Utility Bill Comprehension in the Commercial and Industrial Sector: Results of Field Research

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ABSTRACT

This paper presents the results of interviews conducted with 44 business people in 10 states to examine the use of the utility bill as an information mechanism for providing businesses with the relationship between energy consumption and cost. Our results indicate that there are significant barriers to the use of the utility bill as an information tool for energy consumers. Furthermore, we found significant variations among respondents in the information desired from the bill, and differences in decision-making criteria for investments aimed at reducing energy consumption and for those aimed at other forms of waste minimization. These results call into question the applicability of standard market theories in the purchase of energy by most businesses.

Introduction

Two energy policy developments have received much attention in the past couple of years: the move toward utility deregulation, and the transition of energy efficiency programs to a market transformation paradigm. Both policies depend on consumers making informed decisions in the marketplace and choosing to purchase the most cost-effective product or service. Public utility commissions assume that itemized bills, for example, will allow customers to make informed choices among the variety of energy providers now available. Supporters of market transformation activities assume that providing information about the cost-effectiveness of new technologies (through a variety of information media) will be the primary driver in convincing customers to choose energy efficiency. Underlying these policies is a working assumption that a standard market exists (or can be created easily) between buyers and sellers to determine the price and quantity of energy; e.g., that customers can understand their energy usage, can determine their energy needs, and can base their energy consumption choices on their understanding of energy costs. To determine whether this assumption is justified in the commercial and industrial sector, it is necessary to know how businesses interpret their utility bills—the primary information mechanism relating energy consumption to cost—and how they use, or do not use, that information.

Previous Research

A number of authors; e.g., (Lutzenhiser 1993; Stern 1992), have argued that the predominant research and development paradigm in energy policy focuses too heavily on physical, engineering, and economic analysis, to the exclusion of inquiry into energy consumption behavior. The behavioral research done to counteract this dominance has been conducted primarily in the residential sector. As a result, there is little data upon which to draw about how businesses actually receive and process utility bills.

We were able to identify only one set of studies that analyzed business energy consumption behavior with regard to the utility bill: publications that resulted from work

done in a New Jersey shopping mall by researchers from the Center for Energy and Environmental Studies at Princeton University. The publications from that study include (Haberl and Komor 1989; Komor and Kempton 1991; Komor and Katzev 1988). These publications argue that there are several problems with the business decision-maker's use of current bill information, including: lack of understanding of utility rates, lack of understanding of the relative consumption of different end uses within the business, and problems with passing the appropriate information to relevant actors within the company. They also found a number of other factors that influenced energy consumption information, including: perceived lack of control of energy consumption, perceptions that consumption reduction would entail reduced comfort, split incentives for energy cost reduction, and perceptions that energy costs were a negligible component of business expenses.

The New Jersey studies provide an entry point into the analytical realm of small business decision-making; however, there are a number of issues with the research. First, it was conducted in only one location, a strip mall in New Jersey. How were the results affected by the fact that only one utility company was supplying the energy to these businesses? How were the results affected by the economic, cultural, and physical geography of New Jersey? Second, only stores based in a mall were analyzed. How did they differ from other business types? Third, the businesses were all relatively small. Are there differences in behavior based on the size of the firm? Finally, the research was conducted over ten years ago. Has the onset of utility deregulation changed the behavior of businesses?

Method

Our intent was to gather primary data about how business decision-makers use the utility bill as a mechanism to relate their energy consumption to cost. Furthermore, we wanted to try to understand why they come to the conclusions they do. How is the bill information received by decision-makers within the company? What is the thought process that takes place when reading the bill? What information is used, and what information is discarded? Is additional information desired? Etc.

We chose in-person semi-structured interviews to gather data about this behavior. Semi-structured interviewing is a technique that allows the specification of certain questions to be covered in the interview while allowing the respondent some latitude in the development of the conversation. We felt it necessary to conduct the interviews in person so that we could examine the utility bill with the respondent and carefully identify the specific bill components that were or were not used in the respondent's comprehension and analysis of the bill. We also felt it important that we not impose too much of a structure on the allowable responses, as so little is known about the environment in which these decisions are taking place. We were concerned that more structured data collection techniques; e.g. surveys, had a high potential for misinterpretation of meaning by both respondents and researchers. For example, a seemingly straightforward survey question might be, "Does your utility rate include a demand charge?" However, as the CEES studies above showed and our interviews confirmed, many companies who were being charged for demand didn't realize that it was a component of their cost. As a result, they would likely have incorrectly answered "no" to such a survey question, even if the term "demand" were carefully defined by the survey. Using in-person semi-structured interviews, we were able to deal with this particular situation by (a) identifying the demand charge as present on the bill, since we were

looking over the bill with them, (b) explaining the concept of a demand charge when it wasn't understood, and (c) recording the reaction to that piece of information, including the respondent's thoughts about potential change in energy consumption as a result.

We identified potential interview respondents via a number of mechanisms, including social acquaintance, participation in the Energy Star/Green Lights program,[1] and simple "cold calling." Throughout the process, we tried to develop a mix of business sizes, locations, and activities. Each interview respondent confirmed that they were either the person who received the utility bill or the person within the organization who made decisions about energy use.

We spoke with respondents within 44 business. These businesses were spread across 20 cities in 10 states. The businesses included restaurants, dry cleaners, professional services (lawyers, dentists, psychologists, etc.), retail sales (furniture, auto parts, gifts), schools and universities, printers, auto body shops, manufacturing facilities, churches, hospitals, and others. Business sizes ranged from one employee to over one thousand. Monthly utility bills ranged from less than one hundred dollars to several hundred thousand, with a wide variety of tariff structures and energy providers.

Interviews were conducted from December 1997 through February 1999. The interview data were captured either by audio tape and transcription (29 interviews) or interviewer notes, based on respondent preference, ambient noise, and other factors.

This sample provides an interesting set of anecdotal information from which to draw a sense of the context within which businesses make choices about energy consumption. The variety of the size, type, and location of the businesses provides some interesting comparisons among the respondents. Nevertheless, it does not lend itself to any form of extrapolation to the US commercial sector as a whole. The comparisons reported here are only suggestive.

Results

This paper presents three major areas of discussion: the information mechanism of the utility bill, reaction to the idea of consumption feedback as an addition to the bill, and the decision-making environment in which bill information is processed and to which the bill contributes. While there has been some research within the energy policy community on the impact of organizational structure on energy decision-making; e.g., (Cebon 1990; Cebon 1992; Kulakowski 1999), very little if anything has been said about the impact of business size on decision-making. Our interviews revealed a number of differences between businesses based on their size. These differences will be noted in each section.

The Utility Bill

The first set of questions in our interviews dealt with the way the mailed utility bill was processed within the organization. Key issues here included the receipt and distribution of the mail packet to involved parties, the comprehension of the information received by decision-makers, and the use of that information to make energy consumption decisions.

[1] Five respondents had participated in one of EPA's voluntary programs. One of the five, approached via a social network contact, had no recollection of participation in an EPA program but appeared on EPA's program participants' list.

Mail handling. Utility mailings often include information – bill stuffers – along with the actual bill. Mass mailings are known for low response rates; however, the problem is exacerbated by the problem of inter-organizational mail processing. Often, everything but the bill itself is eliminated at the mail opening stage, so the information never gets passed on to the decision maker, even if the decision maker were to be interested in the information. Furthermore, the bill itself is often not passed to the decision-maker. Only the amount due is communicated, usually through the accounts payable check writing process. This phenomenon is in substantial agreement with the findings of Komor and Katzev (Komor and Katzev 1988, 236).

There are distinctions that should be made within this general scope. In very small firms (one or a few employees), the decision-maker was usually the mail handler. While we still found that the stuffers were summarily discarded, the information associated with the bill itself was available to be read. As the business grew to a size that allowed for a specialization of tasks, the bill itself would then often not be passed to a decision-maker, and only a summary of the amount would be communicated. Interestingly, though, this barrier faded as the business grew still larger. In the case where the business was large enough to sustain a facility or energy manager, the firms with whom we spoke often had devised a specific process of information sharing about the specific energy consumption information on the bill. For example, copies of the bill were circulated among multiple personnel within the company. One company brought together an "energy council" of staff from a number of different departments, including facilities, security, energy management, and finance.

Overall, therefore, stuffers seem to reach an exceedingly small percentage of the market; however, information included on the bill itself does reach a larger fraction of business decision-makers than might be anticipated, and all decision-makers with whom we spoke were at least aware of the dollar amount owed to the utility.

Bill layout. A problem that occurred multiple times in our interviewing had to do with the presentation of data on the bill. Prior research showed that seemingly obvious information cues on the bill could be misinterpreted, so this was not unexpected. See, e.g., (Egan, et al. 1996, 41), in which graphics thought to be self-evident to researchers were interpreted incorrectly by respondents. We found two instances where the layout of the meter data affected the interpretation of the data. In the first, a bill with a standard consumption-only tariff, the previous month's meter reading was shown first, then the current month's reading to the right, and finally the total usage to the right again. Several of our interview respondents ignored the last column and read the first two columns as last month's and this month's *consumption*, rather than the meter values. As a result, they believed their energy usage to be consistently increasing over time. In the second instance, a time-of-use tariff, a similar comprehension problem occurred. Interview respondents read the third column (off-peak) as the sum of the first two columns (on-peak and intermediate.) In this case, visual clues could easily lead to that conclusion, as directly underneath the third column was the summation of the bill charges. In both cases, of course, it was extremely difficult for the consumer to make an accurate correlation between energy consumption and energy cost.

A more common problem was the perceived clutter of the bill. Respondents often expressed puzzlement and frustration at the variety of charges, cost adjustments, and taxes listed on the bill. This was exacerbated in locations where utility deregulation was underway and the various components of energy service were listed; e.g., transmission, distribution,

generation, etc. The proliferation of line items on the bill led most people to ignore them completely and focus solely on the amount due. The result is a bill that, by providing so much information, ends up providing very little information of use.

Unfamiliarity with charges. We found a significant lack of understanding of the charges on the utility bill. In agreement with Komor and Katzev, we found that very few small business people recognized that a demand charge was a component of their bill. At the very small end of the spectrum, the businesses were often on consumption-only tariffs, but often expressed unfamiliarity and resignation at the way the total bill was calculated. One respondent received bills for three different locations, and the three locations were on three separate rates. The respondent had not realized the difference, nor could he explain why there would be a difference. Another example was differences between summer and winter rates. A respondent indicated that the line item reporting that charge reflected the semi-annual rate increase that the utility imposed. As the businesses got larger and tariffs became more complicated, we ran into the lack of understanding of the method of calculating the various components of the charge. Time of use rates were understood somewhat, in that respondents knew they were being charged different amounts at different times of the day; however, very few could identify the hour blocks. Demand charges were almost entirely misunderstood. Very few respondents in this business size category could even identify the demand charge as a component of the bill, much less explain the concept or identify ways to lower the charge. As the business got larger still, this problem faded. These very large firms generally had specialized energy managers, and they were quite familiar with the bill components and terms.

Relative consumption by end use. We found that a number of companies faced the same problem as residential customers with regard to understanding the end-use breakdown of energy consumption, as previous studies have shown; cf. (Kempton, et al. 1985; Komor and Katzev 1988). However, we did not find the same the same level of perceptual salience response these other studies had identified. Komor and Katzev write, "When asked which appliances used a lot of energy, many respondents mentioned appliances that were noisy or easily controlled…. Less visible or controllable appliances, such as refrigerators or air conditioners, were often ignored." (Komor and Katzev 1988, 236). Lighting, for example, was mentioned very rarely as a major consumer of energy by our respondents, although it is easily controlled and quite visible. HVAC system performance was most often mentioned as the reason for high energy bills.

While the issue of end-use breakdown affected both small and large firms, we found a significant difference in the use of the energy bill to determine end-use consumption. Decision makers in smaller firms largely used their intuition to identify energy consumption devices, and did so on the basis of monthly consumption alone. Larger firms, on the other hand, were more attuned to demand fluctuations, and were therefore interested in daily or even hourly data. Because they could not receive this information from the monthly utility bill, they had devised strategies to calculate energy consumption within the business on this finer degree of detail. Respondents reported using standard techniques of energy management systems or buying utility data. In addition, however, they reported techniques such as having the security or janitorial staff read the meters every night as part of their rounds, or installing their own meters at a more end-use specific level than the utility provided.

Consumption Feedback

In our second set of interview questions, we asked about two types of feedback comparisons: self comparisons (i.e., historic consumption information) and comparisons with other businesses. Many of the respondents had some form of self-comparison already on their bill – a comparison of their current month's bill with the same month's consumption the previous year.

Self comparisons were often mentioned as something that would be of interest to the respondents. However, the feedback that many interviewees were already receiving was not seen as particularly helpful. Several interviewees suggested a longer time frame would be more useful. Another use of self-comparison data that was suggested was the desirability of projections of future consumption based on prior bill history. Small businesses in particular were interested in this as a budgeting measure.

Larger businesses, those that had full-time energy managers, were relatively unimpressed with the idea of historic comparisons, primarily because they were already collecting that data for themselves. In most cases, the larger firms had spreadsheets that tracked their energy consumption over many months, often including the information they had collected themselves (as mentioned above.) Therefore, the one month's worth of data that they were currently receiving on their bill was not of much use. These respondents did report that they thought the utility could do the job just as easily, and they indicated a preference for that over their current system.

By and large, then, none of the respondents indicated that the current method of displaying self-comparison data was very useful. Most, in fact, had to be prompted about it as a component of the bill before they would mention it. They seemed to lose the data among all the other numbers provided. When shown graphical representations of comparative information, respondents reacted positively. It seems likely, then, that current implementations of historic data are not as effective as they could be, and that careful attention to the design of such comparisons could provide more effective information.

None of the respondents received a bill that contained comparative information, although two respondents who owned multiple stores each mentioned the fact that differences in energy costs between the stores had caught their attention.

From an analytical perspective, one might suppose that comparative consumption information would be particularly useful to small businesses. For one thing, most smaller businesses do not have significant process loads, so it is an easier analytical task to compare the major consumption elements among different businesses. For another thing, several small businesses we spoke with were located in strip malls, where the utility services available, and often the hours of operation, for each business were essentially the same – the major variation would be square footage. Finally, some respondents were franchise operators, and those franchises had relatively standardized floor plans, equipment installations, etc.

Given all of these factors, we were surprised at the vehemence with which the respondents from smaller firms rejected the idea of "like business" comparison. There was significant resistance to the idea that any business could be like their own, and any comparison that would be done would not therefore be on an "apples to apples" basis.

In contrast, large firms did express interest in "like business" comparative information, even though they recognized that the comparison would have to be very rough. Their concern was on an "order of magnitude" basis – they wanted to make sure that nearby

companies had not found significant process or price savings that their own company had overlooked.

The Decision Environment

Our final set of questions had to do with general impressions of the importance of reducing energy cost to the business. Three factors we considered significant within this area: the intangibility of energy consumption as an identifiable, ongoing business cost; the perception that energy cost reduction was difficult to achieve and unlikely to be worth the effort; and the way energy investment decisions were made in comparison to other investment possibilities.

Intangibility. Of the respondents we spoke with who seemed to be particularly interested in reducing their energy consumption, a common theme was their use of a particular item of their business process as a proxy for energy consumption. For example, an ice cream store owner thought of electricity in terms of "keeping the ice cream cold." A fast-food restaurateur thought in terms of "cents per burger." Manufacturers thought in terms of units of product produced per unit energy.

All of these techniques addressed the issue of the tangibility of energy consumption. It is a common refrain in the efficiency community that people do not buy energy, they buy the services that energy provides. However, the utility bill does not charge in service units, but in energy units. Making the linkage seems important in correlating energy consumption and energy cost in these businesses.

Consumption reduction: effort and value. Among the respondents who were not specifically trained in energy issues, there was a sense that analysis of energy consumption was complex, and that they were not trained to do it. As a result, they felt unqualified to make any decisions about changing energy costs. This feeling even extended to respondents whose job was specifically related to energy use. The self-identified "energy manager" of one company had personal friends who ran an energy services company. He had considered asking them about the school, but decided that the school was not too complicated. He said it did not have any "industrial processes." Because of this, he felt that there was nothing that could be done.

While it is true that careful analysis of business energy consumption on a system-wide basis can require significant analytical expertise to conduct appropriately, we were struck by the vehemence with which respondents claimed that they were incapable of understanding any of the issues involved. We believe that this opinion stemmed from a number of factors. First, there was a sense that any change in consumption would have to be the result of a complicated process, or it either would already have been done or would not have significant impact. This reflected a bit of the "Lake Wobegon effect" – all of the respondents considered their energy use to be generally efficient. Second, the complex nature of the utility bill (as discussed above) implied to them that the topic of energy consumption had to be a complicated one, and any reduction would therefore have to be complicated, too.

A number of the businesses we interviewed rented space in a building owned by another party. This creates the well-known split-incentive problem, in which owners have little incentive to invest in energy-efficient equipment, as they do not pay the energy cost,

while tenants do not want to pay for capital costs that they cannot recoup if they leave the rented space.

Respondents in this group were quite aware of this incentive problem, and it directly contributed to their lack of interest in bill consumption information. One respondent, a grocer, said that he would have to discuss any potential lighting changes with the mall owner, and that dealing with that was not worth the hassle.

It is important to note that these issues are confined to the realm of capital investment. Some studies have shown that comparative energy consumption information can affect energy consumption behavior, even in the commercial sector; e.g., (Siero, et al. 1996). If the utility bill were to offer comparative consumption information, it might foster the competitive nature that seems to encourage lower energy use through changes in operations practices. Clear correlation between actions and results could also help to reduce this sense of the overwhelming complexity of the topic. As outlined above, though, there are validity questions to that comparison that would have to be addressed.

Decision Criteria. Finally, we found that there was a significant difference in the way companies made decisions about investment in energy efficiency compared to other investment decisions. A two-year payback on energy investment was quite standard among the larger firms we spoke with, while smaller firms considered any investment to be beyond their ability to pay. We found numerous instances, though, of other investments that were not considered based upon a payback criteria. One of the most striking had to do with another type of conservation investment: water conservation. Several respondents in large companies reported that they had undertaken significant water conservation investments in their firms because it was the "neighborly" thing to do in their community. Water expenses were not significant, but water conservation was seen as an appropriate stewardship of a community resource.

Similarly, one company had split its energy management efforts into two separate departments: one dealt solely with energy prices, while the other dealt solely with energy consumption. Both of these examples, I would argue, show that there is something about the belief system of the company that determines whether or not to invest in energy efficiency improvements. Economics need not be the motivating factor. The energy policy community has largely argued in favor of efficiency investment only the economic grounds. Perhaps this argument needs to be expanded.

Conclusion

Our interviews with business decision-makers have shown that there are a number of barriers to the receipt, comprehension, and use of utility bill information to make decisions about the relationship between energy consumption and business costs. Utility bills are the primary information mechanism for most businesses, yet the design and content of the bill has not been carefully analyzed to supply the information businesses need. More research is necessary to determine how effective utility bills can be in providing useful information, and what additional information mechanisms might be available.

If regulators are using the utility bill as a mechanism to send signals to the marketplace, it must be recognized that the bill needs significant improvement for those signals to be received. The goal of reducing peak generation demand through time of use and

demand charges, for example, is limited in its effectiveness by the lack of understanding of these charges by business decision-makers. More broadly, the information currently provided confuses people. This, in turn, leads to a sense of helplessness and frustration with regard to energy issues in general. This sense is a strong hurdle to overcome with a message of the market benefits of energy efficiency. Furthermore, market transactions need not be the sole motivator for efficiency improvements. In fact, the resignation many respondents reported about paying their utility bill is indicative not of a market interaction between buyer and seller, but more of a regulated interaction between a collection authority and a taxed citizen. Conceiving of the utility/customer relationship in this way may shed very different light on the avenues available for market transformation activities.

By and large, it is important to note that a significant fraction of decision-makers within the market do receive the utility bill itself. The utility bill is therefore an important information source. It is clear that (a) important information must appear on the bill itself if one is attempting to take advantage of this communication mechanism, and (b) the information provided must be specific and comprehensible to the recipient.

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