Serving Low Income Households In A Competitive Environment: It's A Tough Job, But Someone's Got To Do It

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ABSTRACT

In the brave new world of a more "competitive" electricity market, low income customers are destined to be the forgotten market segment. Given the endemic challenges of minimal incomes, high turnover, payment problems, security risks, etc., this is the last place where ambitious power marketers (or the new "competitively oriented" utilities) are going to look for profits. Consequently, whereas private sector research devoted to potentially profitable segments of the residential market has picked up speed (especially regarding those higher socio-economic status "early adopter" types who participate in pilot programs), little or no market research has been focused on the low income population. The only trouble with this scenario is that the problem of needing to serve low income customers is not going to disappear after deregulation. If anything, it will likely intensify (e.g., see Colton, 1998).

In recognition of these circumstances, the purpose of this paper is to focus attention on the issue of providing energy efficiency services to low income customers in a restructured electricity market. The vehicle for doing so is to present some highlight results of an extensive sequence of research focused on the low income area, conducted for the Detroit Edison Evaluation Collaborative. This research includes an evaluation of a rather innovative in-home education and energy efficiency program operated by Detroit Edison, together with what the authors believe to be an unprecedented investigation and market assessment of the low income customer population of that major Midwestern utility. The paper then concludes with some more general observations regarding the need for and feasibility of providing energy efficiency services to this customer segment.

Introduction

The Detroit Edison Company is a large electric utility (over 1.8 million residential customers) serving Southeastern Michigan, including the Detroit Metropolitan Area. Over 300,000 of those customers (approximately 18% of the residential class) are low income, as defined using the 150 percent of poverty level standard. As is the case for most major metropolitan utilities, the low income customer population is a substantial population segment which Detroit Edison must incorporate into their business plans.

The purpose of this paper is to present highlight results from two different research efforts which provide useful information and insights into the challenges of serving low income customers. The first is a process and impact evaluation of an in-home education and efficiency measure installation program, the "Energy Management Program", which Detroit Edison operated during 1995 and 1996. The second is a possibly heretofore unique effort to perform a comprehensive market assessment and segmentation study of the low income population. Whereas there has been a fair amount of research devoted to evaluating specific low income energy efficiency programs (e.g., see Pye, 1996), this second study is unusual because

it was not program focused. Rather, it was devoted exclusively to identifying and studying the low income customer population of this major Midwestern utility. Each of these studies were performed in late 1997 and early 1998.

These research efforts were conducted by independent evaluation contractors, under the direction of an evaluation collaborative organized in connection with a Detroit Edison DSM planning case. Members of the collaborative included: Detroit Edison, the Michigan Public Service Commission staff, the Michigan Attorney General, each of the "big 3" auto companies, an environmental group, a low income service organization, a major university, and a representative of a labor union at Detroit Edison.

Proceeding in the chronological order of the events themselves, this paper will first discuss the evaluation of the Detroit Edison Energy Management Program.

The Energy Management Program

The focus of this portion of the paper is the 1995 Detroit Edison Low Income Energy Management Program (EMP). The EMP was put in place under Michigan Public Service Commission (MPSC) Order U-10297, and represented a slight modification of a program first initiated in 1991. The program provided energy efficiency measures and in-home educational training to low income customers (i.e., households below 150% of poverty level). The program was managed by Detroit Edison (DECo), and was implemented by DECo staff and private contractors throughout the DECo service territory in Southeastern Michigan.

The program featured in-home education and training regarding energy efficiency behaviors, plus the provision of four to six compact fluorescent light bulbs and certain water heating related measures where applicable (for the small fraction of participant homes which had electric water heating). Space heating measures were not included, as electric space heating is rare in area. A particularly innovative component of the program focused on refrigerators. Replacement of inefficient refrigerators has been identified as a promising measure to undertake in low income dwellings (National Consumer Law Center, 1995). In this case, it was decided to make that a central component of the EMP service. In those homes found to have old and inefficient refrigerators, the customer could receive a new energy efficient refrigerator for a nominal fee ($50 to $100). The program would deliver and install the new refrigerator and haul away the old model for recycling.

Program Results

Detroit Edison's program goals for 1995 were to conduct 20,000 audits and replace 4,952 refrigerators. As it turned out, 19,293 audits were conducted and 9,534 refrigerators were replaced. A comprehensive impact evaluation was conducted on behalf of the evaluation collaborative, featuring a rigorous regression based billing analysis using a time series/cross sectional experimental design with a matched control group. (See RLW Analytics, Inc., 1997, for details on the methodology and results of the impact evaluation.)

Energy Savings. The mean point estimate of net savings was 1,234 kWh per participant household per year, with a +/- 2.2% relative confidence interval. That represents an average 17% annual savings. (Note: these were non electrically heated homes, with an average annual consumption of approximately 7500 kWh. That compares to DECo's overall average residential usage of approximately 6700 KWh per year.)

The study also estimated the savings and realization rate for each of the 3 primary components of the program: (1) education, (2) low cost measures, and (3) refrigerator replacement. These results are summarized in Table 1 below.

Table 1. Savings By Program Component

	Engineering estimate of savings (kWh)	Measured savings (kWh)	Realization rate	Relative confidence interval
Education	200	311	155%	42%
Low cost measures only	1002	522	52%	8%
Refrigerator only	760	819	108%	5%

As the results in Table 1 indicate, both the education and refrigerator components exceeded their engineering estimated savings. The principal reason for the shortfall in the low cost measures category was believed to be the fact that the engineering estimate was premised upon the inclusion of certain water heating savings measures (e.g., a tank wrap and faucet flow restrictor), when in fact the incidence of electric water heating was quite low. The relative precision of the savings estimates was very good, with the exception of the education component. This is not surprising given the nature of "education" as an intervention, as well as the fact that only 4% of participants received "education only".

A useful way to look at the results in terms of potential future program effects is to consider the estimate of total savings for participants receiving each level of service. Those results are presented in Table 2.

Table 2. Savings By Level Of Service Received

Measures	Engineering estimate of savings	Measured savings
Education only	200	311
Education + low-cost measures	1202	833
Education + low-cost measures + refrigerators	1962	1652
Overall program average	1554	1234

Educational Effect. Another particularly interesting finding from the study had to do with the results of the evaluation of the program's educational impact. Through an innovative two-step evaluation process used in the on-site evaluation interviews, respondents were asked to "tell and show" their knowledge regarding various energy efficiency measures and actions. That is, they were first asked to list all of the energy conserving actions they could think of in each of four areas (heating, lighting, refrigeration and cooking). Then, for each item they had listed they were asked to show the interviewer how they would

implement that action or explain how they would take the action if they were unable to demonstrate the measure. The results of this assessment demonstrated that program participants were able to list 30% more conservation actions (i.e., "ways to save energy and money on utility bills") than non-participants. Furthermore, on average across the items mentioned by both groups, participants were 10% more likely to be able to correctly show or describe how to implement a measure they had mentioned (95% vs. 86%).

Attitudes Toward The Utility. An additional indicator that may be of some interest to utilities had to do with the apparent effect of the program on customer attitudes toward DECo. When participants were asked if their opinions of DECo had changed as a result of the program, 55% said yes. Of those, 96% said that their opinions were more positive. This is even more noteworthy given that 30% of participants did not know that DECo sponsored the program. (Many of the services were provided through contractors.) In contrast, the non-participant group reported almost no change in attitude toward DECo during that time period (82% no change, 12% more favorable, 6% less favorable).

Environmental Impact. One final area of interest examined in this study was the issue of environmental impact. Although obviously not a driving rationale behind this type of program, in considering the net societal benefits from such a program, environmental benefits can be a useful additional factor. In this case an analysis was performed of the air emissions reductions resulting from the energy savings produced by the program. For that analysis, a definition of the likely current marginal generation source plant for DECo (i.e., in their current dispatch operations) was developed, which determined that the plant would be a coal plant, assumed to have a 10,000 Btu/kWh heat rate, using a 1.2% sulfur coal with no scrubber. The results of that analysis concluded that the estimated annual reductions in air emissions from the 1995 Low Income Energy Management Program would be 55 million pounds of CO_2, 472,000 pounds of SO_2, 159,000 pounds of No_x, and 119,000 pounds of suspended particulates. These reductions would continue each year over the life of the program's energy saving measures.

The Low Income Market Assessment

The second component of this paper focuses on an innovative and comprehensive market assessment and segmentation study conducted on the DECo low income customer population. This study featured 550 detailed telephone surveys, consisting of 100 Energy Management Program participants; 200 EMP non-participants identified as low income on DECo's customer information system (CIS); and 250 non-participant customers not coded as low income in the CIS, but identified through a proprietary customer segmentation system ("MicroVision") which identified survey targets with a high probability of low income status. The 200 DECo identified non-participants were selected at random from a random sample of 5,000 of the 125,000 customers identified as low-income customer on the CIS. These customers are identified as low-income on the CIS if the customer has provided proof of income to DECo or if they have been identified via coordination with one or more public service programs providing services to DECo customers in which company is involved. The MicroVision sample was selected by identifying pre-defined MicroVision segments with low-income customers and surveying these segments at random until 250 surveys were completed by families with total household incomes less than 150% of poverty level.

Because the MicroVision sample is clustered into segments by income probabilities (among other methods) we needed to start the MicroVision sample survey with an income question in order to filter non-qualifying customers. TecMRKT Works designed a survey protocol that worked very well in identifying

household income levels without alienating the customer and allowed for a 90%+ completion rate once a low-income household was identified. This method also served to verify the MicroVision segment profiles in terms of the number and percent of low-income households and made population estimations a relatively easy task. This method not only served to identify pockets of low income customers in the Detroit metropolitan area, but also served to document that low income customers are heavily distributed in non-urban areas as well.

Although these methods proved to be quite successful at locating and reaching a wide range of low income households, it is necessary to mention the common caveat that this survey does suffer from a form of frame bias. That is, low income customers without telephones are not included in the samples. Having acknowledged that limitation, however, it is nevertheless true that this research (due to its creative use of the Microvision data) goes far beyond common practice for low income customer surveys and provides a much more thorough exploration of the low income population than is typically available.

The results of this market assessment are extensive and much of the information is beyond the scope of this paper. For details on the methodology, analyses and results, the reader is referred to the source document (TecMRKT Works, 1998). The intent of this paper is simply to note certain highlight results which contribute to the goal of better understanding and serving low income customers.

Differing Market Segments

The market segmentation utilized in the 3-group study design, described above, itself represents an important but frequently overlooked fact about the low income sector. That is, the low income population is not at all homogeneous. A major objective of this market assessment study was to locate and reach a broad cross section of the low income population, so that information could be obtained to help understand the complexity of this market sector.

One initial key observation from this overall research effort was that a substantial proportion of the low income population in Detroit Edison's service territory are households not previously identified as low income in DECo's CIS database or in databases maintained by the state's social service agencies. Estimates from this study suggest that as many as 60% of low income customers fall into this category. An important implication from this fact is that if the utility wished to target its low income customers to receive specialized services (e.g., energy efficiency services, budget billing assistance, discounted rates, etc.), it would be unable to identify the majority of the eligible low income customers. (In fairness to Detroit Edison, experience with other utility companies suggests that this situation is not atypical.)

This study explored the nature of the differences between the three low income customer segments represented and came up with some interesting observations. In general, participants in the DECo Energy Management Program tended to have lower income; lower education levels; higher levels of unemployment; fewer major appliances; less social interaction with neighbors, friends and relatives; and tended to be more often a single head of household and be more connected to government service networks (nearly 80% of participants reported hearing about the program from a government organization).

In contrast, those in the market segment whose low income status was not known to the utility prior to the study (the "non-CIS" group) tended to more often be elderly, to be more connected to social networks and have less connection to government service networks.

Together these results offer some insight into the relative success of the DECo Energy Management Program. For example, it appears that the program is fairly successful at reaching customers who are clearly in need (lower income and education, higher unemployment, etc.). However, it also appears that there are other low income customer segments (e.g., the elderly, those not tied into government social

service networks) who are not being reached and who are indeed relatively unknown to the utility. These findings have implications both for program design (e.g., develop some services tailored to the elderly) and for program marketing (e.g., make better use of community organizations, neighborhood groups, churches, etc.).

Other Observations With Program Implications

Aside from demographic and descriptive variables used in defining market segments, the market assessment research explored a wide variety of other issues. Some of the more interesting findings are summarized below.

Sources Of Information. One of the more striking findings of the market assessment was the extent to which the utility company was viewed as the best source of information about saving energy. When asked whom they would turn to if they wanted to gather information on ways to save money on their utility bill, all three sample groups overwhelmingly mentioned Detroit Edison (ranging from 100% of the EMP participants to 76% of the non-CIS identified group). Reflecting the government linkage of the EMP participant group mentioned above, 93% of EMP participants cited government agencies as a source for such information, whereas only 11% of the CIS non-participants and 34% of the non-CIS group mentioned that source. This means that the majority of low income customers who are not tapped into the low income social service networks do not see government agencies as the most recognized provider of energy information or services. Instead, the low income households surveyed in this research look to the utility for energy information and support. This clearly has ramifications concerning what organizations have the best market influence for providing low income services. Finally, in some findings with significant implications regarding the need for regulatory/government programming, less than 10% of each group cited friends, relatives or neighbors as a source for information on how to save, and only 1% of the respondents cited private contractors, vendors or suppliers as a source of such information. These findings strongly suggest that a strategy of privatizing all energy efficiency services would have little likelihood of success for low income customers

Attitudes Regarding Competition. Another topic area with significance for low income customers is the issue of utility restructuring. When asked about whether it would be a good idea to deregulate and have customers choose their electric utility, the large majority of respondents were "not sure", with just 22% of EMP participants, 34% of CIS non participants and 19% of non-CIS low income customers saying it would be a good idea. Interestingly, when asked whether they themselves would switch if given the chance, loyalty to the current electric supplier (DECo) was exceptionally strong for the participant group, moderately strong for the CIS non-participant group and strong for the MicroVision non-participant group. This data demonstrates that customers served by the program have higher to much higher levels of customer loyalty than non-participants. This loyalty is in spite of the fact that DECo's residential rates are higher than the rates of the other major electric utility in the state. While this data pertains only to low-income customers, it is one demonstration of the potential impact of customer service programs on at least one segment of the residential market. The following table presents the results of the question pertaining to what customers would do if given the opportunity to switch electric suppliers.

Table 3. Customer Predictions Of Their Switching Behavior

	Percent response		
	EMP participants	CIS non-participants	MicroVision non-participants
Would switch	9	15	13
Unsure	1	21	14
Would not switch	90	64	73

These results have at least two noteworthy implications. First, as with the above section on "sources of information", it is evident that low income customers have a very strong reliance upon, and solid connection with, their local utility company. Hence, any discussion of restructuring the electric industry should take that relationship into account. Second, it appears that providing an energy efficiency service such as EMP may be a good way to enhance customer loyalty.

Barriers To Action. To explore this concept, respondents were first asked whether there were things they knew about in their home which could be done to save energy but had not yet been done. In an interesting finding suggestive of the educational effects of the program, 62% of EMP participants mentioned some type of energy saving measure, versus only 6% of the CIS non-participants and 17% of the non-CIS group. Beyond that factor, however, the responses of the three groups were quite consistent. A majority of the respondents mentioned one of three measure areas: (1) air sealing (storm windows, caulking, weather stripping); (2) installing additional or new insulation; and (3) tune-up, change, or clean the air conditioning unit.

The respondents were then asked the reasons for not having completed the measures they mentioned. These results demonstrated a very similar pattern of barriers. Not surprisingly, all three groups cited "costs too much" as by far the most frequent barrier. Two other barriers cited with approximately equal frequency were "don't have time" and "need someone to help me". However those were cited only about one-third as often as the cost barrier. "Lack of skills or knowledge" was cited only about 10% of the time or less. (Recall that this question only pertained to measures which they already knew they needed, so the lack of information about efficiency opportunities as a barrier in general is not fully reflected. However, the results in the preceding paragraph, showing the other two groups being far less aware of potential improvements than the EMP participants, suggests that there may be a widespread lack of information among low income customers about energy efficiency improvements needed in their homes.)

Aside from that awareness issue, the only noteworthy difference among the three groups in their reported barriers was the fact that over one fourth of the respondents in the non-CIS group cited "physically unable to do it", whereas that factor was virtually unmentioned in the other two groups. This latter finding is likely explained by the much higher proportion of elderly customers in the non-CIS group (nearly 40% vs. 11%-17% in the other two groups).

Educational Impact. The market assessment survey also verified the positive educational effects of the EMP program noted earlier in the process evaluation results. Respondents were asked to list all the ways to save energy they could think of in the areas of lighting, refrigeration and space heating. Whereas EMP

participants were only slightly ahead in the common measure responses such as "turning off lights when not in use" they were typically two to three times more likely to mention EMP education program related savings ideas such as using low wattage light bulbs, opening the refrigerator door less, setting appropriate refrigerator temperature, defrosting/cleaning refrigerator regularly, tuning up furnace, fixing or plugging air leaks, and closing doors to unheated rooms. Participants in the EMP program were, by far, more knowledgeable about how they could control or reduce their electric consumption. These results strongly confirm the energy efficiency educational effects of the EMP service.

Table 4. Energy Saving Actions Mentioned

Measures	Percent response		
	EMP participants	CIS non-participants	MicroVision non-participants
Turn off lights when not in use	95	75	82
Use low wattage light bulbs	42	17	16
Open refrigerator door less	92	33	58
Setting appropriate refrigerator temperature	58	2	22
Defrost or clean refrigerator	63	30	9
Tune-up the furnace	58	2	22
Plug or fix air leaks in home	42	8	13
Close doors to unheated rooms	58	8	6

Conclusion

The primary purpose of this paper was to focus attention on the issue of providing energy efficiency services to the low income customer population as we enter the era of electric utility restructuring. This attention is warranted for three fundamental reasons.

The first is the expectation of a likely market failure under the new deregulated market paradigm which is approaching. In a competitive market driven by profit maximization, the low income customer segment is simply not going to be regarded as a profitable area to target energy efficiency services, due to the endemic problems of minimal income, high turnover, credit and collection problems, security risks and other challenges. This market segment represents the epitome of high transaction costs and low revenue potential.

The second is, ironically, the presence of good technical potential for efficiency. While lacking in profit potential, the low income market represents a very good physical potential for energy efficiency improvement. This market segment is characterized by a generally old and inefficient housing stock, a lack of capital to purchase efficiency measures on their own, and a lack of awareness of energy efficiency measures and actions which could be implemented

The third is a question of human need. Electricity service (and utility service generally) is not just another commodity. This is an essential public service that is necessary to sustain life in a modern society. Energy efficiency is one important way to maintain the affordability of utility service for low income

households.

Given the above three fundamental factors (human need, good technical potential, and likely market failure), it would seem to be an inescapable conclusion that regulatory/government intervention is both necessary and justified in securing the provision of energy efficiency services to the low income market segment. There are approaches to providing energy efficiency to low income households which make sense and are feasible, even in a more competitive environment (Pye, 1996). It is encouraging to note that in a recent review of state restructuring decisions (Ruberti, 1997) most states which have passed legislation or issued regulatory orders to implement electricity restructuring have included specific requirements for low income programs (although Michigan, the home state of Detroit Edison, has ironically not yet done so).

In the context of the above factors, this paper has presented some highlight results of research conducted for the Detroit Edison Evaluation Collaborative. Among other things, this research demonstrated the ability to reach low income customers with energy efficiency services; achieve significant electricity savings; apparently produce notable energy efficiency educational effects; substantially improve customer attitudes toward the utility; and achieve praiseworthy environmental emission reductions as a side benefit. The research also made a major contribution toward identifying and understanding in much more detail the intricacies of the low income customer population. It is hoped that together this research contributes toward further efforts to better understand this important market segment and helps to assure that necessary energy efficiency services are provided for in the emerging restructured world.

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