good idea of the size of the energy services business sector. From the interviews, the research team calculated that the approximate sales volume of work among EESP in Massachusetts is $543 million. In the EESP technical appendix, this sales volume is disaggregated by group. Group 1 EESP in the sample reported the greatest volume of work ($134 million). Group 2 EESP were estimated to perform an estimated level of activity in the state of $143 million, while groups 3 and 4 were estimated to perform approximately $66 million and $103 million, respectively[29]. A majority of the respondents said that they have experienced significant revenue growth in the past 3 years, and expect business to continue to grow in the foreseeable future.

Role of Financing

Only two EESP (one Group 2 and one Group 3 respondent) indicated that financing was a very or extremely important barrier for their customers, with 12 indicating that it is a somewhat important barrier. Group 1 does the majority of their projects through performance contracting. Group 2 does approximately 42% in performance contracting, while the majority of the Group 3 projects are done on a fee for service basis.

Comparisons between Massachusetts and Other States Energy Efficiency Programs

We asked survey respondents that operate in multiple states to reflect on differences in their experiences, perceived opportunities, etc., in Massachusetts and elsewhere. Of all of the states

[29] There are several items to note when interpreting the sales volume results. First, it is important to note that there are likely to be other groups of EESP in the marketplace that were not selected for inclusion among the four selected in this study that also derive revenue from efficiency services (home builders and retail outlets are two notable providers in the residential market). Similarly, the populations gathered in each group (which was used to weight these results) may be imprecise.

discussed, Massachusetts and New York State garnered the most positive comments. Two interviewees from Group 2 expressed negative comments on energy efficiency programs in other states. One specifically indicated that California programs are 'not doing much' with [the] residential [sector]. The other interviewee indicated that 'New Hampshire is more conservative' than Massachusetts in program offerings. Some respondents from Groups 1 and 2 also reported that the Massachusetts energy efficiency programs are more user friendly and a little more aggressive than those of other states.

Involvement with Competitive Retail Suppliers

The team attempted to identify the current level of activity and the anticipated synergies between EESP and Competitive Retail Suppliers (CRS), to test the hypothesis that EESP would be benefited by the entry of CRS firms offering energy efficiency services as part of a package, but subcontracting the delivery of those services. Eighteen of our respondents indicated that **none** of their Massachusetts projects have come from arrangements with CRS. Four group 1 respondents and two group 2 respondents indicated that they do have such arrangements with CRS in other states. These arrangements were generally targeted to the non-residential sectors. These respondents indicated that they received the advantages of prospecting and joint marketing. The only negative we received on CRS/EESP relationships was from an engineering firm who recounted trying to do cogeneration construction combined with power purchases but found that the market has not been stable enough to make it a business strategy.

The EESP respondents in general viewed more competitive retail suppliers entering the Massachusetts market as a double-edged sword. A number of them believe that it would broaden the marketplace with the potential of raising customer awareness of energy efficiency services and their value, as well as the provider community. An equal number of respondents, however, expressed the view that a statewide increase of these suppliers would make it more competitive for them with the downside risk of cutting into their market share. Some also commented that the business strategies of CRS and EESP are incompatible: "Suppliers want to sell electric and gas, while ESCo's want to reduce usage." Two respondents (viewing the electricity side of the commodity business) felt that the question was in effect moot, because the CRS perceived the current legislated rates as too difficult to compete against.

Perceived Value of the Energy Efficiency Funds

Many EESP are dependent on energy efficiency funding. Many EESP are dependent on the energy efficiency funding and the education and awareness generated by the utilities to sustain their level of project work. In fact, 19 EESP respondents reported that an average of 67% of their projects use MA energy efficiency funds, as indicated in Table 22. In addition, it was reported by respondents that an average of 55% of their projects would be negatively impacted if MA energy efficiency funds were to cease, driven primarily by Group 2 EESP. It is important to note that it is not known what size projects the 55% estimate would include, nor whether future EESP projects would receive funding due to changing baselines or other program criteria.

Table 22: Impact of Energy Efficiency Funds

Q27a: What % of Your Company's MA Projects have used EE Funds? (n = 20)	Q27b: Would Projects or Parts of Projects not be Done if EE Funds were not Available? (n = 20)	Q27c: If yes, About what Percent?
Group One average: 66%, median: 70%	Yes: 9, No: 0	average: 49%, median: 50%
Group Two average: 64%, median: 85%	Yes: 4, No: 1	average: 71%, median: 83%
Group Three average: 79%, median: 90%	Yes: 5, No: 0	average: 73%, median: 90%
Group Four average: 30%, median: 10%	Yes: 2, No: 0	average: 19%, median: 10%
All EESP average: 67%, median: 80%	Yes: 20, No: 1	average: 55%, median: 65%

Respondents were overwhelmingly favorable as to the impact of funding on acquiring new projects and clients as well as project enlargement. The respondents described a variety of benefits associated with the energy efficiency funding including:

- Makes a direct, important impact on the growth of EESP;
- Builds customer acceptance of projects, both by reducing payback periods and by overcoming credibility barriers;
- Provides the opportunity to work with utilities on identifying and motivating customers to do projects;
- Allows studies to be done that otherwise would not be performed;
- Allows companies to be creative in project design and utilize more comprehensive measures;
- Reduces upfront and payback costs, which in turn makes projects more viable or more readily accepted; and
- Lends an air of credibility to savings projections, i.e. customers are more willing to believe the promise of energy savings within a project.

Only three drawbacks to the funding were mentioned. They were:

- Program caps sometimes prevent customers from doing more;
- The added complication involved with program approval processing, measurement, and verification; and
- The lack of freedom to use funding for "fuel neutral" projects effectively eliminating measures that would allow the customer to reduce the most energy cost or usage regardless of the fuel source.

Summary and Implications

The EESP surveyed were generally positive about their level of success within the state of Massachusetts. However, there seems to be a significant amount of dependence on the energy efficiency funding and the education and awareness generated by the utilities to sustain the level of project work that these companies perform. In fact, EESP respondents reported that an average of 67% of their projects use MA energy efficiency funds. In addition, respondents reported that an average of 55% of their projects would be negatively impacted if MA energy efficiency were to cease.

Many EESP are optimistic about their growth potential in Massachusetts, provided that funding for projects continue. This is based upon questions regarding expected growth trends over the

next 2-3 years. This is supported by the results in which nineteen of the twenty-three respondents said that funding has a direct impact on moving customers to accept or expand projects. In addition, the entry of more competitive retail suppliers is seen as making a positive impact in raising customer awareness and broadening the market, but at the same time some EESP perceive that the entry of such firms may impinge on their own market share.

The EESP results also suggest that traditional market sectors targeted by the utilities, namely residential and small commercial customers, are being underserved by the EESP. Most of the EESP surveyed shy away from these markets due to the acquisition or transaction costs, customer education barriers, and the low gross profitability. Utility intervention and funding still appear to be needed in order to provide these customers with the opportunity and means of reducing energy usage.

5.2 Competitive Retail Supplier Interviews

Under deregulation of the electric industry, end-use customers are not limited to purchasing power from the traditional utilities providing the commodity in defined service territories. For the purposes of this report, we refer to the set of other market actors licensed to sell power in deregulated states as "Competitive Retail Suppliers"; collectively, CRS.

The core issue under consideration here is whether CRS firms are offering energy efficiency services to their customers as part of their effort to compete on more than commodity sales. More specifically, the following questions arise:

- What are key characteristics of the CRS now offering power?
- What services do they offer, and to which customer sectors?
- What proportion of CRS offer energy efficiency services in particular, and with what response from customers?
- How is delivery of pertinent services accomplished?
- Why are some CRS not offering these services and what would be necessary to motivate their doing so?
- How does CRS activity in this arena differ, if at all, between Massachusetts and other states with a deregulated market?
- What is the perceived value of the energy efficiency charge to CRS firms?

The remainder of this section addresses each of these issues in turn, and then provides a summary discussion of the results and their implications. Before turning to these questions, however, we provide a brief summary of the data source.

To provide some background to the current CRS market, RLW acquired data from MA DOER on the migration of residential and C&I customers to competitive retail suppliers. Table 23 presents data on migration of Massachusetts customers from their local distribution company to CRS firms. This migration data underlies the information collected from the CRS interviews. Only among large C&I accounts have the CRS made any inroads to selling electricity to customers---and their market share in that sector is well below 10%. In no other sector have more than one percent of the customers switched to CRS firms for power services. Thus, even if

energy efficiency offerings from CRS were successful, they would represent but a miniscule portion of the customer base that would be receiving energy efficiency from those providers in the near future.

Table 23: Status of Customers Migrating to CRS

February 2001	Competitive Generation				% Competitive	
	Total Number of Customers Switched to Competitive Generation (A)	MMkWh of Competitive Generation Used for Month (B)	Total Customers (C)	Total MMkWh Sales (D)	Customers (A/C)	Energy (B/D)
Residential	2,514	2.91	2,061,164	1,267.19	0.12%	0.23%
Small C/I	145	1.98	247,824	376.09	0.06%	0.53%
Medium C/I	205	13.07	20,733	650.85	0.99%	2.01%
Large C/I	411	180.44	6,164	1,337.26	6.67%	13.49%

Research Methods

The research team conducted 23 in-depth interviews with CRS companies[30]. A discussion guide was constructed prior to the interviewing, to provide a consistent framework for data collection and analysis. The discussion guide and a summary of interview attempts are provided in the technical appendix, entitled 'CRS Survey Technical Appendix'.

Interview Results

Sample Members and their Characteristics

Of our 23 respondents, 15 provide services in Massachusetts (and sometimes other states with Massachusetts) and 8 do not. Other characteristics of the sample contacted include:

- About one-half of the firms are independent and about one-half are subsidiaries of a larger corporate entity, such as a utility or an equipment manufacturer.
- The median firm contacted has been in business for five years.
- Mid- to high-level executives, such as presidents/owners, directors/managers, or general managers/vice presidents, represented each firm.

Services Offered and Customers Addressed

The firms represented provide a variety of customer offerings, including commodity supplies, value-added services other than energy efficiency, and energy efficiency and related services. Table 24 summarizes these services and the number of firms offering each.

As the reader will note, the number and variety of services related to energy efficiency are quite limited. Moreover, further probing indicates that only a small proportion of the CRS firms offers any energy efficiency services to residential end-users. (For example, only one firm provides energy management services, including follow-up on audit recommendations, to such

[30] It should be noted that many firms (more than one in six) included in our original lists do not meet the qualifications set forth in the screening instrument (see the CRS technical appendix) or have left the business. Moreover, many failed to return repeated call attempts. These results suggest that the sector is very volatile at this time with respect to the viability of CRS firms in general, and that the staffs of those firms that are active may be stretched in delivering their services.

customers.) When asked to identify the firm's most profitable services, two respondents mentioned customized or bundled "solutions"; one mentioned energy management services and one mentioned demand-side reduction. However, it should be noted that only three CRS contacted noted that they felt all segments could be profitable under the right circumstances.

Table 24: Services Offered by CRS Firms Interviewed

Service Category	Services Included	No. Firms Offering
Commodity services—energy	Electric power	23[a]
	Natural gas	16
	Energy transportation	6
	Home heating oil	1
	Propane	1
Value-added, non-energy efficiency—supply-related	Premium power	7
	High voltage power	6
Commodity services—other	Internet/DSL services	6
	Phone or cable services	5
	Water or sewer services	2
	Security services	1
Value-added, non-energy efficiency—other	Bill consolidation/payment services	13
	Capital and risk management	10
	Project development and project management	7
	Weather risk management	4
	O&M outsourcing	4
	Special multi-site metering	1
	On-line sales of products and equipment	1
	Customer information systems	1
Energy efficiency and related services	Energy audits	8
	Total energy management solution strategies	1
	Energy information and on-line services	2
	Consulting services	1

[a] One company has discontinued electric power supply since the interviews were conducted, as a result of the current California crisis.

To assess customer responses to energy efficiency offerings, we asked respondents who offer such services as well as power supply to estimate the proportion of customers who show interest in those opportunities. CRS respondents' estimates of customer interest in the energy efficiency services they offer vary widely as a function of the sector involved. Specifically, their median estimates vary from 5% for residential customers (only one firm estimating),[31] through 18% among institutional customers and 25% among other government customers, to 50% among commercial customers. In addition, the median estimate of interest among industrial customers is 30%, but varies across almost the entire scale, from 5% to 95%.

[31] The reader will note the congruence of low reported demand among residential customers with the low number of relevant offerings.

We also asked firms that offer audits about follow-up activities. The respondents believe their use of audits as a sales tool to be relatively successful, reporting that more than 60% of customers who receive audits do implement at least some of the recommendations offered and that they do so within an average of four months after the audit.

Delivery of Energy Efficiency Services

As noted earlier, one hypothesis about the presence of CRS firms in the energy market is that they may provide some stimulus for the expansion of EESP, to the degree that they (the CRS) outsource the specific design and implementation components of energy efficiency offerings. The evidence here is mixed:

- Approximately one-half of the CRS firms offering energy efficiency do so with in-house resources and approximately one-half contract with other firms to implement their projects.
- It appears that national firms are more likely to employ in-house resources, and the determining factor appears to be the type of services involved (installation services are far more often outsourced, in support of the initial hypothesis).
- Preference for internal resources is associated with the perceived benefits of cost control and, for customers, one-stop shopping.
- Preference for outsourcing is associated with the ability to employ experts in specific technologies while managing external commitments and minimizing training costs, and with the ability to tailor capabilities to specific project needs.
- The limitation to outsourcing energy efficiency services appears to be that few CRS offer those services, not that they are unwilling to subcontract to EESP.

It remains to be seen if CRS involvement in the market results in any increase in efficiency investment work or just a transfer of work to CRS from what normally other EESP may find. In our interviews there were few CRS that believed that efficiency services played a key role in the sale of electricity; it appeared to be more of an incidental and independent service. However, the power market is still in a developmental stage. It is possible (albeit difficult to predict) that the current market positions of CRS and EESP may change if rates increase and rate structures change. As larger and broader markets for electricity sales develop in states that have settled their deregulation plans, buyers may increasingly master commodity purchasing skills and knowledge. In turn, they then have the time to learn, consider, and buy into more sophisticated packages of efficiency and power products.

Preliminary interview results performed by ACEEE further support the general observation that only a minority of firms they have interviewed to date offer energy efficiency services, although this data collection effort is not yet completed and is concurrent with this report writing. Specifically, from the preliminary data the conclusion appears to be that that relatively few commodity suppliers are successfully offering energy efficiency services at this time nationally. These interviews have been performed with CRS in nine states so far, including PA and MA.

Other research conducted by Xenergy and EFI entitled "Wholesale Energy Markets Study" proclaims that the Northeastern energy markets have design flaws that prevent the emergence of

competitive retail markets and increase price uncertainty. The report further notes that a solution to these problems is "unlikely to be accomplished for several years." These findings suggest that the transition to a competitive retail market may be years away, which may further hinder the emergence of CRS firms in Massachusetts and any provision of energy efficiency services from these firms.

Barriers to Offering Energy Efficiency Services

Respondents cited both internal and external barriers to their firms offering energy efficiency services. The major internal barriers they mentioned were that many CRS firms are too small to provide a broad menu of services or to offer energy services in particular and that the return on such offerings tend not to meet the firm's profitability requirements. To a large extent, the respondents perceive energy efficiency services as complex and requiring a degree of expertise or staffing that is beyond their capabilities or willingness to invest. It is important to note energy efficiency services are not currently part of the business strategy for four of the respondents; neither are such services planned for the future. These firms, therefore, do not cite barriers to offering EE services because they don't see them as being part of their strategic plan.

The external barriers identified were similar to those found in other recent studies of the market for energy efficiency services. The list includes references to the economic climate, customer ignorance, and financial concerns of customers. Concerns with the economic climate relate to low energy costs (at least relative to other expenditures),32 the presence of price caps in certain states, the minimal size of shopping credits33 in those states where they are offered, and requirements to provide supplier credits, ancillary services, and reserves at the front end of CRS offerings.

Customer ignorance of energy efficiency issues and solutions is problematic for CRS firms for two reasons, particularly in the residential sector. First, it inhibits demand for their services, overall; second, it requires them to spend considerable time and effort (i.e., high transaction costs) educating customers with whom they do meet.

Financing is a consideration from several perspectives. Some customer financial concerns stem from corporate practices in the commercial and industrial sectors, such as the need to meet mandated payback or rate of return criteria. In addition, some customers are reticent to participate in projects because of the costs involved in shutting down services or production to accommodate improvements. Furthermore, several of the respondents reported that many projects in the commercial sector are dependent on customer access to financing and that some require the sellers to bring capital funding to the project to make a sale.[34]

Other barriers mentioned were also similar to those found in other studies of reported customer barriers to energy efficiency projects. These include the lack of attention given energy issues by industrial customers for whom energy costs are a very small proportion of the budget and the fact that those industries for whom energy is a crucial input tend to have their own expert staff and thus a limited need for external resources. Respondents also noted that the long decision cycles

[32] It should also be noted that the interviews took place before the effects of any 2001 rate increases.
[33] 'Shopping Credit' is also known as 'Price to Compare', which is Kilowatt-hour amount a consumer uses to compare prices and potential savings among generation suppliers.
[34] Respondents also report that, in contrast to commercial customers, industrial customers typically have ready access to capital.

that characterize large, complex customers further increases the CRS transaction costs. The concern of residential customers with avoiding disruptions to their routines was also mentioned.

When asked to describe the most attractive customers, respondents cited several characteristics. Generally, of course, CRS firms seek large customers who are currently very inefficient. Ideally, a customer would have a sizeable portfolio of buildings, a corporate commitment to improve energy efficiency, and centralized decision making and control over satellite sites.

Comparisons between Massachusetts and Other States

An important concern of this study was to recognize the variation in the degree to which deregulation has proceeded in different states, as well as variations in regulatory and legislative support for and restrictions on CRS activity, and to explore resulting differences in CRS opportunities and offerings. Accordingly, the team asked interviewees that operate in multiple jurisdictions to reflect on differences in their experiences, perceived opportunities, etc., in Massachusetts and elsewhere, and probed extensively on this issue throughout the interviews.

Somewhat surprisingly, the respondents cited few major differences between their experiences in the Commonwealth and their experience in other states. The only area in which differences were cited relates to the legislative and regulatory climate for their specific offerings. In particular, interviewees indicated frustration at being unable to provide commodity services at a price lower than the standard offer in Massachusetts and with regard to the burden of having to provide supplier credits, reserves, and ancillary services up-front. Two of the firms that are not currently operating in Massachusetts stated that they did not expect to do so until deregulation had "settled down" in the Commonwealth and the standard offer had been eliminated. No comments were made specific to providing energy efficiency services. Indeed, a comparison of the services offered in Massachusetts and those offered in other states shows no appreciable difference with respect to services related to energy efficiency.

Perceived Value of the Energy Efficiency Charge

Respondents who discussed the energy efficiency charge were positive as to its value for their firms. They noted, in particular, the value of such charges (which have different names in different states) as a means to increase customer awareness of energy efficiency issues. Also noted was the role of such funds in supporting relevant projects, particularly for clients who might otherwise do nothing in the efficiency arena. In this latter role, the funds provide those CRS firms that offer efficiency services with a sales tool and some leverage for marketing their capabilities.

Summary and Implications

The information provided by the CRS respondents leads to the following summary points:

- CRS firms are relative newcomers to the energy market, having been in business less than a decade. Efforts to reach firms licensed in Massachusetts, Pennsylvania, and California—states relatively advanced in deregulation—suggest that some volatility exists in the number of firms offering CRS services.

- We did identify and interview nearly one dozen firms that offer CRS services in the Commonwealth, and found that six offer some energy efficiency services as part of their effort to be more than commodity suppliers. About one-half of the firms contacted are subsidiaries of larger companies and thus may have access to resources beyond their immediate revenues as they consider expanding their efforts and competing for market share in Massachusetts. It may be expected that the others are more likely to act as niche players, offering a more limited range of services.

- The likelihood that CRS firms will provide stimulation to the EESP and contractor sectors seems likely to be a function of the portions of the market controlled by those CRS that outsource and the portion controlled by those that use in-house resources. To the degree that national firms, which appear less likely to outsource, capture larger portions of the market, they may provide competition, not support, for EESP and installation contractors. Even if CRS firms are likely to outsource installation assignments, as seems to be the case, it remains to be seen whether the types of installation involved encourage a vibrant market in energy efficiency services or whether the projects are limited to standard installations with little focus on efficiency opportunities.
- Based upon the CRS interview results, it remains to be seen if CRS involvement in the market results in any increase in efficiency investment work or just a transfer of work to CRS from what normally other EESP may find. In our interviews there were few CRS that believed that efficiency services played a key role in the sale of electricity; it appeared to be more of an incidental and independent service. However, the power market is still in a developmental stage. It is possible (albeit difficult to predict) that the current market positions of CRS and EESP may change if rates increase and rate structures change. There were several CRS that indicated that they would reassess launching EE services when full retail competition occurs in Massachusetts. However, the interviews support the notion that even in states where deregulation has matured there is still limited EE services offered by CRS. As larger and broader markets for electricity sales develop in states that have settled their deregulation plans, buyers may increasingly master commodity purchasing skills and knowledge. In turn, they then have the time to learn, consider, and buy into more sophisticated packages of efficiency and power products. These results are further supported by preliminary data from ACEEE interviews performed with CRS, in which the conclusion appears to be that that relatively few commodity suppliers are successfully offering energy efficiency services at this time nationally.

6 National and International Perspective

A historical review was done of the development of energy efficiency services, within the US and globally, after government energy programs are stopped. There has been little prior research conducted to learn the level and amount of private enterprise activity that replaces utility or government energy efficiency programs once they are removed, however. The market transformation literature implies that newly deregulated electric and gas marketplaces need intervention in order to become self-sustaining.

Specifically, as energy deregulation begins, utilities significantly reduce their energy efficiency or DSM programs. In that absence, energy service companies begin to promote energy efficiency technologies and services, mostly to large commercial and industrial customers. Customer segments that government or utility energy programs often target (residential, small business, low income) tend to remain unserved or underserved by private enterprise.

In response, government or government-sponsored agencies create focused programs to address the needs of these unserved/underserved sectors. In the US, this has come in the form of a utility surcharge that is collected by a state to fund energy efficiency programs and services directed towards those sectors. In England, Commonwealth countries, and Northern European countries the government response has been to create regional information centers. These regionalized centers concentrate on providing information, awareness, and technical assistance to market sectors that are poorly served by the existing energy services industry. A more detailed report of this literature review can be found in the national and international perspective technical appendix.

7 Conclusions and Recommendations

7.1 Conclusions Regarding the Residential Sector

The conclusions relating to the residential sector are presented according to the key questions described in the introduction.

Key Question #1: **Characterize the remaining energy efficiency opportunities in the residential sector in Massachusetts. (2003-2007).**

Table 25 shows the accumulated 'with funding' and 'without funding' savings estimated over the 2003-2007 forecast horizon in the residential sector, along with the estimated economic potential. The difference between the 'with funding' and 'without funding' estimates (the savings directly associated with continued funding) totals 335 MMkWh over the forecast horizon.

Table 25: Summary of Residential Remaining Energy Efficiency Opportunities

Estimated Economic Potential	Without Funding Savings	With Funding Savings
3,787 MMkWh	332 MMkWh	667 MMkWh

Key Question #2: **Estimate what portion of these remaining energy efficiency opportunities are likely to be achieved over the next five years (2003-2007) absent continued ratepayer funding.**

The portion of the economic savings that the team estimates is likely to be achieved absent ratepayer funding is approximately 9% of the economic potential, or 332 MMkWh. Based upon the CRS and ESCO interviews performed, the team does not expect private enterprise to facilitate much of these activities should utility funding be discontinued. This conclusion is further supported by residential survey results indicating only 3.7% of the homeowners surveyed report having been marketed for efficiency services by a private company. Nearly all of the 332 MMkWh in savings that are estimated to be captured by the market absent funding are expected to be generated through consumers' purchasing efficient alternatives on their own as well as through increases in codes and standards over the forecast horizon.

Key Question #3: **Identify Market Barriers that prevent further development of competitive markets for energy efficiency products and services.**

Table 26 below is a chart of the key barriers identified in the residential barrier analysis and recommended strategies that can be used to overcome the highest identified barriers for CFLs and refrigerators, and broad marketing strategies to develop understanding and knowledge about air sealing. These marketing measures are recommended with the assumption that many barriers relate to a lack of education and understanding about the energy efficient product or measure, and recognizes that purchasing decisions are more than just rational economic choices. It is

important to note that while the barriers are based upon survey results, the strategies to overcome the barriers are based upon the teams past experience and opinions.

Table 26: Summary of Residential Barriers

Barriers and Strategies to Overcome Residential Barriers	
CFLs – Lack of availability, lack of awareness.	Work with manufacturers to **develop retail sales**: co-op advertising opportunities, spiffs for desirable shelf placements, and high visibility end cap displays
Refrigerators –Asymmetric information, first cost, and access to financing.	Continue to provide **ENERGY STAR marketing campaign** to customers Improve and enhance **countertop displays and materials** that clearly show real-life savings projections for ENERGY STAR labeled refrigerators Provide funding for easy eligibility **low-cost/no-cost financing** of ENERGY STAR labeled refrigerators
Air sealing – general lack of understanding and knowledge.	Subsidize **demonstrations** at home improvement centers Create and implement **promotional and descriptive newspaper and radio advertising** Create first hand knowledge and word of mouth marketing in targeted neighborhoods by **giving away free installations** at home shows, chamber of commerce events, and other community functions

Key Question #4: **What is the current role of the evolving competitive energy service market in providing energy efficiency products and services to customers and how might that role change in the near future?**

In the residential market, the current role of Energy Efficiency Service Providers is limited. Furthermore, the role of EESP and CRS in delivering energy efficiency services to the residential sector appears likely to remain nominal without utility incentive, primarily due to such barriers as high transaction costs, low profit margins, and the need to educate consumers on the part of providers and split incentives, distrust of private providers, performance uncertainties and inattention to energy costs on the part of consumers. One indicator of the degree to which private energy efficiency services are occurring was assessed in the residential surveys, which shows that only 4% of all residential customers contacted were approached by a private company to have an energy audit performed. Data available on the migration of residential customers to

CRS firms underlines this information. Among residential customers, only approximately one tenth of one percent has switched to a competitive supplier through February 2001. Thus, even if all CRS were offering energy efficiency services at this time, only a very small portion of the customer base would be receiving energy efficiency from those providers in the near future.

7.2 Recommendations Regarding the Residential Sector

Based upon the results from this study, the research team believes that funding of residential sector energy-efficiency programs will be necessary if the policy goal is to capture a considerable portion of remaining energy-efficiency opportunities over the forecast horizon. This recommendation rests on the following points:

1. The projections of economic potential remaining in the residential sector that can be achieved indicate a significant opportunity for continued funding to target. Only 332 GWh of savings would likely be achieved in the absence of such funding, whereas twice that amount would be achieved if funding were to continue at levels consistent with recent expenditures. Under a more aggressive funding scenario, which would target new programs and emerging technologies, an even higher percentage of the estimated savings potential could be achieved.
2. Continued funding for the residential sector appears to be particularly important as EESP and CRS interviews indicate that little activity is being directed to this market with the exception of EESP who participate in ratepayer-funded programs as a vendor (e.g., program implementers).
3. Barriers and obstacles to the adoption of energy efficient alternatives by consumers in the marketplace persist. Programs to overcome these barriers are not likely to be mounted in the absence of public funding.
4. The instabilities seen in other deregulated markets carry the risk of reliability problems and volatile energy prices. The research team believes that continued funding of these programs will help buffer customers from high energy prices.

7.3 Conclusions Regarding the Commercial and Industrial Sector

The conclusions of the Commercial and Industrial sector are presented by the key questions described in the introduction. The team has responded to each of these questions in turn below.

Key Question #1: **Characterize the remaining energy efficiency opportunities in the small, medium and large commercial and industrial (C&I) sectors in Massachusetts. (2003-2007).**

Table 27 shows the accumulated 'with funding' and 'without funding' savings estimated over the 2003-2007 forecast horizon in the commercial and industrial sectors, along with the estimated economic potential. The difference between the 'with funding' and 'without funding' estimates (the savings directly associated with continued funding) totals 911 MMkWh over the forecast horizon.

Table 27: Summary of C&I Remaining Energy Efficiency Opportunities

C&I Sector	Estimated Economic Potential (MMkWh)	Without Funding Savings (MMkWh)	With Funding Savings (MMkWh)
Small C&I	1,246	42	187
Medium & Large C&I	3,282	154	732
Very Large C&I	1,235	70	258
Total	5,763	266	1177

Key Question #2: **Estimate what portion of these remaining energy efficiency opportunities are likely to be achieved over the next five years (2003-2007) absent further ratepayer funding.**

The portion of the economic savings that the team estimates is likely to be achieved absent utility funding is approximately 5% of the economic potential, or 266 MMkWh.

Key Question #3: **Identify Market Barriers that prevent further development of competitive markets for energy efficiency products and services.**

Generally, there are four primary factors in the C&I market that impede customer adoption of energy efficient alternatives. These are:

- Practices & Value. This factor indicates such barriers as customer practices, lack of available financing, and the lack of perceived value of the improvement.
- Availability & Uncertainty. This factor indicates such barriers as the lack of availability of the efficient alternative, and concern over the performance of an efficient alternative.
- Complacency. This factor primarily describes the barrier of companies not considering the reduction of electric charges as important.
- Lack of Need. This factor is regarding companies that do not feel that there is a need to change their energy use, or a way to change their energy use.

All of these barriers can be targeted deliberately through energy conservation funds to minimize the level they inhibit energy efficient equipment adoption. Some available strategies are presented below.

Table 28: Summary of C&I Market Barriers

Barriers and Strategies to Overcome Practices & Value	
Long payback	Education on long term operating costs, promotion of grants, quantification of non-energy and non-electric savings.
Inadequate time, financing difficulty	Provision of audit services and/or low-cost/no-cost financing.
Training too costly	Provision of free group training, promote available low-cost training by non-profits or government agencies.
Barriers and Strategies to Overcome Unavailability & Performance Uncertainty (Risk)	
Some EE equipment is difficult to get	Identify specialized and qualified vendors and bulk purchasing programs. Encourage manufacturers to produce more efficient equipment and reduce unit costs.
Performance Uncertainty	Utilize case studies and testimonials. Facilitate customer-to-customer networking. Conduct emerging technology workshops.
Untrusting of EE contractors	Develop project standards, facilitate contractor/user breakfast meetings. Provide a utility sponsored energy efficiency 'consumer protection' service, provide contractor training and qualification services (such as teaching how to market higher-end services and how to show customers there is a predictable return and more reliable service associated with those premium services), develop joint utility/contractor projects to define and market premium services.
Barriers and Strategies to Overcome General Complacency	
Reducing electric costs not important	Provide quick and easy tools to estimate energy costs.
Does not understand major electric end-uses	Provide benchmarking services for specific industries.
Does not track energy usage	Educate about value of tracking costs, and promote efficiency based upon societal and environmental performance. Demonstrate to the customer that real-time metering can provide useful information for managing demand and energy aspects of the customers load. Furthermore, real time metering allows the customer to participate in current and future load management offerings.
Barriers and Strategies to Overcome Lack of Perceived Need	
Happy with current lighting design/HVAC	Promote new lighting and HVAC technologies, provide lighting design workshop, provide newsletters on available technologies, develop case studies showcasing lighting design projects.
More important things to do	Identify links between efficiency improvements and customer priorities.
No additional energy efficiency opportunities	Provide benchmarking services for specific industries.

Key Question #4: **What is the current role of the evolving competitive energy service market in providing energy efficiency products and services to customers and how might that role change in the near future?**

Based upon the CRS and EESP interviews performed, the team does not expect these market players to facilitate much efficiency activity should utility funding be discontinued. In those surveys, it was reported that only 6 out of 16 CRS provided energy audits as part of its ancillary services. In addition, CRS reported that competition with the standard offer in Massachusetts is difficult, which we suspect will result in little growth in sale of the energy commodity and likely the ancillary services that accompany it until the standard offer expires. In migration data from the DOER, the lack of CRS activity is supported by the fact that less than one percent of the population has changed from their default utility.

The EESP surveyed were generally positive about their level of success within the state of Massachusetts but indicated a significant amount of dependence on the energy efficiency funding and the education and awareness generated by the utilities to sustain the level of project work that these companies perform. EESP are, however, optimistic about their growth potential in Massachusetts, providing that funding for projects continue. In addition, the entry of more competitive retail suppliers is seen as making a positive impact in raising customer awareness and broadening the market, but at the same time some EESP perceive that the entry of such firms may impinge on their own market share.

We reviewed the efficiency needs and opportunities in the California, other national and international markets. This review indicates that a subsidized portfolio of energy efficiency programs is necessary to ensure energy efficiency is adopted by market actors. This is due, in part, to historical market failures in achieving savings and the lack of service to residential and small commercial segments. The CRS and EESP interviews support these findings as they indicated the largest C&I customers as the most profitable and attractive for them to do business with at this time. Also, these groups indicated that the residential and small commercial customers are underserved.

7.4 Recommendations Regarding the Commercial and Industrial Sector

The research team believes that funding of C&I sector energy efficiency programs will be necessary if the policy goal is to capture a considerable portion of available electricity savings over the forecast horizon. This recommendation rests on the following points:

1. The projections of economic potential remaining in the C&I sector that can be acquired indicate a considerable opportunity for continued funding to target. Specifically, in the 2003-2007 time period, 1,177 GWh would be saved with funding continued at levels consistent with recent expenditures. However, there is limited likelihood of these savings being achieved in the absence of continued funding, with a mere 266 GWh of savings, or 5% of the economic potential. The Small C&I sector in particular appears to be the least likely to achieve significant savings without incentives.
2. Emerging technologies represent a significant opportunity for energy savings within the C&I sector, particularly within the Very Large C&I sector. This suggests that early promotion of these technologies by the utilities or third parties is necessary to ensure the potential savings arising from these technologies are realized. However, this would require higher funding levels than recent expenditures.

3. Barriers and obstacles to the adoption of energy efficient alternatives by C&I consumers in the marketplace persist, particularly in the Small C&I sector. This report provides suggested strategies to overcome the specific barriers identified.

4. Competitive Retail Suppliers are not providing energy-efficiency services to a broad base of customers. Specifically, interview results indicate that market dynamics such as the competitiveness of the standard offer and associated lack of migration of C&I customers to CRS has slowed the maturation of a competitive market in Massachusetts (one respondent estimated that the actual cost of supplying retail customers is up to 50% higher than what the retail customer can get under default service rate). The CRS market players are still struggling to make money on the electricity commodity with the small margins currently available. This leaves CRS little incentive to embrace added value services such as energy conservation.

5. The extent to which any energy-efficiency services are being provided to customers focuses on the large C&I sector. In addition, the small and medium C&I marketplace continues to show little demand for efficiency services, as customers do not appear to be fully aware of savings opportunities. The education process is still very long and transaction costs are high among C&I customers as well. The reported lack of profitability in certain C&I segments (especially the Small C&I market) is also hindering the provision of efficiency services by CRS and EESP firms alike. Utility intervention and funding still appears to be needed in order to provide small C&I customers the opportunity and means of reducing energy usage.

6. There appears to be strong support among EESP for maintaining existing funding. The majority feels that the success of many of their projects would be compromised if efficiency funding were to be eliminated.

7. Account executives appear to focus a significant amount of their time on energy efficiency rather than including other motivators as well as customer feedback in assessing a company's potential for program participation. Other barriers to success in recruiting participation include turnover of utility account executives and program participation databases that are not structured to help identify the responsible decisionmakers in large and very large companies.