

The Mom and Pop Machine Shop – Designing Programs for Small Industrial Customers

Marissa Myers, Quantum Consulting, Inc.
Kris Bradley, Quantum Consulting, Inc.
Philippus Willems, Quantum Consulting, Inc.
Rafael Friedmann, Pacific Gas & Electric

ABSTRACT

The Small Industrial Customer Wants and Needs Study sheds light on small and medium-sized California industrial customers' wants, needs and energy efficiency opportunities in order to tailor programs to the technical and institutional requirements of this under 500kW market. The study presents key findings obtained from 382 telephone interviews of small and medium California industrial customers in the food processing, printing, industrial machinery and fabricated metals industries, conducted in late 2002, and 23 interviews with those customers' suppliers. An extensive literature review, and interviews with program managers and industry experts also contributes to this characterization of the small industrial market. The study characterizes small and medium customers with respect to their energy use, business demographics, energy efficiency practices, equipment decision-making and needs and wants. The study also offers program design implications, both general and industry-specific, based on findings from the market characterization and from a review of other programs targeted to the small-medium industrial customer segment.

INTRODUCTION

The small industrial market offers significant EE possibilities, yet little is known about small manufacturers relative to their large counterparts (Xenergy, 2001). Recent research suggests that insight into customer's needs and industry-specific expertise are key factors for program success in this market. (Shiple, Elliott and Hinge, 2002). This paper attempts to bridge this gap by focusing on four specific industries – all large energy users – in the small industrial market.

Small and medium industrial customers are a promising target market for energy efficiency programs for two reasons. First, they have a simpler decision tree than large customers. They tend to be owned and managed by a single individual, and this business owner is easier to access and sell to than decision makers in a corporate setting (Megdal, Bensch and Schauff, 2002). Second, industrial customers (including renters) tend to pay their own energy bill, diminishing the split incentive problem faced, for example, by small commercial tenants.

The study characterizes small and medium customers with respect to their energy use, business demographics, energy efficiency practices, equipment decision-making and needs and wants. The study also offers program design implications, both general and industry-specific, based on findings from the market characterization and from a review of other programs targeted to the small-medium industrial customer segment.

The study presents key findings obtained from 382 telephone interviews of small and medium California industrial customers in the food processing, printing, industrial machinery and fabricated metals industries, conducted in the fall of 2002, and 23 interviews with those customers' suppliers. An

extensive literature review, and interviews with program managers and industry experts also contributes to this characterization of the small industrial market.¹

METHODOLOGY

A variety of data sources, both primary and secondary, were used in this two-phase study. Phase I involved a literature search, program manager interviews, program review, industry expert interviews, and secondary data analysis involving energy characterization at the 2-, 3-, and 4-digit SIC levels and program participation. The program participation analysis conducted in Phase I included the number of sites participating, rebates, energy saved for the two big Investor-owned utility (IOU) programs, Express Efficiency and Standard Performance contracting (SPC) programs.

The energy/end use characterization conducted in Phase I examined energy consumption at the 4-digit SIC level. This energy/end use characterization guided selection of industry segments targeted for Phase II study. Phase II activities consisted of 382 customer surveys and supply chain interviews to support hypothesis testing.

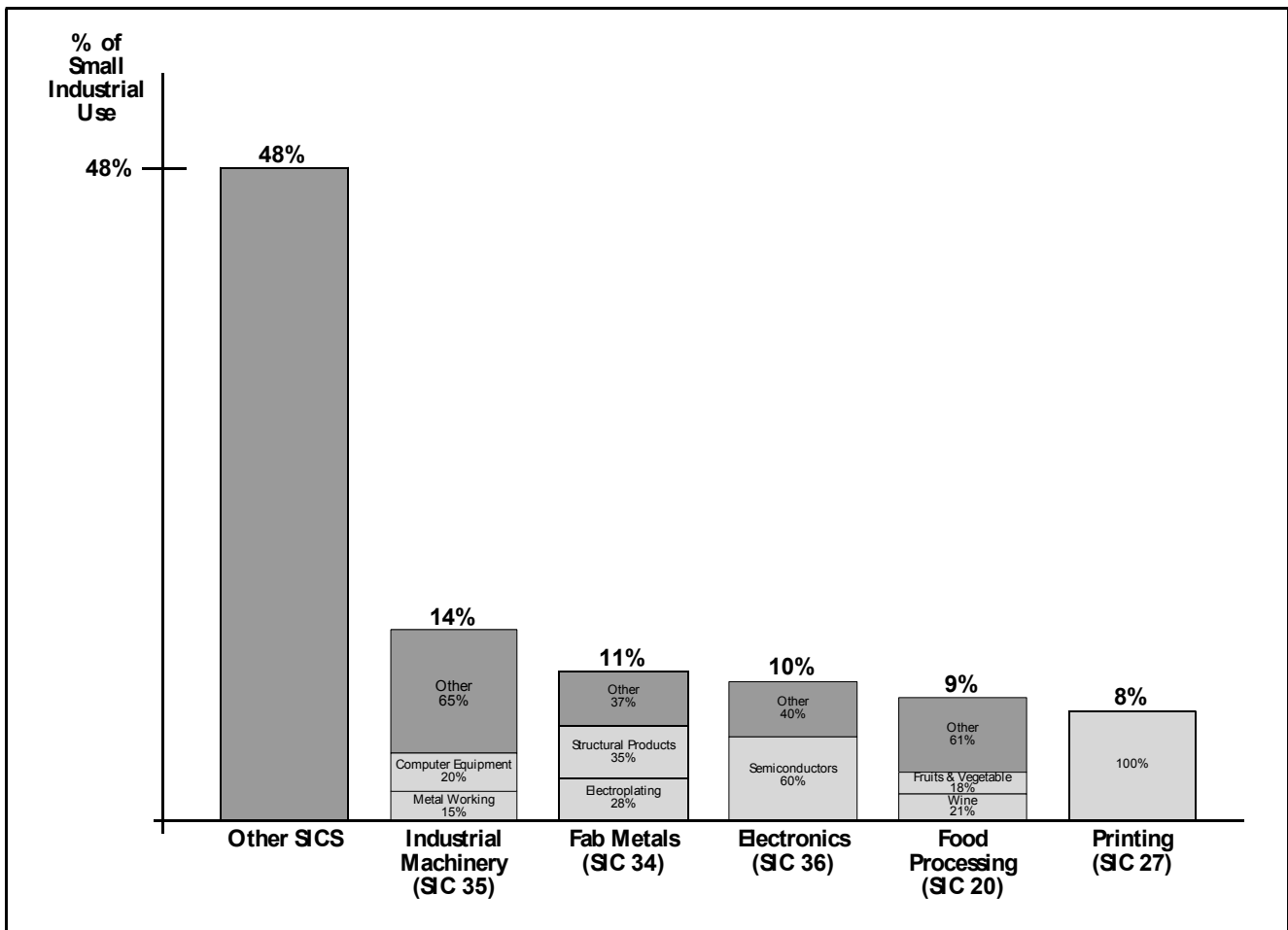


Figure 1. Annual IOU Electric Use of Industries Selected for Study

¹This study defines small customers have annual electrical usage of less than 500 kWh, while medium customers are those with annual usage between 500 and 1,500 kWh

Targeted Industry Segments. Figure 1, above, shows the industries selected for inclusion in the study – Food Products, Printing, Fabricated Metals and Industrial Machinery – in terms of small/medium site electric use. The lighter gray portion denotes the eight industry segments selected for study.

Customer surveys were conducted with these industry groups:

- **Food Processing** (SIC 20), concentrating on fruit and vegetable processing (SIC 203) and wine (2084).
- **Metal Fabrication** (SIC 34), concentrating on fabricated structural metal products (SIC 344, notably metal finishing and sheet work) and surface finishers (SIC 347), the biggest energy-using sub-industries.
- **Industrial Machinery** (SIC 35), concentrating on its largest energy-using segments, metalworking (SIC 354, 15%) and computers (SIC 357, 20%).
- **Printing** (SIC 27): Though a smaller energy user than the other industries selected, printers have a high concentration of small customers, who may have distinct decision making dynamics.

The selected industries represent 52% of the under 500 kW industrial market.

Data Collection. The bulk of primary data collection consisted of telephone surveys with small/medium industrial customers from the four industries and supplier interviews.

- **Customer survey:** Customer data were collected through telephone interviews conducted with customers statewide in late 2002. The sample design ensured proportional representation across the four California IOUs within each of the seven industry segments and among small and medium-sized customers.
- **Supply side interviews:** 23 suppliers were interviewed, including vendors that supplied boilers, compressed air, HVAC, motors, machine tools, pumps, printing equipment, winery equipment, metal canning lines for food processors, industrial gases, bottling equipment, wet processing equipment and liquid filling machines. Most supplied all industrial customers while also serving a few particular industries, such as winemakers.

RESULTS

Business demographics (at the site level) from the customer survey and energy use (for the entire small and medium customer population, drawn from utility databases) are presented in Figure 2.

SIC-Based Industry	Customer Site Demographics			CIS Information	
	Average square feet	% less than 20 employees	% less than 4 locations	Average MWh/site	Average Therms/site
Food (SIC 20)	46,745	55%	89%	1294	314,966
Printing (SIC 27)	14,246	97%	93%	170	8,010
Fab Metals (SIC 34)	24,712	98%	97%	360	35,562
Industrial Machinery (SIC 35)	26,283	99%	98%	346	9,651

Figure 2. Summary Statistics for Selected Industries

Food processors tend to operate the largest facilities, employ more people, run more locations and use more energy than the other three industries. This is especially true with respect to natural gas use. Fabricated metals and industrial machine shops are next largest, similar in terms of their size and electric energy use, although fabricated metal shops are more energy intensive with respect to natural gas. Printers, which have the smallest facilities, also use considerably less energy than the other three industries.

Market-Based Findings

There are significant differences among small/medium industrial segments, both by size and within and across industries. Company size ranges from fewer than 5 employees to well over 100. Facility square footage from less than 1000 square feet to over 100,000. Moreover, survey results as well as supplier and industry observer interviews all point to differences in perceptions and behavior between medium and very small customers, between Express Efficiency participants and non-participants, and across industries.

Therefore, different groups need to be approached with different program elements, technologies and marketing messages. Cost-effectiveness considerations will necessarily help determine what elements are targeted to what sectors. At the same time, there are a number of broad unifying threads that appear to cut across all segments in the small/medium industrial sector. These broadly applicable conclusions are discussed first, followed by segment-specific market findings.

Cross-Cutting Findings

Five findings have vital implications for program design in the small/medium industrial market and help drive the study conclusions regarding program approach.

1. The **owner is the most important player** in selecting equipment for retrofit projects. Suppliers confirm, saying, “The owner is the key decision maker, he is going to decide yes we do this or no we don't, so the buck stops there [because] the owner signs the check.”
2. Small customers **depend on equipment vendors** for assistance in selecting equipment. As a boiler supplier commented, “They definitely rely on us – and all their vendors – more than larger customers.” Customer survey data confirms that small and medium customers tend to rely on themselves and their equipment vendors for information on new equipment efficiency.
3. Small and medium customers often **lack technical knowledge**. “Some of them don't have the staff, a lot don't have the budget to hire a design engineer, and may not be that knowledgeable about technical issues.” reports one supplier.
4. Small and medium customers are **receptive to training initiatives**. Customers are quite interested in training and best practices as a way to cut costs.
5. Medium customers have shown themselves to be **willing and able to implement** energy efficiency measures when provided with detailed, actionable recommendations for cost-effective process improvements.

Small versus Medium Customers

In the analysis of survey results, a distinction is made between small customers (those with annual electrical usage of less than 500 MWh) and medium customers (those with annual usage between 500 and 1,500 MWh). The survey results – as well as input from suppliers, industry observers, and review of the literature – provide the following relevant findings regarding the distinction between small and medium customers.

In addition to the obvious distinction of having more workers, larger facilities and higher overall energy use in comparison to small customers, medium sized customers:

- are more likely to have multiple locations
- assign a higher degree of importance to several key business issues, including identifying and implementing cost-saving measures, keeping up with new technology, and keeping up with shifting market demand
- are more likely to implement cost saving measures, including the purchase of new equipment, using best practices or training, and implementing conservation measures
- are more likely to be aware of and install new technologies
- feel better-equipped to make energy efficiency decisions with internal resources
- are more likely to have an energy policy and to be aware of energy efficiency programs
- are more likely to rely on their utility to provide them with information and assign a higher value to the utility as an information source

Medium-sized customers (34%) are much more likely to adopt high efficiency equipment than small industrial customers (19%). Food processors lead the other three industries in adoptions. Finally, it is not surprising that the biggest difference in adoptions lies among Express Efficiency non-participants (17%) and participants (54%).

A picture clearly emerges of medium industrial customers as being more pro-active, more concerned with cost savings and other business issues, and more ready to take action to address those issues. This makes them excellent candidates for several of the approaches being successfully used in past programs, particularly those that provide customers with audit-based information that then gives them the ability to access a pool of screened resources, including service providers, financing, and rebates or other incentives.

In contrast, smaller customers:

- are generally knowledgeable about new technologies, but less inclined to undertake cost-cutting or energy conservation actions, including installation of new equipment or use of training/best practices
- are prevented from implementing cost-cutting measures by a lack of capital, limited time and uncertain business conditions
- rely on suppliers, particularly manufacturers and contractors, to provide them with information about energy efficiency and new technologies
- often have an almost fatalistic view of their business, feeling that their success is determined by external economic conditions and that energy and other costs are beyond their control.

Furthermore, current economic conditions have created a difficult climate for energy efficiency improvements among small industrial customers. Several of the industries studied are now characterized by a predominance of subcontracting, where the largest manufacturing companies contract out all or most of their production to medium sized firms, who in turn subcontract out the manufacture of components, subsystems, and parts to small family owned businesses. The current economic slowdown has meant less business throughout the subcontracting chain, with the result that the smallest manufacturers have been particularly hard-hit as medium sized firms keep in-house much of the work they would otherwise have subcontracted out. This places severe constraints on the willingness and ability of these small firms to make energy related investments.

All of the above suggest that programs targeted to the smallest customer group should be designed so that they are easy to implement, can be delivered through those vendors whose advice the customer trusts, and take account of the capital (and even cash flow) constraints faced by small industrial businesses.

Study Recommendations for Program Design

Drawing on the results of the surveys and interviews, a number of program elements were considered. The distinction between small and medium customers that comes out of the results suggests that different combinations of these program elements are appropriate for the small versus medium markets. We recommend a quick-and-to-the-point approach to the small customers, offering them information, rebates, and even direct funding to install relatively simple technologies, but not a great deal of costly audit/recommendation time. This approach to small customers addresses their needs for a no-hassle program. Medium customers, on the other hand, appear to be well suited to audits, recommendations, and financing and other assistance to help them implement measures through the channels of their choice. These two approaches are presented in Figure 3.

Target Market	Program Elements									
	Onsite Assessment	Specific Recommendations	Direct Installs	Referrals	Implementation Assistance	Financing	Rebates/ Grants	Performance Contracts	Information & Education	Technology Demonstration
Small Industrial	○	○	●	○			●		●	○
Medium Industrial	●	●		●	●	●	●	○	○	●

KEY

Major Program Element ●

Minor Program Element ○

Figure 3. Recommended Program Elements by Target Market

These program approaches, though developed on the basis of customer size, can also be applied at the industry level. The industry segments studied reveal differences in perceptions and behavior, thus lending themselves to the different program approaches.

- Of the industries studied, **food processors** stand out as the most promising target for the **medium sized program approach**. Food processors have characteristics of medium sized customers: they tend to operate larger facilities, employ more people and run more locations. Moreover, food processors are the biggest natural gas user and claims the highest energy cost relative to operating costs of the industry segments studied. Because of their track record of energy efficiency actions and willingness to work with vendors to gather information, food processors would likely respond well to the **audit-based approach** recommended for medium sized customers.

- The **printing segment** does not appear to offer as much opportunity for cost-effective market interventions due to their low energy intensity, relatively small size, and prevalence of single facilities. In addition, printers demonstrated lower awareness of new technologies for their industry than other industries. Therefore, the **small customer approach** may be appropriate for printers, where equipment vendors and utilities (both regarded as reliable information sources) team up to **educate** this segment about energy efficiency.
- Small facilities outnumber medium sized ones 14 to 1 in the **industrial machinery** industry, making machine shops a good fit for the **small customer program approach**. Industry observers report that small machine shops, hard hit by economic recession, have shown a willingness to change behavior to reduce energy costs, but the least likely of the industries studied to adopt energy efficient equipment, according to our survey results. Therefore, machine shops are an excellent candidate for direct installations. In addition, machine shops that installed energy efficient equipment have relied more on publications and equipment vendors than in-house staff for information. These findings suggest that **information and education**, particularly about low/no-cost measures, would be useful for this industry.
- The **metal fabricating** industry lends itself to a combination of **both approaches**. The small customer **emphasis on information and training** is appropriate for these users – whose opportunities are somewhat limited by the small size of the typical facility – because metal fabricators are responsive to training and see utilities as valuable information sources. However, metal fabricators are a relatively heavy user of both electricity and gas (their biggest electrical use is production equipment) who have shown themselves to be willing to install EE equipment, suggesting that they would respond to **audits and technical recommendations** provided by the **medium sized approach**.

Small Customer Program Recommendations

As described in the analysis of survey and interview results, small customers often take a somewhat passive approach to many aspects of their business. While they are generally knowledgeable about new technologies, they lack the time, interest, and resources to investigate and install energy efficiency measures, preferring instead to rely on trusted suppliers to provide them with information.

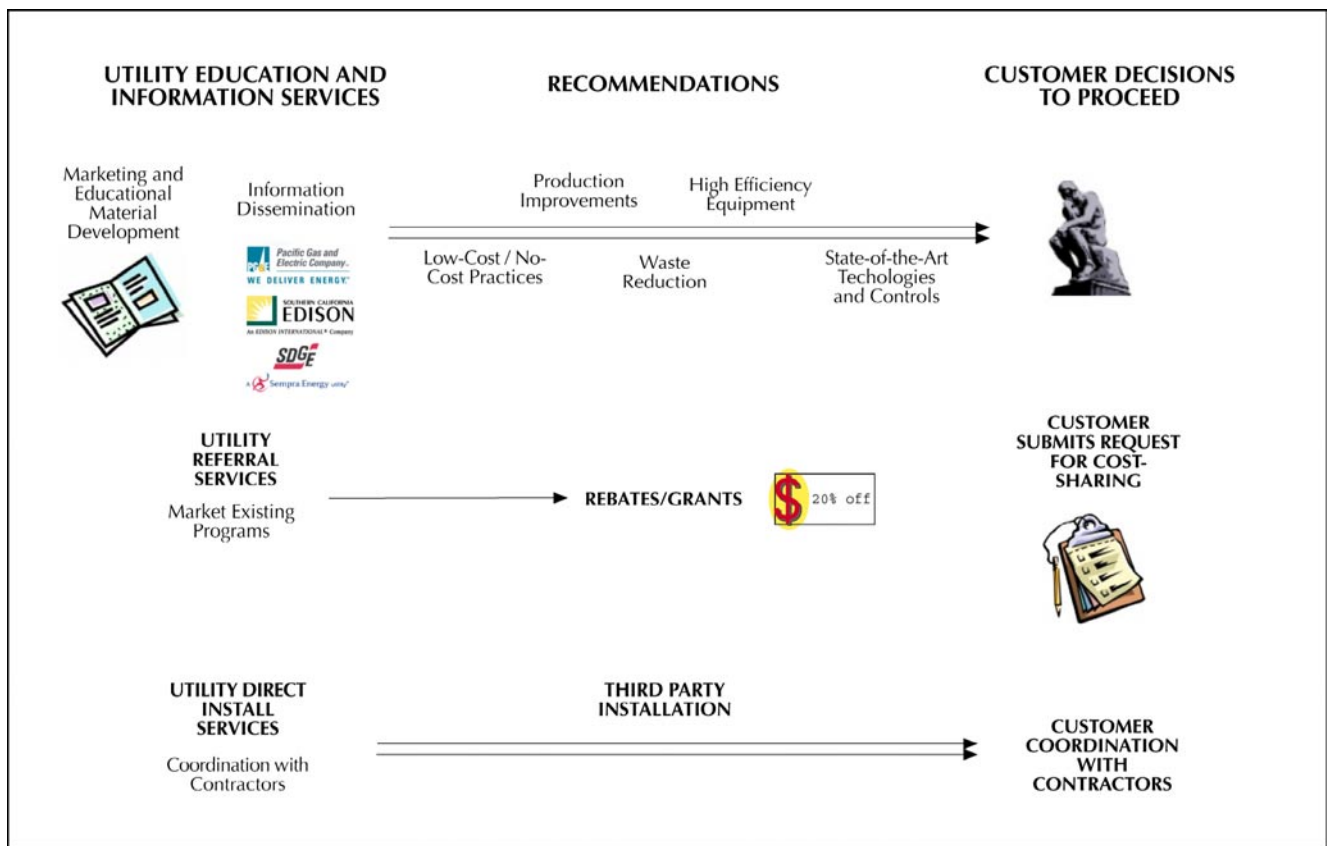


Figure 4. Small Industrial Customer Program Diagram

For this group, it does not make sense to pursue a program of detailed audits and recommendations – both because of the time involved and because the scale of production processes (and resulting efficiency opportunities) are small. Instead, we propose a program which emphasizes the elements detailed in Figure 5.

- Energy efficiency *information* is made available through suppliers – particularly suppliers of electric motors, HVAC equipment, boilers, and lighting. The supplier benefits by having a tool to “up-sell” the customer, while **the customer benefits by being able to compare the savings associated with an energy efficiency option using data from an independent source.**
- In addition to *printed materials* (the preferred medium for receiving information), small customers could be provided with *case studies* describing specific measures installed by other small companies in their industry. For some segments, notably the metal fabricating industry, *training and best practices* presentations might also be effective.
- The program could provide *referrals* for rebates through cooperating suppliers who are knowledgeable about other available program elements.
- **For some relatively simple measures that can be easily identified (e.g., high efficiency motors, ASDs, lighting) it may be appropriate for the sponsoring organization to provide rebates or even to cover all or most of the cost of installation.** This minimizes the expense associated with audits and development of recommendations, and assumes that there will be some measures that justify installation under a total resource cost measure, but that

have not yet been implemented by the small customer. A *direct install* element would deflect the time constraint barriers that small industrial customers face.

The goal of this approach is to recognize the difficulty of cost-effectively delivering a complex program to the smallest customers, while still making available the information and resources that enable interested customers and their suppliers to pursue energy efficient options.

Medium Customer Program Recommendations

Medium-sized customers offer more energy savings potential than small customers. The recommended program elements for medium customers match both the strengths and characteristics of this group of customers and to provide an appropriate level of support throughout the energy efficiency opportunity identification and implementation process. As shown in Figure 5, key elements of our approach include onsite assessment, specific recommendations, and referral to customer-selected, program-approved resources to provide implementation assistance, financing, and even rebates.

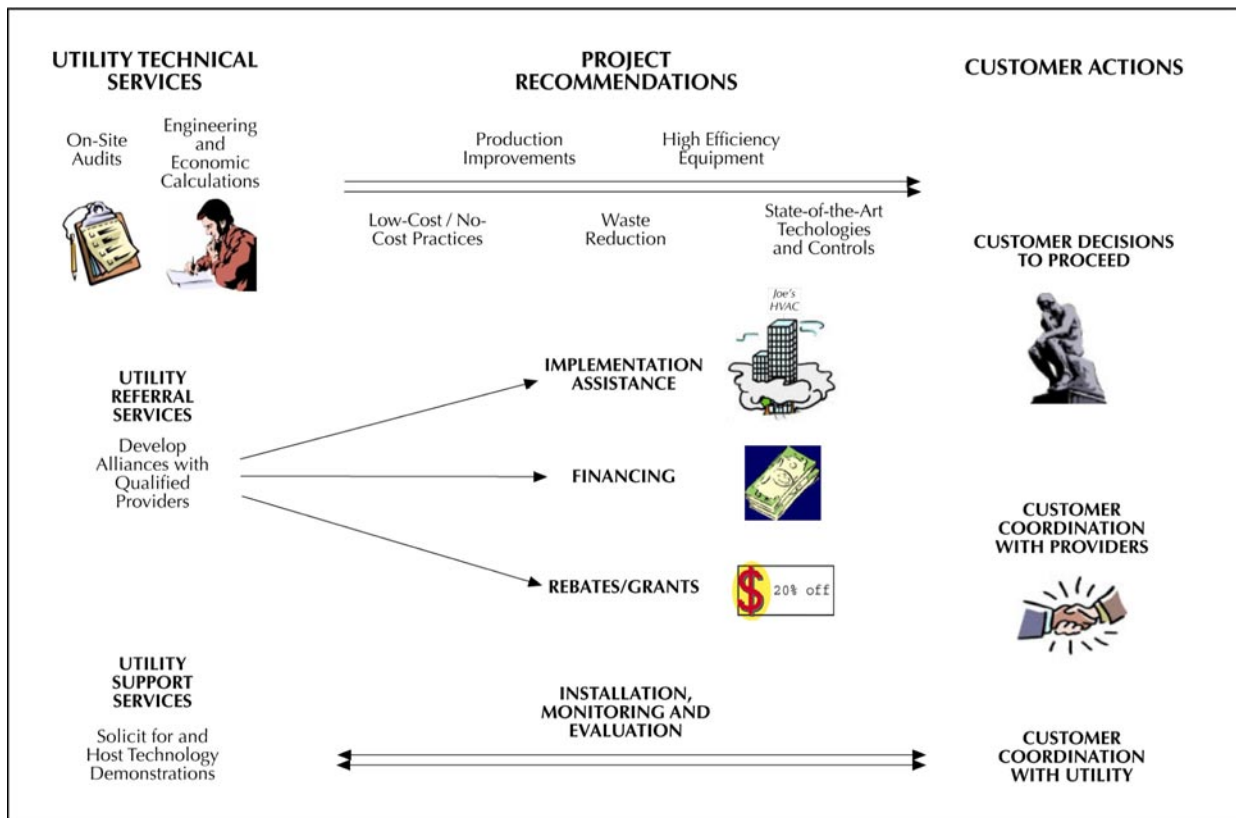


Figure 5. Medium Industrial Customer Program Diagram

An onsite assessment presented directly to the decision maker – usually the business owner – should be the cornerstone of a medium industrial market program.

- A recent evaluation of an industrial program states that, “the key ingredient in overcoming the barriers to participation seems to be **focused one-to-one attention provided by a technically competent, independent third party.**” (Shipley, Elliott and Hinge, 2002, p. 24)

- Utilities should partner with a roster of pre-screened technical consultants already working in the industrial sector to identify efficiency improvements.
 - Customer and supplier data suggest that **small and medium industrial customers are inclined to seek assistance from equipment vendors or contractors that they already know**
 - Choosing technical consultants for their industry rather than technology expertise ensures that a single assessment will cover all opportunities, rather than requiring separate reviews for process heat, compressed air, motors, etc.
 - **Consultants with industry expertise are likely to be located in the same areas as their customers**, placing them in close proximity to other firms in that industry (for example, wineries in the Napa Valley)
 - PG&E’s Industrial Strength seminars and similar initiatives by the other utilities are **effective vehicles for training and building relationships with vendors.**

The onsite assessment should yield audit data, payback calculations, engineering analysis, and a set of *specific recommendations* that are presented directly to the business owner.

- **Suppliers support the notion that direct presentation of findings to the owner is essential**, noting that “The best source is to go into the actual owners of these businesses and show them how they can save money,” and “The most effective way is to give a good explanation and data to prove they will save money.”
- **It is easier to get in front of a single decision maker, even a meeting of several hours, to pitch an upgrade, than in a corporate setting with multiple decision makers. As one supplier noted**, “Bigger firms may be more receptive, but we may have a more direct contact with the smaller buyers so that we’re able to explain it rather than just respond to a spec.”

An industry observer, formerly with an ESCO in the small industrial market, observed that, “If it’s economically viable, they’ll do it.” No further utility effort is needed. “Opportunity identification and payback is the important part. The owner will run with the rest of it.”

CONCLUSIONS

Programs have targeted large industrial sites because most energy use and savings potential lies in large industry (Xenergy, 2001).² Because medium-sized customers are more likely to make energy efficiency investments than small customers, an onsite assessment presented directly to the decision maker – usually the business owner – should be the cornerstone of a medium industrial market program. This approach supports findings from a recent review of small and medium industrial programs: “the key ingredient in overcoming the barriers to participation seems to be focused one-to-one attention provided by a technically competent, independent third party (Shipley, Elliott and Hinge, 2002, p. 24).” Likewise, a cost-effective program to small industrial customers should focus on making information available to interested customers, coupled with direct installation for some simple measures, because

² In California, small and medium industrial customers account for about an equal share of electric use statewide, with a slightly greater percentage of electric use accounted for by medium customers (8.7% of industrial electric use vs. 8.1% for small).

survey results show that the smallest customers lack the time, interest, and resources to investigate and install energy efficiency measures.

Of the industries studied, food processors stand out as the most promising target for energy efficiency programs. Food processors tend to operate larger facilities, employ more people, run more locations and use more energy (particularly natural gas). Recent sharp increases in energy costs have made the food processing industry much more aware about the importance of controlling energy costs. Opportunities for improved EE exist in all aspects of food processing – more efficient, lower emission boilers, high efficiency motors, ASDs for production equipment, improvements in refrigeration, new technologies for efficient thermal processing, steam recycling and intelligent process control. For medium sized customers, technical opportunities exists in all end uses in a given plant, including compressed air and production machinery. Small customers are best suited for traditional lighting, HVAC, motors measures, as small facilities are unlikely to modify their production process.

REFERENCES

Megdal, Lori, Darren Schauf, and Ingo Bensch, 2002. “Decision-Making Among Small and Medium Manufacturers, and Indications of What is Needed to Reach These Customers.” *Proceedings from the 2002 ACEEE Summer Study*.

Shiple, Anna Monis, Elliott, R. Neal, and Hinge, Adam, *Energy Efficiency Programs for Small and Medium-Sized Industry*, American Council for an Energy-Efficient Economy, February 2002.

Xenergy, *California Industrial Energy Efficiency Market Characterization Study*. December 2001.

