

Decision-Making Among Small and Medium Manufacturers, And Indications of What Is Needed to Reach These Customers

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ABSTRACT

Energy efficiency programs have had a difficult time making inroads with small and medium-sized manufacturers. A survey was undertaken with small to medium manufacturers in Wisconsin as part of an evaluation of two different programs. This survey included detailed questions concerning the structure of different types of energy equipment and operating equipment decision-making. This paper presents results from the decision-making information gathered. This information is provided in the hope that it can be useful in designing future energy efficiency programs that better target these customers.

This paper concludes by providing insights gained on the types of energy efficiency program attributes that might have the best chance at reaching the small to medium-size manufacturers. From their decision-making perspectives and the overall evaluation findings, attributes that would be useful in designing a program to these customers are discussed.

Introduction

Many energy efficiency programs have concentrated on providing information as to the economic benefits of making energy efficiency investments. However, there has been a continuing body of evidence of the non-economic and non-technical barriers to energy efficiency embodied in the organizational practices and culture of firms and professions. Significant research has documented the existence and importance of these environmental/sociological influences and the interaction between economic, sociological, and other factors in the actual operation of energy decisions (Megdal 1998). These can be seen as professional cultural influences into decision-making practices, such as the research concerning architects and building owners/residences for new construction (Janda 1994, 1996, and 1998; Mahone et. al. 2001). Many of these have focused on the commercial building market (e.g., Janda 1994, 1996, and 1998; Parker, Chao, and Gillespie 2000; Reed, Oh, and Hall 2000, Weber 2000 and 2001, Kunkle and Lutzenhiser 2001).

A common recommendation from these studies is the need to further research customer decision-making factors besides economic returns and greater understanding of the structure of decision-making and the organizational influences on decisions. The call for a better understanding of customer needs and projects that have conducted more in-depth research on customer needs (e.g., Jones et. al. 2001) are an element of this perspective.

Studies examining decision-making in this broader context are less frequent within the industrial sector. The many studies conducted on decision-making in industrial firms often focus on the large industrial customers (Peters, Way, and Seratt 1996, Jones et. al. 2001). These studies have often found that the decision making is not focused upon return on investment or direct economic returns, but on factors that promote larger revenue

enhancement, productivity, and other non-energy elements of their business (Peters, Way, and Seratt 1996, and cites therein).

An early review of industrial programs by Jordan and Nadel (1992), four key factors were identified to contribute most to successful efforts. These are: (1) insight into the customer's needs, (2) program flexibility, (3) innovative marketing approaches, and (4) financial incentives.

This paper adds to this body of research by examining a less examined market, the small-to-medium sized manufacturers. It also provides additional evidence and insight into how various energy decisions are made at these smaller industrial firms and what factors influence these decisions. The paper then concludes by highlighting insights from these findings for program design elements specific to small-to-medium sized manufacturers.

Background on the Programs

Influencing energy-efficiency practices in the industrial sector has always been a challenge for program managers and regulators. Some strategies involve the formation of partnerships with organizations that provide complementary services and with those that already have existing relationships with targeted industries. The Energy Center of Wisconsin (the ECW) has conducted an evaluation of two related programs that address industrial efficiency. The programs are:

- The Wisconsin Manufacturing Extension Partnership's (WMEP) industrial assessments (WMEP industrial assessments); and
- A collaborative program between the ECW and WMEP that offered a free energy audit in addition to the normal WMEP services (WMEP-ECW partnership).¹

The WMEP is affiliated with the Manufacturing Extension Partnership program of the National Institute for Standards and Technology (NIST). This U.S. Department of Commerce office and program helped establish centers such as WMEP through grants from the federal government that are matched with state and local grants and funding. The purpose of WMEP is to facilitate Wisconsin's small- and medium-sized manufacturers' ability to improve their competitiveness.

WMEP services are offered for fees that are subsidized by the grant funding. WMEP develops partnerships with its customers and facilitates the companies making changes that will make them more competitive. WMEP primarily teaches its customers quality management techniques and then provides support to them in implementing the techniques toward improving business and plant processes that will make the company more competitive. WMEP field representatives provide expert assistance through services that include lean manufacturing seminars, benchmarking surveys, employee feedback surveys, specific process assessments, and an integrated assessment. Changes recommended and implemented can be to any dimension of the business, but typically are improvements in business process, employee education, or changes in plant processes.

¹ A third program, a partnership between WMEP and Alliant Energy, had originally been slated for evaluation. Yet, this program had few participants that had received referrals and fewer still that had completed subsequent actions at the time of this evaluation. This made the evaluation component of this effort more limited regarding the issues being discussed in this paper.

The second program, the WMEP-ECW partnership, evolved into an energy audit program made available to WMEP customers during 1999. WMEP field representatives helped to select companies to whom an energy audit by one of three independent energy consultants would be provided at no cost. A total of 26 companies received such audits. The ECW selected the consultants, funded the audits, and helped provide oversight of this effort.

Methodology

An evaluation was conducted to assess energy savings of the WMEP industrial assessment (either directly or as a change in the energy intensity of production), the value and challenges of the partnership with WMEP, and comparison between the different efforts. Interviews, surveys, material review, site visits, engineering analysis of actions, energy bill examinations, and production change data was used for the evaluation.

One component of this evaluation included examining the energy-related decision-making within small-to-medium sized manufacturers. It is this latter component that is the focus of this paper. (A general overview of the findings from the overall evaluation is provided in Bensch, Megdal, Penn, and Schauf 2001.) The surveys provided the information for this assessment.

The telephone surveys contained both quantitative and qualitative inquiries. A senior interviewer experienced in conducting industrial interviews was used for all telephone surveys. The surveys were designed to minimize possible self-reporting bias and a bias in responses from energy saving behavior being seen as normative. Though no systematic evidence of biased responses or interactive influence with the interviewer could be found, the reader should recognize that this is always a possibility in surveys of this type.

The WMEP industrial assessment sample consisted of 15 participants that had not been part of the WMEP-ECW pilot program offering. The sample was selected from WMEP customers based upon there being at least a medium level probability that the industrial assessment recommendations might have some type of energy impact if implemented. This was done to ensure that the sample met the needs of the energy analysis and energy intensity components of the evaluation. This means that there was a somewhat greater probability of these customers having energy impacts from the WMEP services they received than of the general WMEP population. (For example, this sample contained slightly fewer firms where the WMEP services only consisted of changes in accounting practices.) Other than this, the WMEP sample was fairly representative of the entire WMEP population.

There were a total of 26 participants in the WMEP-ECW pilot program (WMEP services plus audit and customized report of audit findings). WMEP field representatives recommended WMEP customers into the WMEP-ECW pilot program based upon their work with the client and where they thought the client might be receptive to an audit and that energy actions might be found. This means that the WMEP-ECW pilot participants would generally have a higher energy savings potential than the general WMEP population. Recognize, however, this is similar to the sample selection criteria used for the WMEP industrial assessment sample.

There was a two-stage process used with this second group of participants, the WMEP-ECW pilot program participants. There was a different survey fielded in each phase for all firms in the study sample. The initial survey was conducted between four and sixteen months after the companies received their free energy audits. We conducted this initial

survey with 22 of the 26 WMEP customers that received the additional energy audit services, the WMEP-ECW pilot program participants.

The initial WMEP-ECW survey found that 35% of the recommendations had been implemented, and most firms (86%) implemented at least one recommendation. The second survey was of those that implemented at least one measure. The initial survey provided 18 firms for the follow-up survey.² There were nine WMEP-ECW pilot program participants interviewed through the second in-depth interview and are the final sample for many of the decision-making questions.

There was a significant diversity in the types of manufacturers in both samples and no systematic difference between the two was noted. These small-to-medium sized manufacturers often fill niche-manufacturing markets. The businesses included food production (cheese, specialty meats), small foundry and special metal applications, building products, composites, plastic part manufacturing, precision and ornamental metal products, electronics, switches, sensors, specialty paper products, furniture products/components, and others.

Another important demographic attribute for decision-making and program design is whether the small-to-medium sized manufacturing facilities are one location sites, multi-location sites with the Wisconsin site being the headquarters, or multi-location site with the corporate headquarters elsewhere. The survey samples from the two programs are similar in this attribute. As seen in Table 1, half of both groups are single-location manufacturing sites. The multi-location sites are split between the corporate headquarters being interviewed versus it being elsewhere.

Table 1. Single and Multi-Location Site Distribution

Type of Site	WMEP-Industrial Assessment	WMEP-ECW Pilot Program
One location site	50%	56%
Multi-location site but this site is corporate headquarters	17%	22%
Multi-location site & corporate headquarters is elsewhere	33%	22%

Findings Concerning Energy Usage Decision-Making for Small-to-Medium Sized Manufacturers

Decision-making of small to medium-sized manufacturers was examined in the participant interviews. Decision-making can differ by whether the decision-making authority is concentrated in the hands of one primary decision-maker, whether there is a technical decision-maker and then a financial or contracting decision-maker that can be seen as a set of hurdles, a committee decision, or an extensive linear corporate process. Participants were asked to characterize how decision-making typically occurred in their firm. An array of decision process types was presented through seven response choices and an “other” category. The response choices were:

² There were 19 firms that implemented at least one measure, but one firm indicated in the first survey a desire not to be conducted again.

1. “A committee of which I chair and have final say makes the decisions.”
2. “The decision is completely a committee decision.”
3. “Someone else makes the technical recommendations but I have the final financial or contracting authority.”
4. “I make the recommendations but others have the financial or contracting authority.”
5. “I make recommendations and the corporate office elsewhere makes the decision, but my recommendations are normally followed.”
6. “I make recommendations but the corporate office always makes their own decisions, sometimes with little regard to my recommendations.”
7. “There are multiple groups and decision points that must be passed that are more complicated than these other statements.”
8. Other.

There were no significant differences (and none were expected) between the decision-making process at the WMEP industrial assessment sample and WMEP-ECW sample firms.

None of the 22 responses (from both Program 1 and Program 2) said that decisions were completely committee decisions (category 2), corporate decisions independent of the respondent’s opinion (category 6) or other. The initial “in general” decision-making question found these customers to be almost equally spread between the other five categories.

We further explored the decision-making process by asking respondents if their firm’s decision-making process is different (providing the category response) or the same for each of the following types of decisions:

- In general
- Replacing heating equipment
- Energy service contracts
- Operating and maintenance (O&M) services for heating and cooling equipment
- O&M services on production equipment or motors
- Purchasing motors, air compressors, or pumps
- Purchasing production equipment
- Production equipment layout, and
- Production process and operations design.

Decision-making on production equipment layout design was also equally spread across these categories. The other categories of decisions, however, were found to be somewhat different when viewed across all the respondents.

Both heating and cooling O&M, and production O&M saw less influence by corporate and some of the other categories and more emphasis on other decision processes. These often involved plant managers, facility managers, and O&M staff.

Decisions surrounding motor and pump decisions, and production equipment decisions saw more involvement from production managers and less committee decision-making.

Decisions about production process design involved “other” decision processes for one-third of the respondents. These decision processes generally included plant managers, production personnel, and other production-related operations. These decisions were less

often made and led by a single or two individuals, but involved more parties, likely making these types of decisions more difficult to influence.

We asked these respondents how important different factors are when making decisions about changing production or business processes. The cost per unit produced and quality of product are absolutely paramount for the small-to-medium sized manufacturer (as seen from the survey in this evaluation). This is followed by employee work environment, overall operating cost, safety, and employee productivity. Though still important to over half the respondents, initial capital cost, expertise to maintain or incorporate the change, and financing are less important. See Table 2 for a list of these factors and the number of respondents who said the factor is “all important and nothing else matters” or “very important.”³

Table 2. Decision-Making Factors that are All Important or Very Important

Decision Factor	WMEP	WMEP-ECW Pilot
Cost per unit produced	13* (100%)	9* (100%)
Quality of product	13 (100%)	9 (100%)
Employee work environment	10 (77%)	8 (89%)
Overall operating cost	12 (92%)	8 (89%)
Safety	12 (92%)	8 (89%)
Employee productivity	12 (92%)	6 (67%)
Expertise required to maintain the more efficient equipment or process	11 (85%)	7 (78%)
Initial capital cost of change	11 (85%)	5 (56%)
Expertise required for making change	9 (69%)	7 (78%)
Down time required for change	9 (69%)	6 (67%)
What I think my competitors are doing	9 (69%)	8 (89%)
Financing availability	8 (62%)	4 (44%)
Time needed to make change	5 (38%)	2 (22%)
Whether I or my group gets the benefits versus another department	1 (8%)	0 (0%)

* In recognition of the very small sample sizes involved in this study, the sample size responding, N, is presented in the table prior to the percent providing that response.

Time needed to make the change is relatively unimportant. This is consistent with the findings from the WMEP-ECW pilot implementation where additional measures were planning to be installed on an on-going basis, sometimes as waiting to be part of other upgrades.

We asked these respondents about their attitudes and opinions toward energy consumption and conservation efforts in their organizations. They rated their level of agreement with several statements addressing these issues based on a scale of one to ten, where one means they “strongly disagree” and ten means they “strongly agree” with the statement. See Table 3 for the mean ratings for each statement about energy efficiency.

³ The other response categories were: “somewhat important”, “somewhat considered”, and “not considered at all”.

Table 3. Attitudes About Energy Consumption and Efficiency (Mean Rating)

Statement	WMEP only	WMEP-ECW Pilot
It's important to us to be able to save money on our energy bills.	7.5	8.6
Our firm actively investigates ways to make our operations more energy efficient.	5.2*	7.2*
Saving energy would make our firm more competitive.	7.8	7.1
There are energy efficient investments that I'm interested in making, but they always seem to fall below other priorities.	5.1	6.2
In the future, our firm would be interested in having energy-efficiency consultants conduct another audit to find additional ways to show us how to save energy.	7.7*	5.3*
Energy use is so secondary to our operations it is never really looked at.	3.3	3.1
I feel uncertain about the reliability of information we receive from firms that would assess our energy use.	5.1	5.0
We feel that there is too much time and hassle involved in us getting a qualified contractor on our own to re-examine our energy usage in a few years.	5.1	5.4
I regularly hear from other business contacts about energy-efficiency investments and practices that we could consider.	3.1	3.1
Since working with WMEP we are more conscious of trying to reduce waste and inefficiency in our operations.	8.4	7.1

* Substantial differences in WMEP and WMEP-ECW pilot respondents are shown in bold.

A comparison of these ratings provides an assessment of these attitudes, and potential barriers for energy efficiency in the small-to-medium sized manufacturing sector. Where there are differences between the ratings from the WMEP industrial assessment sample and WMEP-ECW pilot participants, a comparison between the effects of the energy audit from the overall WMEP services effect were assessed.

Some of the statements are positive and some are negative (designed this way to minimize potential unidirectional response biases). This needs to be taken into account as well as the mean rating's distance from the mid-point, five as neither agree or disagree with the statement (attitude/barrier). In doing this, most of the potential barriers can be discerned.

An important barrier indicated from these statements is the need to have energy expertise to assist in helping firms find additional ways to save energy. This has a mean rating of 7.7 for the WMEP only participants (which had not received this service) and, yet, is neutral for the WMEP-ECW pilot participants (5.3). This provides additional evidence of at least the perceived need by these manufacturers of additional energy expertise to make these improvements. It also provides possible evidence supporting the positive effect of the free energy audits in the WMEP-ECW pilot program for these participants. (Alternatively, we need to recognize that it could also mean that having experienced energy audits, WMEP-ECW pilot participants have found them less valuable than customers originally perceive them to be.)

At the same time, the WMEP-ECW pilot participants did not strongly disagree with the statement. This might indicate that they feel additional expertise could still be warranted at some point.

We also see, in row 2 of Table 3, that WMEP-ECW pilot participants more actively seek ways to make their operations more energy efficient than WMEP participants. Part of this effect may be from the audit program, but part of the effect may also be from the selectivity of the need for energy efficiency contributing to which WMEP customers were referred and recruited into WMEP-ECW pilot.

In addition to these attitude questions, WMEP-ECW pilot participants were asked if they have taken additional energy efficiency actions outside of those proposed in the audit since the audit. A noteworthy 44% of the WMEP-ECW pilot participants have done so.

WMEP participants were asked in the interviews what would have to change to get them to examine and undertake more energy efficiency actions. The responses indicate the same barriers as have been seen in other studies of this sector: low energy costs compared to other production inputs, and the importance of internal corporate attitudes. These are best seen in the following statements by participants.

“Presently our energy is only about 1% of gross product. This is very reasonable and I don’t think we can change this much. If prices go way up in the future and this % increases, we might start to care.”

“We would need to have someone in the company who would be a champion of energy efficiency and who would take responsibility for getting things done related to energy efficiency. Before this would happen, the company likely would have to feel that energy is more important than the company presently feels it is.”

The possible importance and influence of additional energy information and programs such as the free audit, however, are also provided from the WMEP interviews. WMEP participants have said that what would need to change, or the help they would need, to have their firm look for more energy savings opportunities would be:

“We would have to have more information about the opportunities to save.”

“Need to be made more aware of programs and savings capabilities of their plant – awareness building.”

“We need to gain more awareness of savings potentials.”

“We would need to have information regarding ROI, and clearly identifying opportunities that will work for us. The information would need to show cost reductions that are reliable and believable.”

WMEP-ECW pilot participants were asked what needed to be different to have their firm undertake more of the energy savings recommendations (no additional financial incentives were offered to assist in implementation). Their responses indicate that the greatest need is to allow them a long time to phase in the recommendations with five responses, 22% of the sample. Second to this, is a tie between “nothing else is needed” and “additional capital for the investment” with four responses each (17%).

Participants from both programs (WMEP alone and the WMEP-ECW pilot that has the WMEP services along with the energy audit services) were asked about preferred program design options for assisting small to medium-sized manufacturers. The participants strongly preferred program design options that included having energy efficiency considerations as a subset of the industrial assessment assistance (from WMEP) or where this industrial assistance recommended and brought in the energy expertise.

The least effective option, from the respondents' viewpoint, would be energy assistance being provided independently by a private for-profit firm or manufacturer's sales representative.⁴ Assistance from the local electric or gas utility rated ahead of the private energy firm but significantly behind assistance with or within the industrial assistance effort.

Evaluation Insights for Program Design for Small-to-Medium Sized Manufacturers

We found that decision-making in small manufacturers is characterized by different decision and authority structures and that each of these structures are equally common. All too often program designs are developed implicitly envisioning one particular type of decision-making structure in how the program personnel approach a decision-maker and in the material available for their firm. The different decision and authority structures suggests that programs attempting to influence small to medium manufacturers may need to consider adapting their approaches to the decision process of the customer with whom they are working. This may mean having planned alternative presentations, sets of material, and varying approaches for working with firms with different decision and authority structures.

The five categories of decision and authority structures we found are not just reporting categories but can make a significant difference to the internal processes involved to create a positive energy efficiency decision. A program to support the primary decision-making, where information must be reviewed by a committee, may want to offer different support material for the firm's use than one where the review is by the financial authority with little technical input. Programs attempting to influence small to medium manufacturers need to be prepared to adapt their approaches to the decision process of the customer. This may mean designing industrial energy efficiency programs that find out the type of decision-making process that operates at a firm early on in the relationship building process. Then having a program prepared to offer different types of materials, feedback, and support to the primary contact based upon the decision-making process at their firm. This more customized support to the primary contact could allow them to become a more effective internal champion of the energy efficiency investment.

The type of material and process used to "sell energy efficiency" could also vary by the type of equipment or practice being considered given different decision-making structures. Both heating and cooling O&M, and production O&M saw less influence by corporate and some of the other categories and more emphasis on other decision processes involving plant managers, facility managers, and O&M staff. Less committee decision-making surrounded motor, pump, and production equipment decisions and instead, greater involvement from production managers, production personnel, and other production-related operations.

As has been found repeatedly in the industrial sector and has also been found in this study, energy usage is not on the radar screen. The cost per unit produced and quality of product are absolutely paramount for the small-to-medium sized manufacturer. This is followed by employee work environment, overall operating cost, safety, and employee

⁴ Recognize that the WMEP services are offered for fee and no specific energy services have been provided to this sample. The WMEP-ECW pilot participants, however, did receive no cost audit services but no additional financial support for implementation.

productivity. Though still important to over one-half the respondents, initial capital cost, expertise to maintain or incorporate the change, and financing are less important.

As has been recommended before, changes for manufacturers must relate to the cost per unit, quality of the product, and productivity. Having initial capital cost and financing less important means that these potential barriers for small manufacturers may not block investments in energy efficiency if the investment can aid productivity. This is supported by the fact that the decision to implement energy saving recommendations among WMEP-ECW pilot participants was not strongly correlated to either the initial project cost or the length of project payback.

The one barrier that shows up is the need to have energy expertise to assist in helping firms find additional ways to save energy.

At the same time, small-to-medium sized manufacturers felt it quite important that personnel that worked with them understood their particular industry. This means that independent energy assistance is/would not be as well received by these customers as a model that incorporates industry-specific expertise. Concerns about understanding the particular manufacturing industry for that facility might be addressed by a closer working relationship between the energy expert and the industry expert.

The lower priority of energy to cost per unit, product quality and productivity combined with the need to have industry-specific knowledge, points to the opportunities involved of incorporating energy efficiency expertise with industry-specific expertise within an industrial productivity effort. This is akin to the WMEP effort examined in this evaluation.

Challenges in working with the industrial assistance effort, however, were discovered in the pilot efforts tested and documented in the evaluation. Corporate cultures and perspectives can make the meshing of program efforts difficult, though there are definite benefits seen for the customers and the programs of doing so.

These small-to-medium sized manufacturers seemed to show longer-term horizons and staged implementation for energy efficiency investments than originally expected. The WMEP-ECW pilot program offered an energy audit but no additional financial assistance. Nonetheless, most firms (86%) implemented at least one recommendation, additional measures were still in planning, and 44% of those implementing at least one measure also took additional energy efficiency actions outside of those recommended within the first year after the audit. This perspective is best seen in the following statement from one of the interviewees:

“We are a small enough company that the recommendations that seemed reasonable to implement have been or will be put into place. As things in our facility change, we continually refer back to the report for input to process or equipment recommendations. We are slowly, but steadily, making many of the changes in the report.”

This way of using the information provided should be incorporated into the materials, information, and reporting provided to smaller manufacturers. This means viewing potential improvements as those that can easily be done now and providing options for when other changes in manufacturing equipment, layout, material processing, and process design might be assessed down the road.

Small-to-medium sized manufacturers have been a challenge to serve with standard energy efficiency efforts. Yet, programs can be designed to serve them if they keep in mind the viewpoint of these firms. The suggestions included here could provide a much stronger foundation for designing a program that will be accepted by these customers and prove to be

more successful over a longer-term horizon, one that is more aligned with these customers perspectives.

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