

Measuring Market Effects in the Supermarket Industry

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ABSTRACT: MEASURING MARKET EFFECTS ON THE SUPERMARKET INDUSTRY

This paper presents the approach, results, and recommendations from a market effects study conducted of the Supermarket Industry. This study was unique because it focused its activities on the potential within a specific market segment rather than analyzing market effects for a specific technology. The study's objectives included identifying:

- The extent of customer actions as they relate to the activities within a specific utility territory;
- The effects to which the current state of the supermarket industry was influenced by past utility market intervention activities; and
- Recommendations regarding program design to facilitate future market interventions.

This study relied most heavily on qualitative data collection activities including focus groups, a literature search, and in-depth interviews with leading influencers and decision-makers. The data collection activities provided an excellent market characterization describing the size and scope of the supermarket industry while identifying key players and their roles in influencing market decisions.

The study also evaluated the degree to which market barriers affect purchase and installation rates of energy efficient equipment in the supermarket segment. Customer actions within PG&E's territory were compared with customer activities in a comparison territory that did not have active utility programs.

The paper describes how these methodologies can be used in other segment studies. It will help evaluation professionals gain a deeper understanding of the techniques required to conduct an industry-specific study and determine when this approach is most relevant for their own studies.

Introduction

This paper describes the approach, methods, results, and recommendations from a market effects study conducted on the Supermarket Industry. This study was conducted for Pacific Gas & Electric Company (PG&E), and was one of several market effects studies conducted to determine the market effects of past and present PG&E commercial and industrial (C&I) programs.

This study was unique because it focused on the potential within a specific market segment rather than taking the traditional step of analyzing the market effects for a specific technology. This study also identified the degree to which market barriers, such as risk avoidance, and split incentives, influence the purchase and installation of energy-efficient equipment in the supermarket industry.

This paper discusses the benefits that can be accrued by focusing on a specific industry, rather than end-use technologies. Generally, market transformation programs, and demand side management programs before them, concentrated nearly exclusively on encouraging the adoption of specific energy efficient technologies. This focus usually either ignored or overlooked the unique factors driving equipment selection process within a specific market or industry.

Pacific Gas & Electric (PG&E) commissioned a study to evaluate its success in transforming energy efficient equipment adoption rates within a particular market segment. The supermarket industry was selected for a variety of reasons. It is ideal for this market-based approach for several reasons including: similar equipment configurations and usage profiles, high energy costs, slim profit margins, and competitive pressures that require frequent store updating and revamping.

Background

Supermarkets are large energy consumers, whose decision-makers are often too occupied with maintaining market share to consider energy efficiency costs. Generally, new technologies are viewed skeptically unless there is a clear rationale presented that will lead to more profitable operations. Even though energy plays a critical role in a supermarket's operation, store managers are reluctant to try new technologies for fear that they will interfere with marketing and operational concerns.

Although supermarkets install a variety of energy efficient equipment, the highest energy users are refrigeration and lighting. Therefore, refrigeration, and to a lesser degree, lighting, were the primary areas of interest.

Description of PG&E Programs

PG&E had implemented several energy efficient programs targeting lighting and refrigeration uses in the commercial and industrial market. Some programs were particularly relevant to the supermarket segment. These programs included a variety of specialized energy efficiency programs including The Motor Challenge, EPA Green Lights, and the EPRI Supermarket Initiative. The energy efficiency programs that PG&E offered to the supermarket industry are summarized in the following exhibit.

Exhibit 1-1
PG&E's Commercial Energy Efficiency Programs
Targeting Supermarket End Uses

Retrofit Express: Targets small/medium commercial customers with incentives to encourage installations of energy efficient lighting, air conditioning, motors, refrigeration, and food services equipment.
Advanced Performance Options: Offers customized energy efficiency retrofits for commercial, high value projects. Generally targeted highly technical applications in the commercial, industrial, and agricultural customers.
Energy Consulting Services (ECS): Helps non-residential customers minimize energy costs by targeting multi-facility customers in and outside PG&E's service territory. This program provides energy consulting services such as specialized studies.
Nonresidential New Construction: Provides incentives to building owners and developers in specialized buildings including refrigerated warehouses, and new construction off-peak cooling.
The Perspective Program: Focuses primarily on Title 24 occupancies including large and small offices, grocery stores, schools warehouses.
Food Service Technology Center (FSTC) : Assists in the performance evaluation of commercial food service equipment and energy-using systems under laboratory and field conditions. The Center includes the Food Service Appliance Laboratory, the Production Test Kitchen, and the Demonstration and Training Facility. The program targets 25,000 commercial food service and restaurant facilities.

Methodology

The research plan called for a description of the *market* and its major *players*, the *barriers* that appear to limit market efficiency, and the *extent* to which the market may have been transformed in PG&E's service territory by PG&E's programs. The study framework was inspired by the Scoping Study by Eto, et al.¹ This theory states that the adoption of energy efficient technologies is hindered by market barriers. Even though energy efficient technologies may be the best choice, they are often not selected for a variety of reasons. Market Transformation (MT) programs target one or more market barriers as a way to increase the adoption rates of energy efficient technologies. This study focused on measuring the degree of MT that occurred in the supermarket industry by analyzing PG&E programs, customer actions, and the effects these have had on market barriers.

In addition to pursuing the usual sources of professional journals and trade publications, the literature review also included reviewing manufacturers' technical reports and sales brochures. The findings from this review framed the issues that required further exploration and analysis.

Data Collection Activities

Our basic approach to this study was to develop an assessment of MT through a comparison of customer actions within and outside PG&E's service territory. Ideally, a baseline assessment would require a canvass of thousands of customers. Due to time and resource constraints, we collected data primarily using qualitative sources, including in-depth interviews with market

¹ R. Prahl, J.Eto & J. Schagel "A Scoping Study," CADMAC, 1996.

actors, operating within and outside of PG&E's service territory to quantify MT effects.

- **Staff interviews** with PG&E program staff, as well as with program staff focusing on market effects.
- **Focus groups** with supermarket decision-makers. Three focus groups were conducted: two within PG&E's service territory (one with large customers; one with small groceries and convenience stores) and one in the comparison territory.
- **Open-ended interviews with vendors.** Approximately a dozen vendors who supply equipment to the supermarket industry were interviewed informally at the Food Marketing Institute show in Chicago May 3-5, 1998. Additional in-depth interviews were conducted subsequently with half a dozen of these vendors.
- **Open-ended interviews with industry experts:** The project team also conducted in-depth interviews with industry experts from the Electric Power Research Institute (EPRI), as well as with supermarket designers and manufacturers. These interviews provided insights regarding barriers and opportunities unique to the supermarket industry. Data collection and analysis activities for this study are summarized in Exhibit 1-2.

*Exhibit 1-2
Data Collection Activities*

Interview Sample	Within PG&E Service Territory	Outside PG&E Service Territory
PG&E Staff	4	0
Supermarket Decision Makers	15	10
Architects, Designers & Technical Specification Managers	5	5
Vendors/Manufacturers	15	15
Total	39	30

Industry Analysis

The market effects study began with an in-depth review of the characteristics driving this market. These findings illustrate the depth and breadth of information an analyst can gain about a particular market, just by examining available data.

Supermarket Industry Characteristics

The supermarket industry is one of the largest and most important market segments in the energy services marketplace. According to a recently completed study for the Department of Energy, this industry uses an estimated 900 trillion Btu annually for heating, cooling, refrigeration and lighting. There are an estimated 127,000 grocery stores and supermarkets in the United States,

with combined annual sales of \$425 billion.² This study defined the supermarket and grocery sector as selling only or predominantly food for off-site consumption and does not include convenience stores.³

Current Equipment Installations

The supermarket and grocery store industry operates on very thin profit margins--typically about 1% of sales. This means that a 10% reduction in energy costs for a supermarket facility can yield up to an 8% increase in gross profit. Therefore, even minimal changes in energy usage can lead to substantial gains in overall profitability.

Commercial refrigeration accounts for the largest energy usage, and thus the highest costs, within the food industry. Commercial refrigeration equipment represents nearly 50% of a typical store's operating costs and 25% of a store's maintenance costs.

Supermarkets install a variety of refrigeration equipment. The most important component of refrigeration is the compressor. The most commonly installed compressors are semi-hermetic reciprocating compressors (92% market share), but the screw and scroll compressors are gaining market share. Screw compressors represent about 2% of the market, while scroll compressors have about a 6% market share.⁴

To lower energy costs, supermarket energy manager's search for ways to arrange or configure these compressors. Maintenance costs for a parallel rack compressor system are \$75 per 100 sq. ft., of store sales area, translating into an annual outlay of approximately \$20,000 for an average 27,000 sq. ft. supermarket.⁵ The total cost of a 100-ton supermarket refrigeration system is between \$1 and \$1.1 million, with display cases accounting for nearly half of this cost. The average expected life span of compressors and air-cooled condensers is 10 years; but display cases are usually replaced earlier for "cosmetic" reasons.

Decision Criteria Regarding Refrigeration Equipment Selection

Equipment selection is driven by a number of factors relating to operating performance and overall merchandizing strategy. Supermarket managers make equipment selections based upon the following criteria:

² Mahoney, Thomas A., "Commercial Refrigeration Sector Portrayed in DOE Analysis," *Air Conditioning, Heating & Refrigeration News*, Nov. 11, 1996, 199(11) 13.

³ Komor et al, "*Multi-Client Study: Delivering Energy Services to Supermarkets and Grocery Stores*," E Source. January 1998.

⁴"Commercial Refrigeration Sector Portrayed in DOE Analysis;" *Air Conditioning, Heating, and Refrigeration News*, Nov. 11, 1996.

⁵Ibid

- Prepared-food handling regulations
- Federal ozone protection mandates,
- Energy and efficiency concerns, and
- Marketing and merchandising needs.

Prepared-Food Handling Regulations: In recent years, the Food and Drug Administration (FDA) has tightened food handling requirements regarding refrigerated foods. These restrictions are in response to several consumer experiences with improperly cooked or prepared food. The new regulations mandate that all potentially hazardous foods, including sandwiches and salads, must be chilled at a temperature below 41 degrees F. Where it was once acceptable to monitor temperature through a simple thermometer in a typical case, it is now necessary to have electronic temperature probes placed throughout the equipment to ensure that the requirements are met at all points. These regulations affect state and local requirements, since many jurisdictions, including California, incorporate FDA's guidelines into their own food handling codes.

This leads to higher operating costs for both energy and refrigerants. The higher costs are driven by either the need to replace refrigeration systems with new models, or to spend more on technicians to repair and minimize costly refrigerant leaks.

Ozone Protection: Tighter regulations, with possible fines, have forced retailers to rethink their entire refrigeration management approach. As retailers must switch from chlorofluorocarbon (CFC) to hydrofluorocarbon (HFC) gases, they are trying to minimize the costs associated with these new regulations. The cost of compliance is estimated to be nearly \$50,000 per store, creating a tremendous burden on independent stores. Some retailers have used this new federal requirement as an opportunity to standardize their refrigeration equipment, and thus minimize the number of refrigerants used in their stores.

Energy Costs: Since refrigeration and its associated maintenance costs comprise a large portion of the store's operating expenses, more retailers are searching for ways to enhance energy efficiency among their refrigeration compressors. Some stores have developed a "prototypical" energy efficient model that relies on innovative refrigeration and lighting configurations. Others have developed a computerized network to monitor all refrigeration equipment as a way to avoid or to minimize costly repairs.

Marketing and Merchandising Needs: With the rise of dual-income households, and the increasing demand for prepared foods, there has also been a rising need for additional and attractive refrigerated space on store floors. As one retailer explained, "Refrigeration isn't something that can be taken for granted. It is not just a matter of a shelf keeping something cold. It's a merchandising vehicle that can help enhance everything we're doing."⁶

⁶ Millstein, Mark, "A new climate in refrigeration systems," *Supermarket News*, Sept. 11, 1995, 45(37): 14-16.

Industry Trends

Supermarkets are battling for market share against two different types of competitors: large, superstores like Wal-Mart, and smaller convenience stores. The newest entrant in the food industry has been the "supercenter," a combination grocery, drug, and discount store. Many industry experts predict that supercenters will continue to lose market share, particularly among current marginal performers. The rise of the large chains will have the most damaging effect on the smaller, independently owned, and operated grocery stores.

Remodeling and Expansion Strategies. To increase or at least maintain market share, supermarkets and independent grocers engage in extensive remodeling of current stores and either building or acquiring new stores.

Energy Efficiency Strategies

Interviews with supermarket managers, designers, and equipment manufacturers revealed a broad range of awareness and familiarity with the benefits of selecting and installing energy efficient technologies within the supermarket industry. While some retailers are convinced of the benefits of energy efficient technologies; others have been distracted by regulatory and competitive pressures discussed previously. This study illustrated the general feeling of confusion within the supermarket industry regarding the role of utility programs, and their long-term success.

Progressive retailers have developed strategies to reduce energy consumption. However, these retailers are more the exception in the supermarket industry, rather than the rule.

This finding further illustrates the advantages of using a market-specific rather than a study-specific approach. If this study had only focused on end-uses, it may have minimized the effect that type of decision-making process has on equipment selection for *a variety* of energy efficient technologies used throughout a supermarket.

The most forward-thinking supermarket managers look for energy savings in HVAC and lighting as well as refrigeration. Common approaches used by savvy supermarket retailers include:

- Upgrading heating, ventilation and air conditioning (HVAC) equipment
- Retrofitting lighting systems to include natural daylight
- Using energy efficient refrigerants

HVAC Strategies. A supermarket's HVAC system typically represents less than 20% of a store's total power consumption. However, the combination of utility rebate programs and increased competitive pressures has made these upgrades appealing to retailers. A common approach has been to install variable speed drives on HVAC systems, which can lead to savings of up to 66%.

Lighting Strategies. Many retailers are rethinking their lighting choices as they begin to focus on marketing as well as operational concerns. Many prototype energy efficient stores built by chains now include energy efficient lighting throughout the store such as T-8 lights, reflectors and

electronic ballasts. Another strategy has been the move toward daylighting. As stores are remodeled, skylights are being added to increase the amount of light coming into the store. This not only lowers energy costs but also improves the overall appearance.⁷

Some supermarkets use lighting as part of their merchandising strategy, moving to more contrast lighting. It is becoming more common for a medium-activity supermarket to have displays that include darker ambient lighting, and brighter accent lights as a way to move shoppers from one section to another. Retailers are also installing more energy efficient lighting at an angle to reduce glare while improving the overall appearance.⁸

Refrigeration Strategies. The declining prices of non-CFC gases and the cutoff date for CFC production have forced retailers to search for alternatives.⁹ While supermarkets may use a variety of refrigerants to meet their various in-store needs, this trend may be declining.

Key Market Players

Manufacturers. One recurring theme in the market actor interviews is the ability of three or four manufacturers to dominate this industry. In refrigeration systems, for example Hussman, Tyler, Kysor-Warren, and Hill-Phoenix define the market, including the range of energy efficiencies offered. These firms are international in scope, enjoy close relationships with top supermarket chains, and maintain a steady flow of product literature and other information to buyers, designers, and others that might influence the purchase decision. Other findings include:

- Despite intense competition among the major players, there is also a significant amount of information sharing and participation in industry-wide groups and initiatives.
- Vendor representatives cited professional associations and conferences as their primary source of information on trends in energy efficiency.
- Major manufacturers often exert considerable influence in equipment selection decisions, because of their in-house expertise and their experience. This generally favors greater rather than less energy efficiency. Culturally, most key personnel at the manufacturing companies are engineers, with an engineer's interest in and appreciation for energy efficiency. Moreover, energy efficiency figures prominently in the marketing efforts of all major firms.
- Manufacturers are generally fully aware of programs offered by PG&E or other utilities, and use rebate programs to help close a sale or influence the choice of efficient equipment when possible.

⁷"New Illumination Techniques Help Retailers See the Light," *National Petroleum News*, Oct. 1995, 87 (11): 96-98.

⁸Harper, R., "Expert: Proper Lighting Use Makes Fresh Products Shine," *Supermarket News*, April 17, 1995: 45 (16): 24.

⁹*Supermarket News*, June 12, 1995, 45 (24).

- However, manufacturers do not have the ultimate decision-making authority. So even though they may have the knowledge and expertise to design energy efficient equipment, they are not yet able to influence the equipment decision-making process.

Design Services. The design services market is concentrated in a few specialized architects and designers who serve the national market; the limited number of local or regional companies may be called upon to design stores for independents. The few national firms have established relationships with major supermarket chains as well as with leading vendors. Design firms and the in-house design departments for major chains share the store design/equipment specification task, often working together to implement the store's master specifications. Independents are much less likely to have either master specifications or an in-house design staff, thereby creating an opportunity to influence equipment specifications.

Designers indicated that energy efficiency is a consideration in their designs, but the more important consideration is staying within a client's budget. The starting point in the design is usually the energy efficient option for refrigeration as well as lighting, but these designs are subject to change based upon available funds. PG&E or other utility programs are generally not high priority unless their clients, who may ask for rebate-qualifying equipment as part of the design, alert them to these programs.

Refrigeration Contractors. Local refrigeration contractors supplement (and often supplant) in-house supermarket maintenance organizations, playing a critical role in the installation and operation of energy-using equipment. In PG&E's service territory, there are about 140 refrigeration contractors, ranging in size from one-person shops to affiliates of national vendors such as Hussman.

Contractors play an increasingly important role both in influencing the kind of equipment installed and in ensuring its proper operation. Sophisticated systems need better maintenance and fine-tuning and, especially for relatively remote stores, this has increased reliance on local contractors. In addition, the use of racks of multiplexed compressors has led to more frequent purchase decisions as individual compressors and components are replaced.

Customers. Concentration in the industry is increasing.

- For supermarket chains, decisions regarding energy-using equipment are made by regional engineering departments, with senior management exercising final approval authority. These decisions are generally made concurrently with other decisions relating to new construction or retrofit projects.
- Independents (defined by the Food Marketing Institute as chains with fewer than 10 stores) usually have at least some in-house engineering capability, although top management usually plays a more direct role than in larger chains.
- Supermarket decision-makers rely on input from designers (both in-house and consultant), equipment vendors, and even contractors. Input is gathered through professional associations or at conferences and trade shows, which were most often cited as the chief source of supermarket decision-maker information on trends in energy efficiency.

Major Issues and Recommendations

The research activities and findings led to a greater understanding of the market practices, barriers, and strategies for achieving market transformation in this industry. Key recommendations follow next.

Practices and Barriers

Barriers to energy efficiency in supermarkets have grown as the result of a number of external forces.

Marketing Barriers. The emphasis placed on increasing sales is the largest barrier to installing energy efficient equipment in the supermarket industry. Investment dollars are usually allocated to store appearances to help boost sales while little attention is generally paid to energy efficiency.

This barrier has increased as ever-greater emphasis is placed on merchandising. It has led to changes in the ways that lighting and refrigeration equipment are used and deployed throughout supermarkets. Increased competition has also influenced the types of products, services, and items stocked throughout the stores.

Business Considerations. With the economic boom, supermarkets are being constructed at a rapid pace. Once a chain commits to a new location, the store must be built immediately to minimize construction-financing costs and to gain a competitive edge in key demographic areas. Consequently, greater emphasis is placed on getting the store built to generate sales, rather than designing it to maximize energy efficiency.

The wave of mergers and acquisitions are another, though less obvious, barrier in the supermarket industry. Pending deals tend to make top management unwilling to commit to substantial or costly store remodeling, especially for non-core activities such as those related to energy efficiency.

Regulatory Issues. Several significant issues facing the industry today have been brought on by recent regulatory changes, including the ban on CFC refrigerants, greater concern about refrigerant leaks, and a tightening of regulations affecting food safety in general and the temperature of stored foods. Obtaining cost-effective, reliable performance from the new refrigerants has outweighed energy efficiency issues.

Technology Issues. Store systems have become so sophisticated with so many interactions, that the cost of managing them outweighs potential energy benefits. As technology needed to deliver energy efficiency gains become more sophisticated, supermarket decision makers are increasingly worried about the ability of maintenance organizations to provide the level of expertise needed to operate, maintain, and repair new systems. Every supermarket energy manager has a story about a botched repair job, a bypass of critical controls, or a system that is performing sub-par because it has not been properly maintained.

Effects of PG&E Programs on Past Barriers. All of the supermarket customers interviewed in

PG&E's territory were aware of PG&E's programs. The chains that had participated in these programs reported a higher proportion of stores with efficient technologies. Some respondents indicated that the programs have made them more aware of energy efficiency, but few said they had fundamentally changed the way they make energy-related decisions.

In contrast, the participants in the comparison territory showed far less awareness of energy-related issues, opportunities for savings, or company efforts to achieve energy efficiency. Members of the comparison group reported little effort by their utilities to educate them, or to provide options or incentives to become energy efficient.

Conclusions and Recommendations

This paper illustrated how an examination of a particular industry can lead to a better understanding of its barriers as well as its opportunities.

Major Issues:

Rebate Reliance: One issue arising from this study is the reliance on rebates to drive energy efficiency decisions. Rebates may be a misplaced incentive, by focusing on immediate rather than on long-term savings. Nevertheless, the perceived value of rebates to the supermarket industry may also provide a tool to affect the market in the future.

Market Characterization: This study also illustrates the value that an in-depth, albeit largely qualitative approach, can provide in evaluating market barriers. The qualitative data from the focus groups and interviews helped to explore and clarify the inter-relationship of various market barriers. One strategy we recommended to address these market barriers to energy efficiency was to emphasize the non-energy benefits to supermarket decision-makers. For example,

- Less refrigerant leads to lower leakage, thus reducing operating costs;
- "Smart" defrost helps maintain food temperatures and improves presentation quality;
- Self-contained, water cooled cases provide more merchandizing flexibility;
- Greater use of doors on freezer cases improves customer comfort;
- Reducing total heat emissions will help achieve global warming limits on total heat released to the atmosphere.

Measuring Market Effects in the Future: Due to the rapid and extensive changes taking place in this industry, the best method of tracking potential market effects may be through a panel of supermarket decision-makers and other market actors. Talking to the same players over time, and monitoring their perceptions of specific changes that have occurred in the market and how their organizations have responded to those changes would provide a consistent, although qualitative, look at the extent of market effects of future market interventions.