The Chiller’s Role Within a Utility’s Marketing Strategy

Using Chiller Related Products and Services to Win and Retain Customers

TR-110373

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REPORT SUMMARY

Commercial chillers, used in space and industrial process cooling, can comprise as much as 30% of a large office building's electrical load. The selection decisions for a new or replacement chiller (electric versus gas, standard versus high efficiency, thermal storage versus standard cooling) will affect the customer's energy consumption for 20-30 years. This study evaluates specific chiller marketing tactics based on customer needs as well as energy service strategies that take advantage of changes in market structure.

Background
Traditionally, utilities have provided chiller-related services to customers in order to impact the selection of capital equipment. In the deregulated market, the energy retailer, distribution company, and generation company each has a stake in the development of electric cooling customers. Utility services will therefore be geared to building volume, controlling the load profile, and enhancing customer retention. If they are to impact the behavior of chiller customers, utilities will need to understand customer behavior and needs and translate these into products and services with clear market value. This report identifies the first steps in developing such understanding.

Objectives
To provide a framework for segmenting chiller customers and identifying how chillers fit within a retail utility marketing strategy; to evaluate various types of chiller-related products and services.

Approach
Investigators divided chiller users into four categories based on primary research, analysis of previous EPRI studies, findings in secondary research, and interaction with participating utilities. Primary market research involved more than 100 data gathering activities—including interviews with chiller users, chiller original equipment manufacturer (OEM) sales and marketing executives, control systems OEM sales and marketing staffs, and utility salespeople, program managers, and segment managers. A brainstorming session helped identify energy management products and service concepts for retail utilities.

Results

This study will help utilities understand how they can influence chiller selection by evaluating customers' current decision making and determining how deregulation may impact future decisions. In specific, the study defines the needs and expectations associated with the four categories of chiller users and provides a detailed list of energy management products and services in each sector. The study shows how chillers can provide a focal point for a utility's efforts to build and retain customer volume and control load profiles.

Chiller customers behave differently based on their corporate goals and capital availability. For example, some segments value help in understanding and managing the electricity used for cooling. In other segments, the need to minimize cash outlays underlies many decisions. One solution involves shifting the capital cost to an ongoing operating cost. Customers who opt for this course of action are making long-term commitments to cooling service providers in order to avoid large capital investments in non-revenue-producing assets such as chillers. Such a need creates opportunities for utilities to secure demand and influence load profiles. This report provides further examples that will help utilities determine where to cost-effectively direct their marketing efforts.

EPRI Perspective

The fundamental message in this study is that utilities should not unilaterally eliminate their chiller support groups in the rush to prepare for deregulation. Though chiller support does not always persuade customers to select electric chillers, the long-term nature of chiller decisions provides retail utilities with a unique opportunity to establish important customer relationships. The models, method, and chiller-related products and services described in this report will help the retail utility develop strategies for winning and retaining customers while demonstrating the value of its support in corporate decision making. EPRI's *Electric Chiller Handbook* (TR-105951, Rev. 1) provides further information on chiller selection issues.

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EXECUTIVE SUMMARY

The retailing portion of electric utilities will soon face competition from brokers and niche ESCO's who will build lean, efficient organizations focused on specific customer groups. To compete, retail utilities must provide their customers additional services that help customers lower total costs, increase occupant comfort, meet corporate energy/environment needs, or trade capital costs for operating costs.

Historically, utilities have provided chiller related services to customers to impact the selection of capital equipment, i.e., electric versus gas chillers, to manage the use of electricity in their markets. Efforts were in place to grow electric use (keep out gas chillers) and reduce electric use (more efficient chillers and thermal storage).

In the deregulated market, the services that the utility provides will be geared to building volume, controlling the load profile, and customer retention. Therefore, the energy retailer, distribution company, and generation company each has a stake in the development of electric cooling in a deregulated market.

To impact the behavior of chiller customers, utilities will have to understand the customer's behavior and needs and translate these into products and services that the customer will value. This research is a first step in developing this understanding.

Chiller customers behave differently based on their corporate goals, capital availability, and available information. There are four segments of chiller users: Green, Professional, Real Estate, and Too Lean. Each customer segment has different needs leading to differing expectations regarding the utility. Chillers can play a major role in a utility's value proposition for each of these segments. The long term nature of chiller decisions provides the retail utility a unique opportunity to establish a valuable relationship with all customers.

With deregulation, customer behavior will change, complicating utility efforts to understand and serve each segment. For example, some segments value help in understanding and managing the electricity used for cooling. The activities that help manage cooling are valuable to the customer and also provide the utility with information that can be used to influence the customer's load profile.

For some segments, their need to minimize cash outlays underlies many decisions. These customers are searching for alternatives that eliminate or minimize capital outlays. One solution that exists today is to shift the capital cost to an ongoing operating cost.

Customers who make this decision are making long term commitments to cooling service providers to avoid large capital investments in non revenue producing assets such as chillers. This need creates opportunities for utilities to secure demand and influence the load profile.

Thus, chiller related services can help retail utilities win customers and improve their knowledge and control of the collective load profile. Both total energy volume and the load profile will impact a utility's profitability. The ability to buy energy at the "best cost", which volume and the right load profile facilitates, is at the heart of future profitability. Consequently, the retail utility must be able to differentiate customers by segment, present the appropriate value proposition, and then deliver the promised services. Chiller services must be organized around customer segments and integrated into each utility's strategies for each segment.

This report includes the results of a brainstorming session that produced a set of products and services that could be created to meet the needs of each of the four segments of customers that have been identified in this report - Green, Professional, Real Estate and Too Lean. Each utility will have to determine how each product and service fit within the needs of its customer base and its overall strategic direction.

A retail utility can use the models, methodology, and the chiller related products and services in this report to create a chiller strategy that is integrated into its overall strategy to win and retain customers.

1

INTRODUCTION

Commercial chillers are used in space and industrial process cooling. Approximately 3% of commercial buildings, representing 19% of all commercial floor space, are cooled by chillers. Consequently, every chiller represents significant electric (or gas) consumption. Chillers can comprise as much as 30% of a large office building’s electrical load. The selection decisions (electric versus gas, standard versus high efficiency, thermal storage or no thermal storage, etc.) for a new or replacement chiller will affect the customer's energy consumption for twenty to thirty years.

Consequently, this decision can play a major role in the customer's relationship with the energy provider. However, even though these chiller decisions have a significant impact on the utility, today the utility has limited influence over these decisions. EPRI commissioned this study to develop understanding that will help utilities increase their influence over chiller decisions. To achieve this objective, this study looks at the customer’s behavior – how they make chiller decisions, how the customer’s behavior and decisions are influenced today, and how these decisions might change in the future due to the impact of deregulation and changes in customer goals. The output of this project includes a list of product and service offerings that utilities and EPRI could offer to increase their influence over chiller decisions.

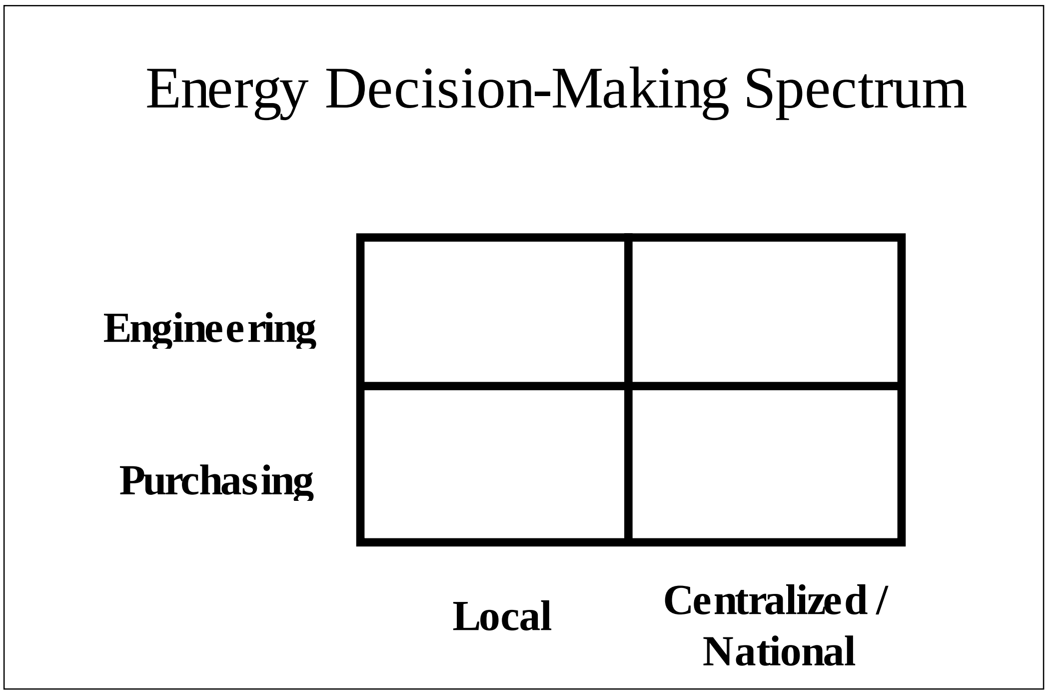
The product and service offerings generated in the brainstorming portion of this project are focused at the primary customer segments that were identified; Green, Professional, Real Estate and Too Lean. These offerings are grouped into five types that were defined by customers and participating utilities:

- Measurement
- Information
- Investment
- Corporate goals
- Operational services

Energy Decision-Making Spectrum

For application of these products and services to individual markets, utilities need to recognize the style of decision making within each account in their marketplace. These styles range from local, engineering based decision making to centralized, purchasing based decision making. This spectrum of decision making behaviors is shown in the figure below.

Figure 1-1
Energy Decision-Making Spectrum



11The research has identified organizations in each quadrant of this table. However, as is discussed in this report, while the decision making behavior in the local segments is well established, the centralized/national modes of decision making are just evolving. As such, the research has identified a major concern of the local decision makers that arises due to the move to centralization.

This concern relates to "maximization" efforts. Historically, selected customer groups attempted to maximize the outcome of their energy, operational and capital equipment decisions. The outcome goals varied by customers, with some focusing more on total cost, than environmental concerns, and others doing the opposite. However, in the regulated era, decision makers had enough influence and control over these decisions to attempt maximization. Now, with the advent of deregulation, these decision makers fear losing control of the energy vendor decision, along with the rate structure, service offerings etc., that were provided by their local utility.

Utilities have an opportunity to help craft the structure of these decisions their customers will make. Providing the right mix of services that has value to the decision maker as well as the others in his organization will go a long way to helping the organization's decision makers continue to maximize their decisions.

For utilities to gain the most value out of this effort, they need to integrate chiller strategy into their individual goals. So the starting point for each utility is to define its goals. In this period of approaching deregulation, utilities have substantially different starting points. Some have high levels of stranded costs and others have low levels. Some have high rate structures and some have low. Some have high levels of customer satisfaction and some have low. With different starting points, each utility should create its own individual set of goals. Perhaps more importantly, different elements within each utility now have different goals. Regulated and unregulated; generation, transmission and distribution, and retailing will all have different objectives and different goals as they relate to chiller strategy. In addition to these differences, customers have different goals and energy strategies and therefore require different types of help.

The perspective this report takes is that of an energy and energy services retailer. The authors have selected this perspective because it provides the most flexibility in terms of the products and services that can be offered to the ultimate consumer, thereby giving the planner the greatest range of options from this effort. Likewise, this perspective has the chiller as its primary focus, but also evaluates the broader range of energy management services that the energy retailer can provide to its customer. The ultimate goal is to build the product and service mix that will win and retain customers. Since chillers are a substantial portion of overall demand for the customer base who uses this technology, chillers are a logical focus for this effort.

As a result, each utility is creating its own marketing strategy. These strategies target selected customer segments with a bundle of products and services appropriate for the segment, including the mix of chiller support activities. There is not one answer for all utilities and all customers. This report has been written to provide the shapers of each strategy with tools that will provide value to their customers and help them increase the strength of their relationships with these customers.

Purpose

The purpose of this report is provide a framework for:

- **segmenting chiller customers**

- **identifying how chillers fit within the marketing strategy**
- **deciding where to use chiller related products and services as a tactic, and**
- **evaluating various types of chiller related products and services**

Because good marketing strategy is built both bottom up and top down, this report will evaluate specific chiller tactics that are based on customer needs as well as energy service strategies that take advantage of the changes in the structure of the market.

Methodology

This study is based on primary research, analysis of prior EPRI studies, findings in secondary research, and interaction with participating utilities.

The primary market research included over 100 data gathering activities:

- **On-site interviews and tours with end users**
- **Telephone interviews with chiller users**
- **Face-to-face interviews with chiller OEM sales and marketing executives**
- **Telephone interviews with control OEM sales and marketing staffs**

The interaction with utilities included:

- **Face-to-face and telephone interviews with participating utility:**
    - **Salespeople**
    - **Program managers**
    - **Segment Managers**
- **A 1 day brainstorming session that identified products and service concepts for retail utilities.**

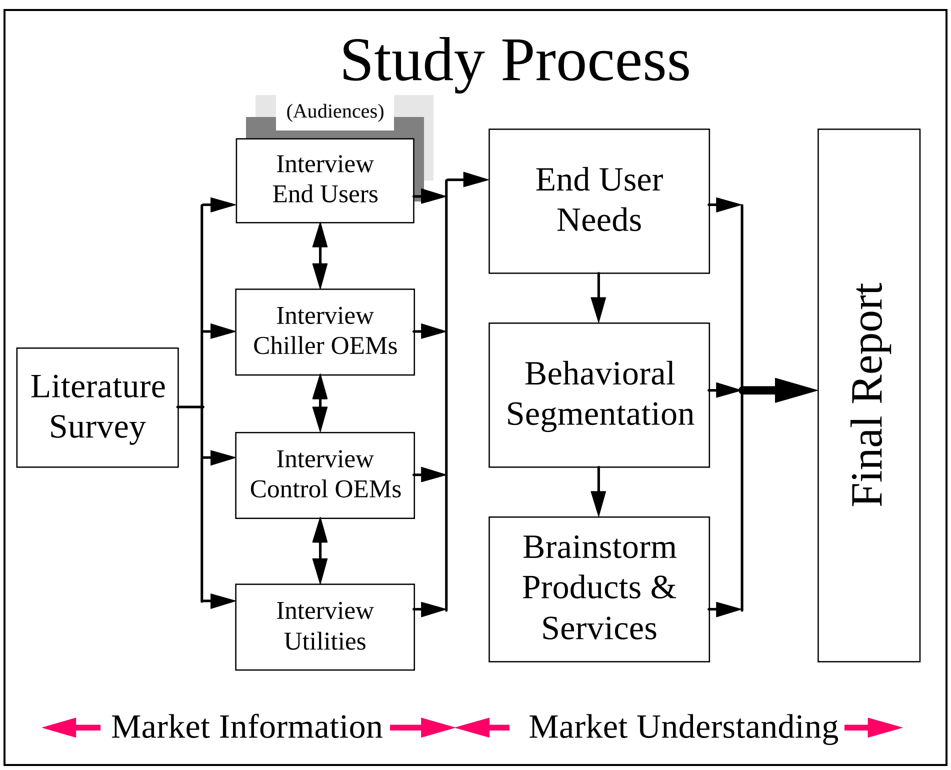
The participating utilities provided invaluable insight during the project particularly during a brainstorming session. We are indebted to these utilities for their time and cooperation.

It is important to realize that the study's findings apply to the chiller users; a small number of organizations with significant energy use. The segmentation's, market sizes, and needs these users express are not representative of non-chiller users. The findings in this study cannot be applied to other market segments without additional investigation into their behavior.

Process

The study is comprised of seven investigative phases and nine total phases. The learning process was iterative moving back and forth between end users, influencers, and manufacturers. For example, insights into end user buying behavior for controls had to be backed-up by finding a corresponding selling behavior in the control OEMs or distributors. As a result, end users were interviewed four different times as the study progressed. Eventually, seven end user audiences (facilities management, engineering, energy management, corporate purchasing/operations, and occupants) were investigated.

Figure 1-2
Study Process



Early work sessions and phases generated large numbers of hypotheses, many of which proved to be of limited value or blind alleys as the study unfolded. The market information stage lasted until the customer behaviors converged into four models, and the different perspectives on centralized purchasing under deregulation could be explained.

Once the market information could be structured, the study shifted from primarily a learning process to a more developmental and testing process. Three techniques were particularly insightful during this stage:

- Examining the underlying needs in each of the behavior segments
- Comparing the practical issues of centralized electricity purchasing with what centralized buyers experienced in purchasing natural gas
- Brainstorming the products and services that would meet the different needs of the different end user segments

Interpreting how end users will actually behave after deregulation or the explosion of products and services was complicated by the seven different types of end users. The final phases of this project involved testing potential scenarios and organizing what was being learned into this report.

2

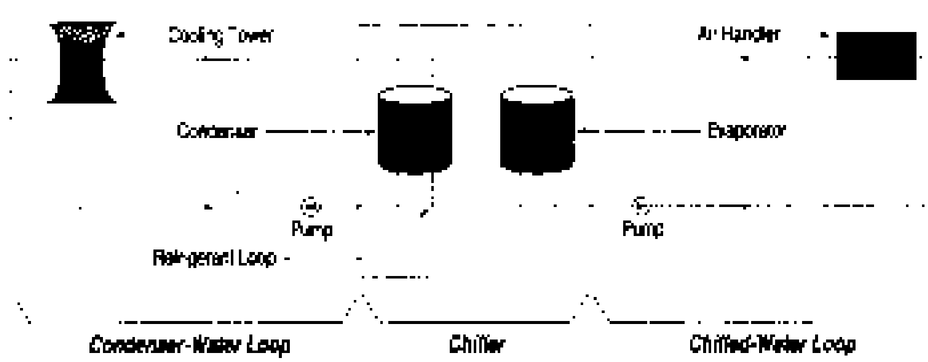
CHILLER TECHNOLOGY AND MARKET POSITION

Chillers produce cold water providing 20 to 2,000 tons of cooling. They are principally used for space conditioning, in which the cold water is used to cool air circulated in the building. Less than 10% of all chillers are in industrial applications, cooling materials, food, or equipment.

A chiller works between two systems. On one side, the chiller is cooling a liquid to be used to cool a building or manufacturing process. On the other side, the chiller is rejecting heat to the outside. For example, the chiller in the figure below produces cool water on the buildings “inside” chilled-water loop, and vents heat through the “outside” condenser-water loop. The “inside” loop pumps the cooled water (e.g. 45°F) through a building’s air handling units. There fans blow air over chilled water coils and through duct work to vents in areas to be cooled. The water temperature rises in the process (e.g. to 55°F) so it is piped back to the chiller and the cycle is repeated.

The “outside” loop rejects the heat from the chiller (e.g. 95°F water) by piping the water to a cooling tower where evaporation reduces the water temperature (e.g. 85°F) so that it can be piped back to the chiller and the cycle repeated.

Figure 2-1
Chiller Operating System



Source: Electric Chiller Handbook (EPRI TR-105951)

There are three types of chiller drives: electric, gas absorption, and gas engine. For an end user, these three technologies offer different trade-offs between, first costs, operating costs, space, noise, power source, environmental impact, and operating requirements.

The following is a very brief overview of the technologies. For a thorough presentation of the alternatives including life cycle cost comparisons, see the Electric Chiller Handbook (EPRI TR-105951).

Electric Chillers

Electric chillers use a vapor compression refrigeration system. The liquid refrigerant passes through an expansion value that allows the refrigerant to expand to a gas, absorbing heat -- producing the chilled water. An electric motor drives a compressor that compresses refrigerant vapor. In the condenser, the vapor is then condensed into a liquid reducing its temperature and rejecting heat to the condenser-water loop. The cycle is then repeated.

Nationwide, approximately 86% of all chillers being installed are electric. In some areas, predominately those with low electric rates and high gas prices, up to 96% of new chillers are electric. In areas with high electric rates and low gas prices, electric chillers will still comprise at least 70% of new chillers.

Electric chillers are viewed as the norm. Gas chillers are generally presented as an alternative for certain situations.

Gas Engine Chillers

Gas engine chillers use a gas engine instead of an electric motor to drive the compressor. Gas engine chillers use the same refrigeration process (vapor compression) as electric chillers. Consequently, gas engine chillers are going through the same environmental issues regarding CFC and HCFC refrigerant phase outs as electric chillers. The cooling system design is basically the same as an electric chiller.

The gas engine has different maintenance requirements than an electric motor. In organizations that do not have other engines, adopting a gas engine chiller requires introducing new maintenance skills. Organizations that already maintain engine driven back-up or peak load generating equipment have maintenance procedures for diesel, gasoline or natural gas engines and, therefore,, may have less difficulty in adopting a gas engine chiller.

Gas Absorption Chillers

Absorption chillers use a different refrigeration process; a heat activated thermodynamic cycle. The refrigerant is absorbed and desorbed in the refrigeration cycle. The two most common sets of refrigerant/absorbents are: water/lithium bromide and ammonia/water. Because this is a fundamentally different refrigeration process, it requires different management and maintenance practices. A primary benefit of absorption chillers is that they do not use any CFC's or HCFC's.

In this process, the desorption is accomplished by adding heat. A gas fired absorber burns gas to directly heat the refrigerant/absorber solution. The installation and maintenance issues of this portion of the process are similar to a gas fired boiler.

Because a chiller's surface temperature exceeds 800°F, it has to be treated as a boiler. Absorption chillers can not be installed in the same chiller room with other electric chillers. They have to be separated by fire rated walls.

The rest of the cooling system is similar to, but not identical to, the system using an electric chiller. The system must reject more heat than an electric chiller and, therefore, requires larger piping, pumps, and larger cooling towers. These additional requirements create design risks for engineers unfamiliar with gas absorption cooling. For example, failure to properly size the piping or account for water consumption could harm the consulting engineer's reputation with this customer or even result in liability for the cost to correct the problem. Unless specifically requested, a consulting engineer's bid for design of the mechanical systems does not allow them time to explore new technologies such as gas absorption.

It should be noted that there are absorption chillers that use steam as their heat source. These are generally used in manufacturing processes where low temperature steam is a waste product or is being generated in high volumes inexpensively. While the economics are different (the steam may be regarded as free), piping, pumping and cooling systems must still be larger than for an equivalent capacity electric chiller.

Energy Efficiency

Improvements in the technology and higher standards have made today's chillers more efficient than chillers manufactured 10-20 years ago. Replacement of an existing chiller almost always improves the energy efficiency of the cooling process. In a few cases this energy savings is sufficient to justify replacing an adequately performing chiller. Generally chiller replacement is driven by a chiller failing to provide the level of cooling required for its application.

In addition to standard chillers, OEMs offer high energy efficiency chillers. For an additional 10 to 30% purchase price, an end user can acquire a higher efficiency chiller that cools using less kWh/ton and hence has a lower operating cost. Obviously, the value of this trade-off depends on the cost of the energy. For organizations that compare standard and energy efficiency equipment, the decision depends on the time value of money. For example, from the research conducted for this report, the majority of customers who upgraded to higher performance chillers were municipalities, hospitals, and public agencies that had payback requirements that could exceed four years, whereas other customer segments required shorter paybacks.

Customer Implications

All of these choices make the chiller decision a potentially complicated process. An end user could consider different technologies, energy sources, and efficiencies. Each alternative can be evaluated on its first costs, operating costs, maintenance requirements, space needs, noise, and environmental impacts.

Table 2-1
Chiller Performance Comparison Chart

Criteria And Performance On The Criteria	Electric Chiller	High Efficiency Electric Chiller	Gas Engine Chiller	Single Stage Absorption Chiller	2 Stage Absorption Chiller
Energy Efficiency (COP)	High (4.0-5.0)	Very High (5.0-7.0)	Medium (1.4-2.0)	Low (0.7)	Medium (1.0)
First Cost (Relative)	Low (1.0)	Medium (1.1)	Very High (1.6)	High (1.2)	Very High (1.6)
Noise	Minor (except reciprocating)	Minor (except reciprocating)	Significant	Minor	Minor
Maintenance (Relative effort required)	1.00	1.00	1.15		
Space Needs (Relative sq. feet required)	1.0	1.0	1.4-2.0		1.5
Environmental Impact	HCFC's	HCFC's	SO_X , NO_X	NO_X , CO , CO_2	NO_X , CO , CO_2
Impact on Rest of Cooling System (Relative size of piping, cooling tower)	1.00	0.95	1.08	1.75	1.50

Source: QDI Strategies, Inc. The wide range of equipment available and the significant difference each organization experiences in actual performance and maintenance makes overall comparison very difficult.

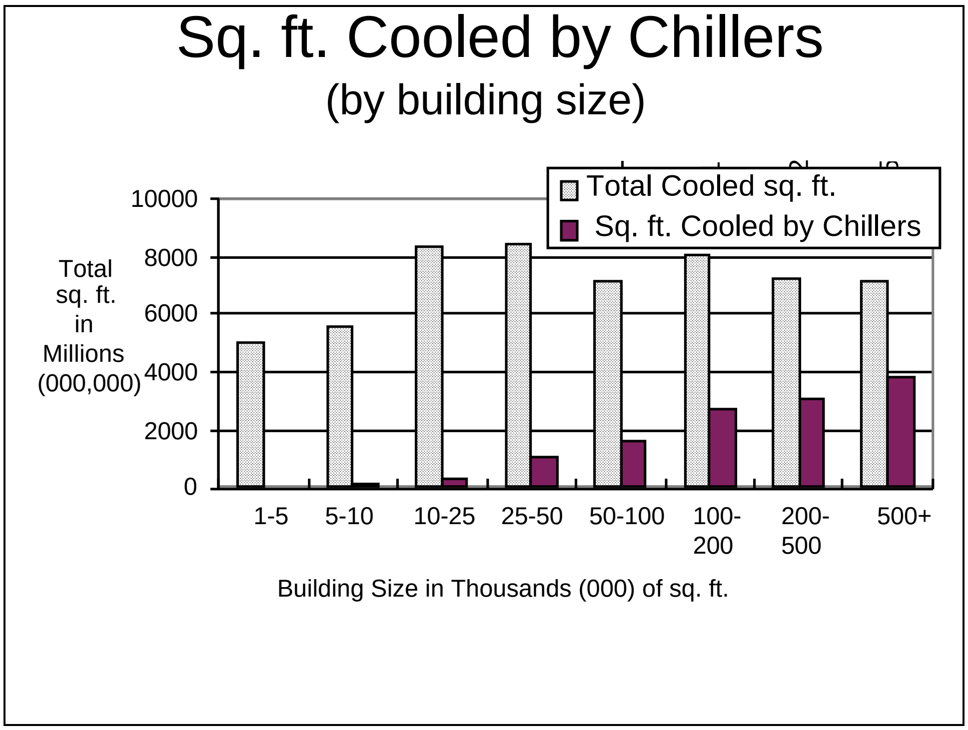
These choices also mean that customers who decide to only consider a subset of these alternatives can use the same process and criteria yet arrive at different outcomes. For example, if an organization only considers high energy efficient equipment, they may make a different selection than another organization even though both use life cycle cost to evaluate alternatives.

Geographic use of Chillers

Chillers are used for space cooling in large buildings. The use of chillers versus direct expansion (DX) cooling systems varies slightly by geographic region, but chillers are still a significant cooling source in every geographic area. Most utilities who have customers with buildings over 100,000 square feet will have chillers in their customer base.

Although chillers are found in larger buildings, over half of all very large buildings use packaged or individual air conditioning units.

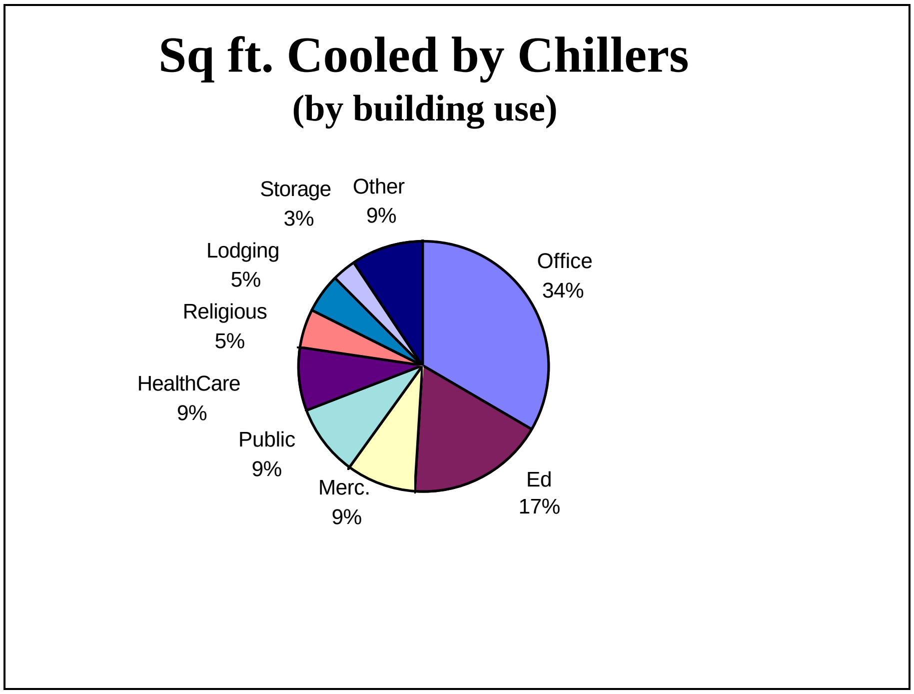
Figure 2-2
Square Feet Cooled by Chillers



Source: Energy Information Administration, 1995, Commercial Buildings Energy Consumption Survey.

As the figure below shows, the majority of the chillers used in commercial buildings are found in offices, education, mercantile, public and healthcare facilities. These facilities together account for almost 75% of all chiller usage.

Figure 2-3
Square Feet Cooled by Chillers



Source: Energy Information Administration, 1995, Commercial Buildings Energy Consumption Survey.

Individually and collectively, chillers represent significant energy load. They can be found in every utility's territory and in each type of end user. An end user's decision to select an electric versus a gas chiller has an important impact on the end user and the utility. The rest of this report examines the potential for the utility to influence the chiller decision and how participating in the decision can strengthen the utility's relationship with the customer.

3

CHILLER END USERS

Customers

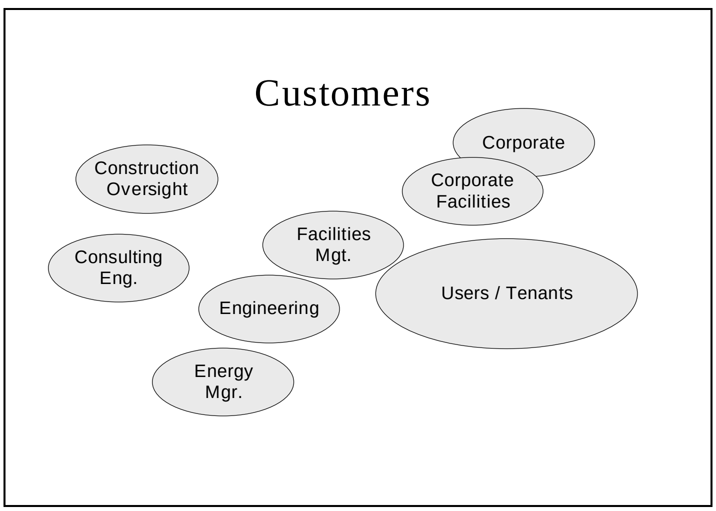
The key to influencing customer decisions is understanding who the customers are, and their behavior. Chiller decision and energy purchase decisions are an outgrowth of:

- Who makes the decision
- What criteria they use
- What information they have to work with

Thus, understanding the customer's decision making process is necessary to be able to influence the decision.

As Figure 3-1 shows, in reality, the customer is many different entities. Each of these people has a role in energy and chiller decisions. What each of these individuals or groups is charged with accomplishing and what information they have affects the collective decisions the customer makes about chillers -- or any large energy use.

Figure 3-1
Different Entities of the Customer



Internal Groups

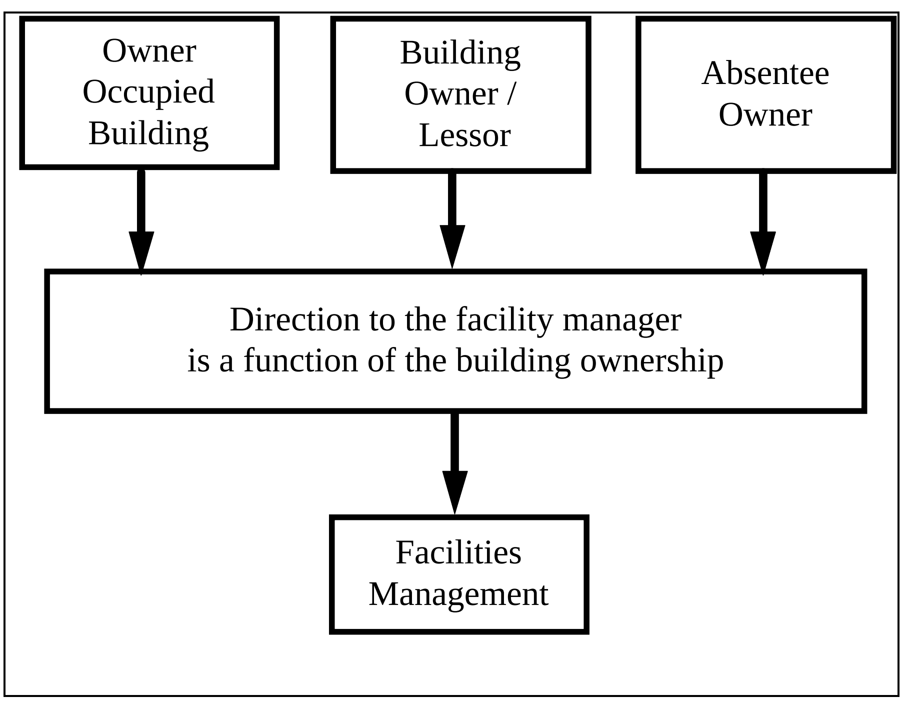
The facilities' manager is the person who has responsibility for operation of the building(s). Facilities managers may be employed by the business that owns and occupies the building, the owner/lessor of the building, or a property management company. They direct an engineering staff that oversees the operation of the mechanical systems and manages the maintenance staff. There is a wide range of engineering skill sets between different types of organizations. Skill sets range from accredited professional engineers to individuals with some on-the-job operating experience.

The facilities manager is responsible for building maintenance, waste disposal, cleaning, landscaping, heating, cooling, lighting, and security. The facilities manager typically decides when to take the engineering or maintenance contractor's equipment recommendations to operations or the building's owner regarding the type of equipment to purchase and when to replace equipment. The electrical expenses are usually less than 25% of their total operating budget.

Engineering is responsible for the mechanical systems operating plan, equipment maintenance and control system programming.

The facilities management group reflects the building owners "style" regardless of the type of building ownership.

Figure 3-2
Directions to Facilities Management



In some organizations, one of the engineers is designated an energy manager who is responsible for implementing energy saving programs and applying for earned rebates. In some larger organizations, those tasks are assigned to a full-time energy manager who identifies energy savings opportunities, tracks progress against past projects, and insures that the organization qualifies for and receives all of the rebates and incentives the utility offers. While this is a significant energy and engineering role, the position typically does not set policy, and its ability to drive execution is limited. The position has limited discretionary funds. The operating changes energy managers identify are changes in procedures and equipment settings that must be implemented by maintenance or engineering. Equipment changes that require capital are taken to the facilities manager who decides if they are submitted in the next capital budget cycle. The on-site energy manager role is not the same as a corporate energy manager. The corporate energy manager's does not necessarily have an engineering background or operating responsibility, but has responsibility for purchasing energy.

The construction of a new building involves a construction oversight group that defines the necessary building characteristics and decides the trade-offs as the building is designed. This group works with the architect and, where appropriate, with the consulting engineers to make these decisions. The oversight team is composed of the user functions that will occupy the building as well as representatives from the facilities and engineering functions from corporate or key sites. The larger the organization, the less likely that oversight team members are the individuals who will operate the new site once it is completed. The individuals who will operate the building are not identified or hired until the organization starts to move into the building.

The maintenance, engineering, and energy managers are all in the same chain of command reporting to the head of facilitie s management. Decisions that cut across these individuals can rise to the facilities manager. For example, should engineering recommend the cooling tower be cleaned more often, the facilities manager controls the maintenance staffing and budget and has the scope to implement such a change.

The construction oversight group on the other hand is often making decisions about new buildings before the facilities group for that site exists. Trade-offs between construction decisions and operating consequences must be made without any one person ultimately accountable for both. The construction oversight team has been focused on the building's end-use and construction costs with less attention paid to its operating costs. The architect and consulting engineers recommend designs, equipment, and operations that fit the client's style, but they generally avoid making specific predictions about the operating costs. The difficulty in making accurate estimates and the confusion estimates create for an owner, give the architect, engineer, and the builder a common incentive to avoid forecasting actual costs.

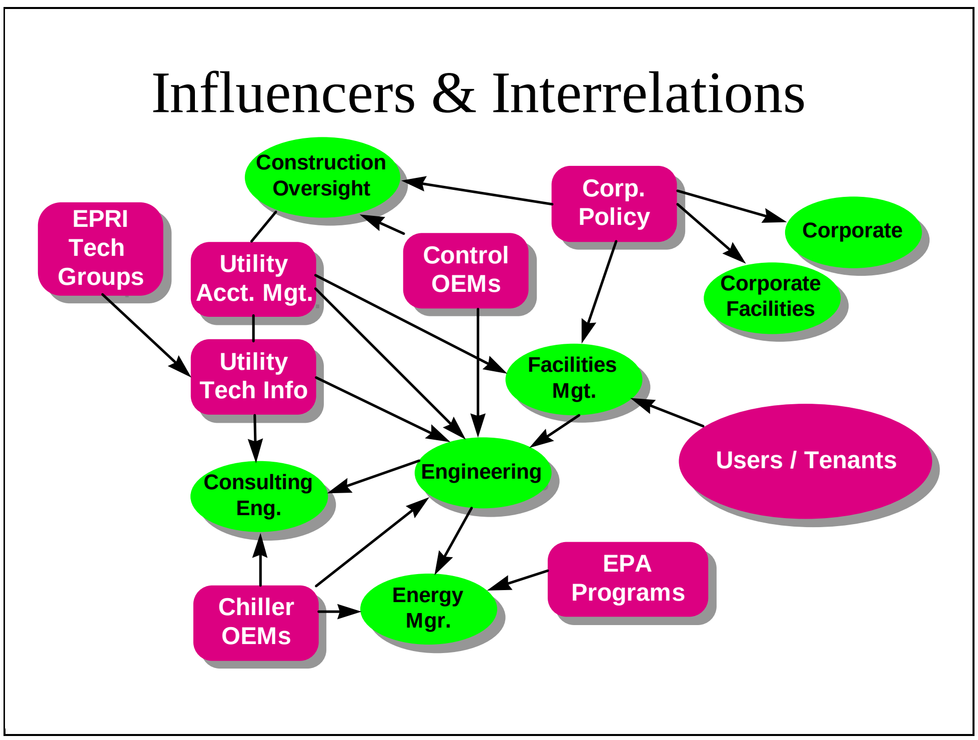
Once the facility manager inherits the new building, his/her goal is to establish an actual base line for the total budget. They are then managing gains and losses as the staff learns how to run the equipment and occupants ask for more services. For example, a facility manager stated:

> "We lowered our energy costs by wiring our air handlers so we could run just the portions of the building used on Saturdays, but due to complaints about dust in the air, we now change the filters and clean the outside windows twice as often as last year -- you win some, you lose some."

Influencers

There is a large number of people interacting with each of the customer entities. Each of these interactions influences the end user's perspective. The customer's different decision makers are influenced by different organizations and vendors.

Figure 3-3
Influencers and Interrelations



The arrows show the primary direction that information or responsibility follows, but many of the relationships effect both parties as they interact over time.

The Influence of Corporate Policy

Corporate policy is a driver for capital purchases, operating decisions, and organizational structure. In some organizations there is a corporate policy regarding energy efficiency and/or environmental issues. In other organizations, corporate policies on capital spending, ROI, and business focus indirectly affect energy and environmental decisions. Corporate policy is a mechanism for improving the consistency of these decisions across corporate management, construction planning, the On-site facilities management, and energy management groups.

Corporate policy indirectly drives the importance of occupant comfort versus operating requirements. The corporate policy is reflected in the make-up of the construction oversight team. The team's influence on the consulting engineer establishes the importance of: control system, air handling, sound, and energy efficiency in the chiller/cooling tower selection. In turn, the consulting engineer influences the team's specific choices.

Utility Relationships with Customers

The utility has an account management and technical relationship with the customer. The account manager is the representative that has ongoing contact with the customer. Typically, the contact is about customer service issues: when will the power be restored, meter reading access, or questions about the bill. Contact ranges from once a month to once every couple of years for chiller sites. In some cases, the utility provides other financial information such as: estimating the impact on the bill of different hours of operation or the savings from using different equipment.

The contact between the utility and the head of engineering focuses on operating issues: power quality, new connections, service for new equipment, etc. In these interactions, the utility provides support to the end user's engineering group.

Companies interviewed by QDI rated their relationship with their utility anywhere from good to a waste of time. Most importantly, regardless of how good the relationship was, customers frequently point out that after deregulation, they will not pay more because of the relationship. A good relationship with the customer earns an opportunity to present alternatives, but not a price premium.

Support from EPRI Technical Groups

The utility may provide materials such as EPRI research or case studies to meet the information needs of the customer. EPRI technical groups such as the HVAC Center provide comparative research and case studies to utilities.

Control OEM Influence

The control OEMs establish a relationship early in the new construction process with the introduction of control systems. Winning the control system means ongoing component and software upgrade sales. It also creates an advantage for the control systems vendor in any outsourcing of maintenance of the chillers and cooling system. As electric power is deregulated, the control vendor is one of the potential competitors at the retail level. By leveraging their control systems and performance contracting experience, they could offer demand management and electric power – potentially with guaranteed results.

The control OEM's attention shifts to facilities engineering once the building is open. Automated control systems can provide significant benefits in occupant comfort and energy savings. The challenge is to properly program the control system. As a result, facilities managers perceive the control OEMs as having an advantage in optimizing their own control system.

In buildings large enough to have a chiller system, the control OEM works with the engineering group about once a year to sell additional controls, software upgrades, system training, etc. If the control OEM is also providing routine equipment maintenance or performance contracting, they are on site as often as once a month.

Chiller OEM Influence

The chiller OEMs are working with the consulting engineer and the customer to establish a presence during the design phase. Some of the OEMs focus more on the consulting engineers, some focus more on the customer. Some types of customers form a chiller brand preference that influences expansion, replacement, and in some cases, new building chiller selection.

Chapter 5 shows the chiller OEM's role in the end user's selection of chillers for both new construction and retrofit projects.

EPA Programs

Government programs such as EPA, DOE, and FEMP and the trade press promote a sequence for addressing energy efficiency programs that are being adopted by customers. Customers generally expect to implement energy efficiency programs in a specific order, using the Energy Star Program as a guide, their order of priority is:

- Lighting
    - Ballast, bulbs

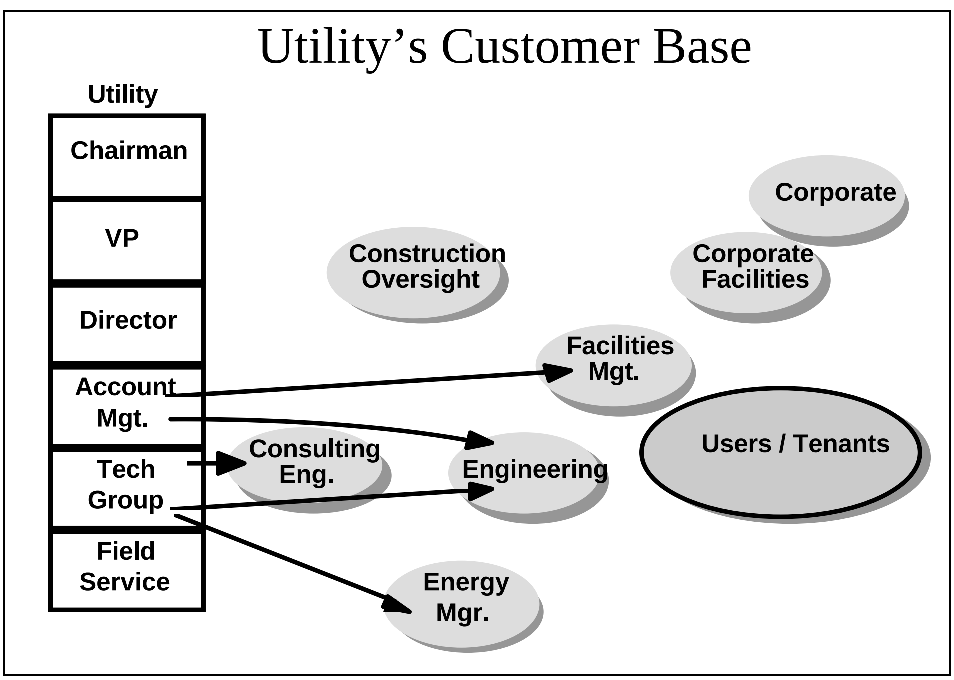
- HVAC tune-up
    - Fans, pumps, air handling, heat exchangers
- Variable speed motors and VAV boxes
- Controls
    - EMS, DDC
- Mechanical systems
    - Chillers
    - Boilers

Chapter 6 shows why firms are at different stages of implementation.

Utility's Customer Base

Utility account management and technical groups interact with some of the customers influencers as shown in Figure 3-4.

Figure 3-4
Utility's Customer Base



Utilities have limited access to some of the audiences in the customer's business. Except for a few anecdotal stories from utility ESCO's, the research has not shown an active presence by the utility management to some of the customer's influencers.

Going forward, the existing customer access provides the utility an opportunity to influence some of the players, but leaves gaps in the overall coverage. To increase influence over chiller and energy decisions, utilities must explore both changes in these relationships as well as forging new ones.

In some cases, leading utilities have established relationships with the corporate headquarters of customers based in their territory. The research found almost no instances of relationships with corporate decision makers and corporate facilities management groups when the headquarters was outside the territory. Consequently, most utilities do not have a relationship with the corporate organization of their chiller customers. This is in contrast to industries such as chiller or controls OEMs where senior executives meet customer decision makers or senior executives during a key sales opportunity.

The utility is trying to keep customers and influence the selection of fuels for key decisions such as chillers, yet the local nature of most utility customer presence hides some of the issues in the decision process from the utility.

Energy / Space Cooling Value Chain

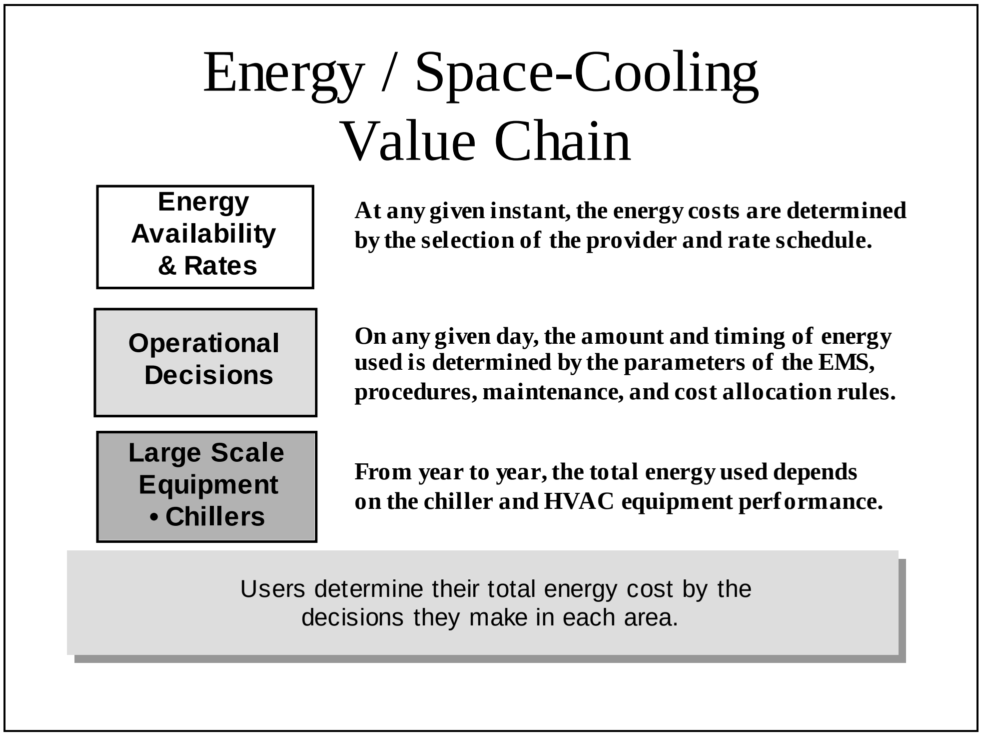
The value chain shown in Figure 3-5 represents the customer's steps to convert "raw energy" into useful results. For example:

- Power is available at a given rate through the relationships with the electric utility.
- Operating decisions are made which turn the cooling system on, maintain or improve its energy efficiency, and impact users' comfort.
- Chiller selection impacts energy efficiency, total energy cost, and operating costs.

The combination of these factors results in a lower temperature in the occupied space, which is the desired outcome. An even more desirable outcome would be interior comfort at minimal operating and capital cost. This value chain forms the basis of the customer's decision making.

Energy cost is an outcome of decisions in three areas; energy provider and rates, operations, and equipment selection.

Figure 3-5
Energy / Space Cooling Value Chain



The research identified customers who were trying to make decisions in three areas: energy availability and rates, operations, and large scale equipment. The fundamental process that determines energy use is the process of optimizing within each area and across the three areas. **The key customer behavior is the process of optimizing these individual decisions.**

However, the key process is not optimizing across these decisions. <u>It is not possible for customers to make perfect simultaneous decisions across all the dimensions at every point in time</u>. Individuals making long term equipment decisions must make assumptions about future operating practices. Individuals executing day to day operating activities must live with equipment decisions made by someone else years ago. This is an ongoing process.

- The decisions are made at different times.
- They are made within different time frames.
    - A rate schedule decision can be made every couple of years.
    - Operating procedures take time to learn and tend to drift over time.
    - A chiller decision lasts for 20 to 30 years.

- They are made by different individuals and, in some cases, by different groups.

Different customer segments are organized and funded differently. This leads to different approaches to managing their costs. Some companies are organized to minimize each of the three components. Others focus on minimizing their cash outlays, particularly for large capital expenditures. Still others will look to improve occupant comfort while managing the total cost of all three components.

Chapter 6 will investigate the different types of vendors who will exist with value propositions that correspond to each segment's needs. Already brokers and ESCO's are emerging with specific value propositions for chiller customers.

Each of these customer segments will be profiled and evaluated in Chapter 4 of this report.

4

CUSTOMER SEGMENTS

Customers exhibit differences in behavior. Some differences are due to the uniqueness of each organization. But the interviews revealed consistent patterns of behavior and needs among groups of end users. Four types of chiller customers have been identified:

- Green
- Professional Management Approach
- Real Estate
- Too Lean

Within each of these segments the end users share a large number of common characteristics. An organization can be classified into one of these segments based on its behavioral characteristics in several different areas as shown in Table 4-1.

Table 4-1
Behavioral Characteristics in Green, Professional, Real Estate and Too Lean Segments

Segment Characteristics	Green	Professional	Real Estate	Too Lean
Types of Organizations	Large corp., non-profits, hospitals, some gov. agencies	Well run corp. organizations, long term property owner/mgrs.	Builders, developers, image driven corporations	Corporate organizations short of capital, some gov. agencies
Corporate Energy Objectives	Minimize environmental impact	Improve efficiency and comfort	None	None
How energy efficiency projects are measured	Total $ ROI or payback	$ per sq. ft. impact	$ per sq. ft impact	Total $ ROI or payback
Projects they will undertake	Payback up to 8-10 years	Payback up to 4-5 years	Payback in 1 year	Payback in 1 year
Control System	Yes, to control energy use	Yes, to improve occupant comfort	Yes, minimum functionality, no chiller control	Yes, turned off or does not control chillers
"Energy Engineer or Mgr."	Sees utility bill	Sees and knows demand vs. use energy costs	Hears about high energy costs	Do not see monthly energy bill

Source: QDI Strategies, Inc.

As shown in this table, these four groups of customers behave differently due to their corporate goals, organizational structure, and available capital. Each group has very different views about chillers.

Green

The green segment is composed of customers driven by a corporate goal to promote environmental projects both internally and externally. The goals are part of the organization’s culture that has been established at the top and are followed to varying degrees throughout. In some cases, the green policy is clearly tied to the PR value, in others it is based on the view environmental sensitivity drives better long run decisions.

This policy affects the HVAC decisions through the facility’s engineering department. Facilities engineers in these companies propose and undertake projects such as replacing CFC based chillers or selecting high efficiency chillers, despite less costly alternatives. Often they create project proposals that show attractive paybacks or the necessity of replacing equipment, however their alternatives are limited to options they consider acceptable to the corporate policy.

For some organizations, this has extended to formal tactics such as eliminating CFC’s from their buildings or reducing energy use by 20%. For other organizations, their policy’s implications for CFC’s (HCFC’s) or energy consumption is being interpreted at each site.

Occupant comfort is important. The organization will not implement a change in HVAC systems they believe will reduce occupant comfort. They may not be interested in increasing occupant control of their environment. They are concerned about air quality, and they may give occupants the ability to adjust air temperature or control fan speed. They will move quickly to address occupant concerns about an unhealthy environment. While these requirements do not impact chiller size, they can make managing and evaluating the chiller's performance more complicated.

The engineering recommendations (either made directly or by the consulting engineer) are not second guessed by the financial or operating functions. Vendors, such as those of building control systems, do not go over the engineering department since the implementation will involve facilities engineering.

The engineer or energy manager generally sees the electric bill, but does not know the details of how the total is calculated; unlike the professional segment where the energy manger must sign the bill. Energy management projects are evaluated on the reduction in kWh.

The engineering and energy management functions in green organizations augment the traditional information resources with sources of “green” information. Their information sources include:

- Trade press
- Other sites within their organization
- Information provided by equipment OEMs

These individuals are aware of the refrigerant, global warming, and air quality issues through the popular and trade press.

Professional

The professional segment is composed of customers managing their energy decisions using payback or ROI. They measure their performance against last year's budget, BOMA (Building Owners and Managers Association) targets, or a ratio of energy costs over a measure of their business activity. The corporation may have an explicit energy efficiency target, or the goals may be implied by standards used to judge all non-revenue generating investments. They have payback standards in the four to five year range.

They use control systems to provide better regulation of the HVAC systems, reducing the comfort problems caused by errors in human management. The savings from the control systems have not been quantified, since contracts provide a mix of benefits including:

- Better control (giving better occupant comfort)
- More efficient equipment operation (lowering energy costs)
- Reliable equipment performance information (improving replacement timing)

The engineering and facilities staff will use a retrofit or expansion project as an opportunity to improve the control and comfort of the occupants. During the building’s first year (after new construction or purchase), they identify areas of the building where occupants have no control over their environment. They also identify operational problems with the mechanical systems. Engineering will use the new project as an opportunity to include changes that correct these issues. For example, an engineer commented:

> “Everyone complained about the fan noise on the top floor. Our first energy efficiency project was to install variable air volume control. We included the top floor in phase I, so we could also make changes that reduced the noise.”

The engineering recommendations (either made directly or by the consulting engineer) are not second guessed by the financial or operating functions. Replacing CFC chillers is not a mandate. Instead facilities management focuses on better CFC management due to the cost of replacing the refrigerant and the chiller. Most organizations retain the refrigerant from obsolete equipment for use in their other chillers; eliminating the need to purchase the increasingly expensive refrigerant.

Corporate real estate and new construction oversight teams look to leverage experience by implementing the same systems where possible. The facilities management person on the team will point out the operating advantages of selecting equipment that they are already familiar with. The same brand of chiller means they can use the same maintenance program; the same control system means they may be able to have the same person program its operation. The engineering representative expects fewer headaches from known equipment as well. The consulting engineer will support this desire by writing the spec around the favored equipment brand. While competitive companies can match the hardware, and may provide a lower bid, the alternative brands are rarely significantly lower than the desired brand. This creates competition for the desired brand and allows the oversight team to recommend the standard brand without implying the organization paid a significant cost penalty. In a design/build program, this whole process will be even less formal, but the same elements exist: a preferred brand, competitive alternatives to create price competition, and selection of the desired brand.

> "When our clients want a specific brand and the price is not set by a national contract, we ask one or two other brands for a quote to improve our negotiating position with the preferred brand."

Their energy management expertise is developed by:

- Learning as they go
- Other corporate sites (by calling their peers who may have similar issues)
- Information provided by the utility
- Trade press

The professional group can be further divided into two subgroups: do-it-yourself and outsource-it.

The DIY's are generally manufacturing companies who have a desire to control everything themselves. Manufacturing companies also have the depth in electrical engineering necessary to implement the energy savings programs they hear about. They view performance contracting as giving away savings they should have earned themselves:

> "We prefer to receive power at 12,000V, then step it to 480V. This way we control the equipment and any reconfiguration of our facility."

> "Why would we pay someone a portion of the savings when we could get the entire savings? We can and have done these types of projects."

The outsourcers want to focus on their core business. They have a corporate policy that allows them to turn over non-revenue generating activities to vendors. They view performance contracting as an acceptable way to shift the responsibility of capturing the savings to the vendor:

> "Why should we maintain the equipment? The price difference is minor. We don't have the skills or the focus to manage the electrical system."

Real Estate

The principle focus of the facilities group in these organizations to increase the value of the real estate. The organizations tend to be developers, professional property managers, or image driven public companies. Their core competency is attracting attention, which brings tenants or public recognition. The primary criteria for a large segment of their customer base are location, curb appeal, space finishing options and, for developers, initial lease terms.

They focus on managing the capital cost of the building. The chiller decisions have no impact on their occupants primary criteria, affecting them only in their share of the building's monthly operating costs. Consequently, customers in this segment invest as much as possible in the buildings curb appeal, but minimize the investment in mechanical systems. Chiller decisions are made to minimize first cost.

They value alternatives that lower their capital cost such as district cooling or ESCO's who shift current capital expenditures to operating costs.

Their energy management expertise is limited. They have retrofitted some of their lighting with new ballast and bulbs because these projects met the 1-2 year payback. Should they decide to pursue other energy projects, there are lighting projects and basic mechanical improvements with quicker paybacks than the chiller projects.

Too Lean

The too lean segment is composed of customers who must focus everything on their core business. All non-revenue generating investments are being minimized.

The facility's staff does not have an energy manager, rather the responsibilities are part of various engineering positions. The primary responsibility of the staff is to keep the mechanical systems operating. Since most investments are made only when absolutely necessary, they rarely identify or recommend energy efficiency projects beyond the quick payback lighting projects. If an energy efficiency project is undertaken, the project engineer may explore whether the utility will pay a rebate. If the project qualifies for a utility or government rebate, the project engineer is responsible for the paper work. Projects to replace equipment face close financial scrutiny. The engineer's proposal to replace a chiller is frequently delayed from one fiscal year to the next by the facilities manager. They accept the risk of operating problems in order to postpone capital expenditures.

The cost of electricity is viewed as given, engineering believes they cannot reduce electric consumption without reducing occupant comfort or additional investment. The engineering group often does not see the electric bill as it is sent directly to accounting.

The facilities engineers are pressured to reduce electric consumption, but do not have many alternatives that do not reduce occupant comfort. They become desensitized to the requests to reduce consumption, accepting the complaints as a fact of life. They have not established targets for their electric consumption, instead they judge projects on their impact on operating expenses and capital outlays.

They undertake projects that have a 1-2 year payback or that are funded by someone else. The one year payback means that the premium that they paid for higher efficiency equipment must be recovered by savings in operating costs during the first year of operation.

Their use of control systems is often limited to simple temperature controls and turning lighting on and off. The operating setup for more sophisticated control requires time and training the staff does not have (the initial training has been lost due to turnover or lack of use). Features of the control system may be turned off since engineering cannot demonstrate the value.

Replacing CFC chillers is not an objective since, with CFC management, they expect to continue to operate the chiller for most or all of its projected life.

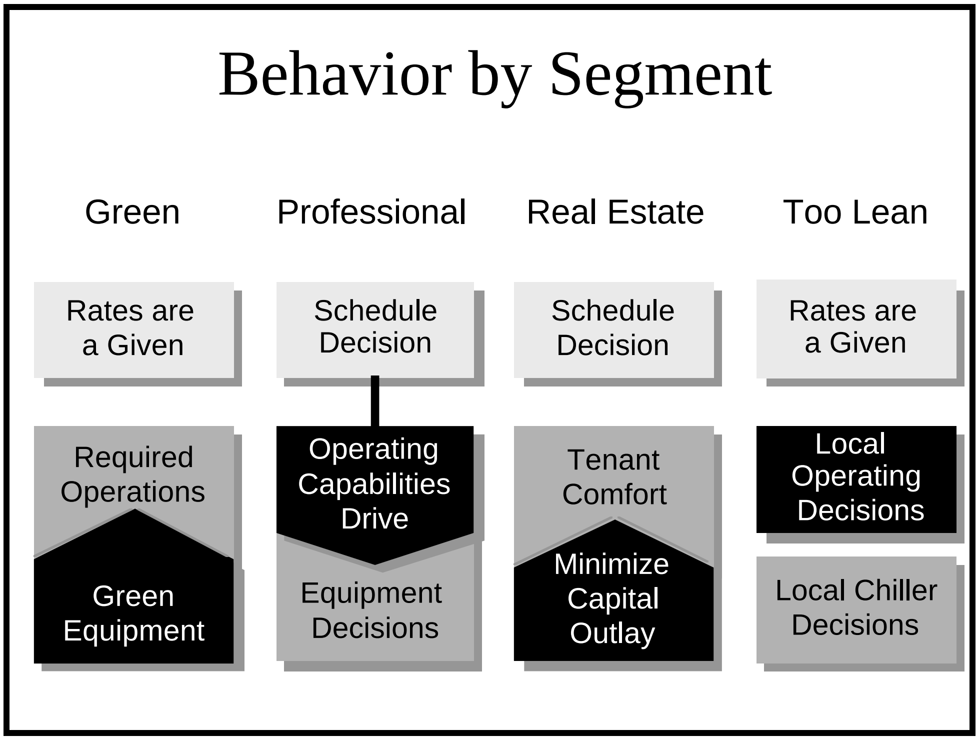
Their energy efficiency information comes from information provided by the utility about rebates and trade press.

Behavior by Segment

These four segments exhibit different decision behaviors relative to their energy/space cooling needs. How these four segments view the energy/space cooling value chain and the decisions they make is summarized in the following diagram.

Each segment relates to the three areas (energy provider and rates, operating decisions, and equipment selection) differently.

Figure 4-1
Behavior by Segment



Each group is attempting to optimize the three areas introduced in Chapter 4. But each philosophy starts from a different point.

Green organizations start by selecting the equipment. This in turn dictates the operating capabilities they need. Rate decisions are treated separately - with little consideration for alternative schedules. Thus, decisions about rates, operating control systems and procedures, and capital equipment are all based on the premise that certain classes of equipment will be used within these facilities. For example, some green organizations choose absorption chillers to avoid using CFC's or HCFC's. This decision in turn requires them to learn new maintenance skills. The reduction in electric use could effect which rate schedules they can use, but the chiller decision and any rate schedule decisions are generally made independently.

Professional organizations focus on perfecting their operating capabilities since they drive the annual cost per square foot. Their equipment decisions tend to reflect operating practicalities; for example, standardizing on equipment. Their rate schedule decisions are made with some consideration for their operating and equipment capabilities.

> "We have looked at thermal storage, but we do not have the staff to operate it."
>
> "We have always maintained the capability to run our backup generators on demand, so last year we reduced our electric bill by switching to an interruptible rate; we will use our backup generators when required to reduce our usage."

Real estate organizations are minimizing their capital outlays. They make their equipment decisions first. Then their operating decisions are focused on tenant comfort at minimal operating cost. It is as important to show responsiveness to tenant needs as it is to show actual performance. If a tenant complains, facilities management always responds in some way. Rate decisions have the same short term focus as other decisions. For example:

> "We switched to a general service rate schedule to avoid the cost of upgrading our backup generators to meet the utility's requirements."

Real estate organizations have signed long term performance and district heating contracts to lower equipment costs and achieve lower rates in the first few years.

Too lean organizations make the decisions fairly independently, i.e., each set of decisions, rates, operations and equipment are made independent of the other. Their small staffs make large scale projects or analysis across functions very difficult.

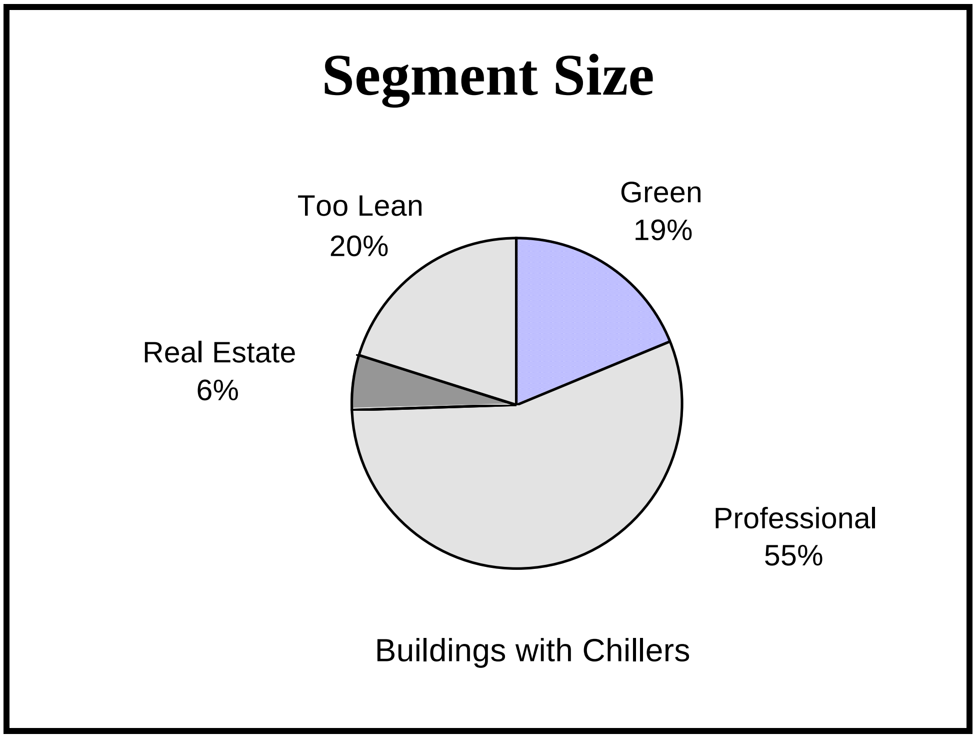
The differences between green and professional organizations versus real estate and too lean organizations can also be seen in the two areas where engineering and energy managers talk about making a significant impact on energy cost: chillers/ thermal storage system and interruptible rate schedules. 67% of green and professional organizations have looked at thermal storage and interruptible rate schedules while only 48% of too lean and real estate organizations have.

Segment Sizes

The size of each segment can be estimated by using the research finding in each type of building to model the universe of chiller users. The significant number of chillers in educational and healthcare institutions yields a larger green segment than is thought to exist in the overall utility customer base.

The majority of buildings with chillers are in the professional segment.

Figure 4-2
Segment Size



5

BUYING A CHILLER

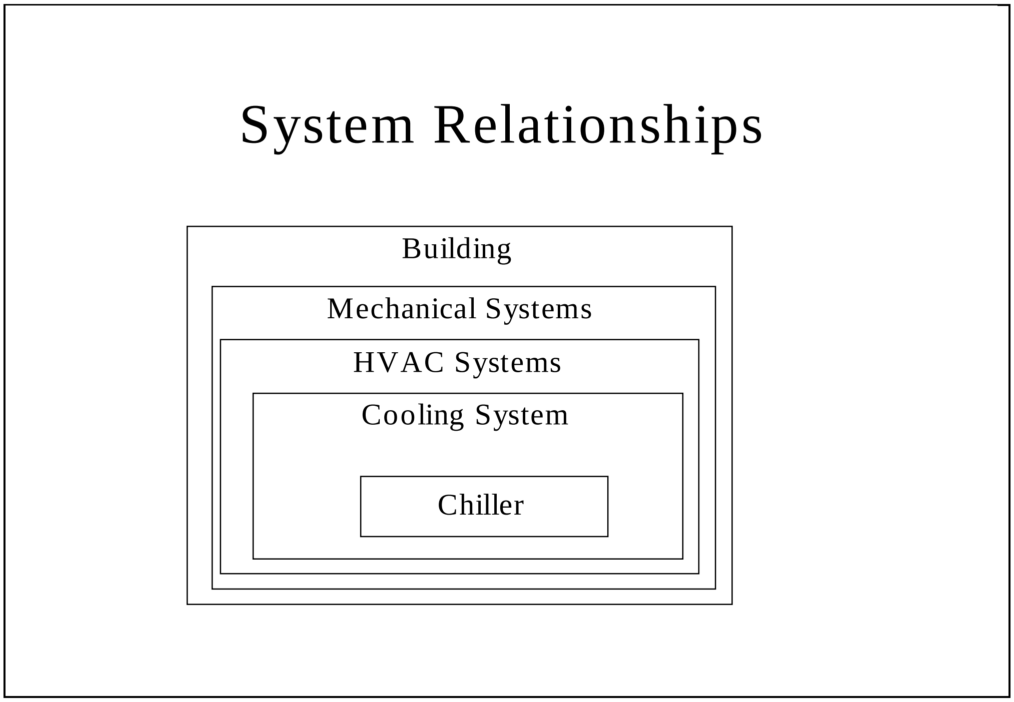
In a new building, the chiller selection is just part of the process to select and install the mechanical systems. The decision steps are driven by the specification, bidding, and construction processes. Chiller replacement in an existing building is constrained by the space, operating experience, cooling requirements, and energy sources available. As such, the selection process is one of dealing with these constraints.

System Relationships

The cost of a building can range anywhere from $30 to $150 per square foot. The electrical and mechanical engineers are responsible for five mechanical systems: HVAC, fire and safety, electrical, plumbing, and sewage. The chiller is a key component of the cooling system. The cooling, ventilation and heating systems comprise the HVAC system. The HVAC system is one of the mechanical systems installed when the building is constructed.

The chiller is the main component in the cooling system, which in turn is part of the overall building.

Figure 5-1
System Relationships



The owner's "style" is reflected in the building's design. The mechanical and electrical engineers on the project are attempting to execute the owner's goals. The type of process the owner uses (spec/bid or design/build) is unrelated to the owners "style."

The architect is balancing the building's function, cost of construction, esthetics, and operation. Mechanical system components, such as cooling towers or ventilation, can be at odds with the architect's vision for the building exterior. Similarly, an architect faced with a design that is over budget must decide whether the budget cuts change his or her building's exterior, the building's interior, or the mechanical systems. While the physical and budget constraints the architect places on the consulting engineer are normal, consulting engineers find the revisions frustrating:

> "The architect will not change his building – it's his creation – so he makes us cut cost out of the mechanical systems."

The chiller is the heart of the cooling system, as discussed in Chapter 2, the selection of the chiller will determine the size of the rest of the system. The mechanical engineer designing the HVAC systems must coordinate with the electrical engineer to insure adequate power is provided for the systems.

There are three processes that account for almost all of the installed chillers:

- Spec/bid
- Design/build
- Replacement

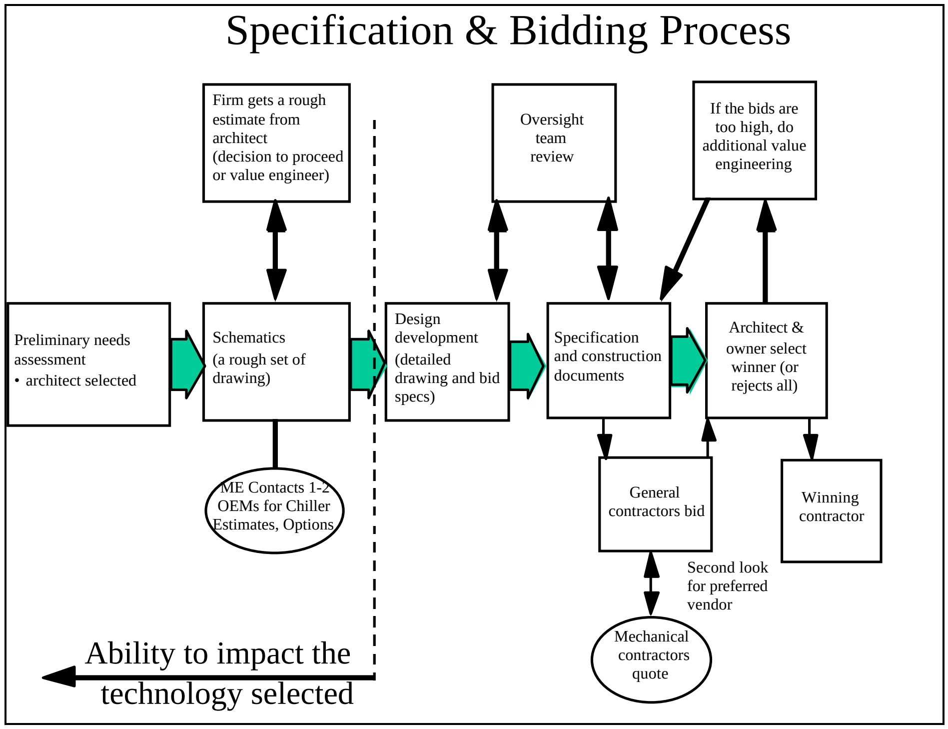
Spec/Bid

In the traditional new construction process, the building owner selects an architect to design the building. The owners select architects and in turn consulting engineers with philosophies similar to their own; when their perspectives differ, the architects and engineers will execute the owner's philosophy. The architect and the consulting engineer adopt the owner's orientation – they see their job as creating the building the owner desires.

The spec/bid process is based on the concept that competition will pressure contractors and equipment suppliers to keep their prices down. To keep them from bidding unacceptable quality, the specifications are strict and enforced. Deviations require the engineer's and owner's approvals. Over time, well defined steps have emerged so that everyone knows how the process will work.

In most bidding processes, the specifications reflect brands and technologies the writer knows. It is difficult to win the bid if the brand has not been involved prior to the spec publication.

Figure 5-2
Specification & Bidding Process



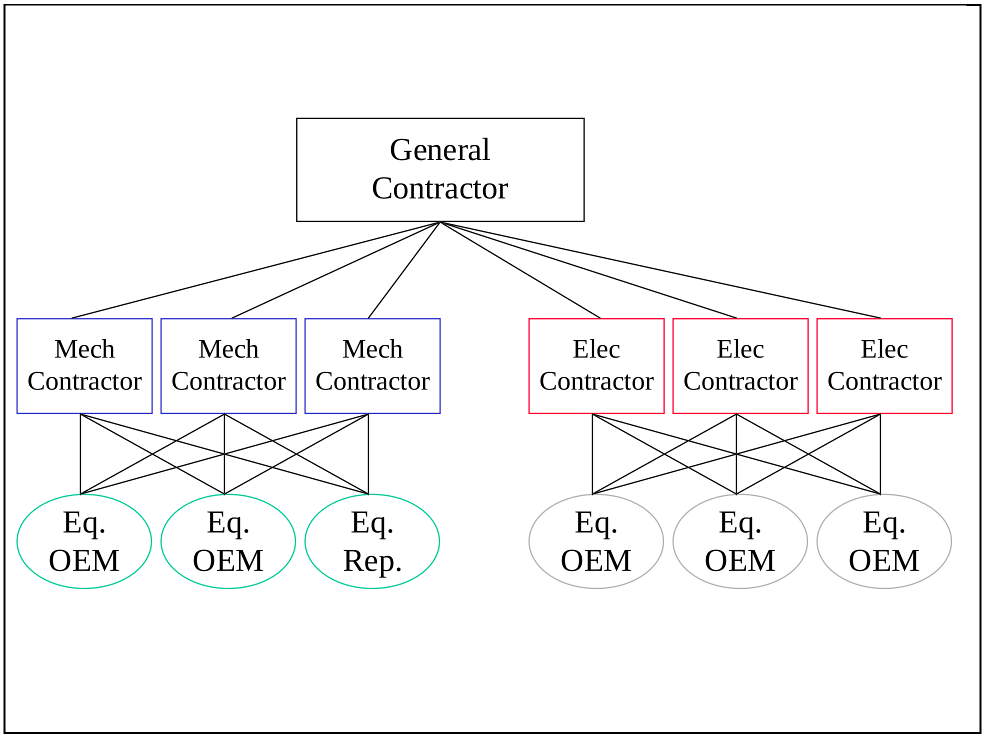
The mechanical engineer creates specifications for the HVAC system. Occasionally during this specification process, the customer could request that the engineer evaluate different technologies and HVAC systems. Since this effort was not included in the consulting engineer's quote, the consulting engineer will ask for additional fees or will focus on a simple comparison.

A product specification is generated which specifies one technology. Since the spec reflects the owners "style," once the spec is written, it is too late for alternative technologies to win the bid.

The specifications almost always can be met by multiple brands. The architect puts the specs out for bid with general contractors. This generates a pyramid of contractors and equipment OEM's (shown in Figure 5-3) responding to the spec with the equipment and prices they believe will win the bid. For government buildings, this is a very formal process; the lowest qualifying bid will win. For commercial buildings, the process is becoming increasingly a negotiated bid.

Each general contractor has multiple mechanical and electrical contractors bid.

Figure 5-3
Pyramid of Contractors and Equipment OEM's



Since each general contractor is looking for the best deal, they ask several subcontractors to bid. These contractors in turn ask multiple equipment vendors to give them equipment prices. Consequently, a chiller OEM will supply a price to several mechanical contractors who in turn may supply a bid to more than one general contractor.

General contractors are responding with the equipment they believe will meet the spec, be approved by the owner, and have a lower installed cost than equivalent alternatives. The lowest cost bid that meet the specs generally wins. In a few cases, the owner and architect are uncomfortable with the low bidder's experience or capabilities and will select another low bid.

Design/Build

In the design build process, the owner charges a single firm with the architectural, engineering, and construction responsibilities. This eliminates any finger pointing between the architect/engineering groups and the construction company. For an owner capable of managing a design/build firm, this process can deliver new construction faster, at the same or lower cost.

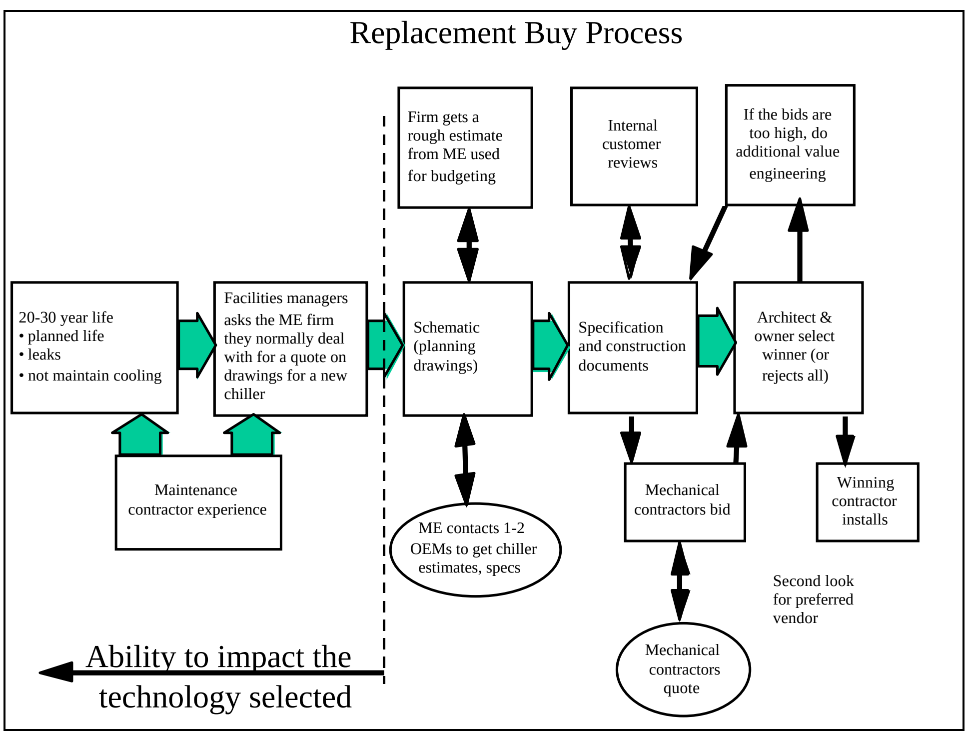
The contract firm either uses its own architect and consulting engineers or hires them as subcontractors. The mechanical engineer still produces specifications. The contractor may reduce or eliminate the bid process since they limit their consideration to mechanical and electrical contractors they trust. They may also reduce or eliminate the equipment bidding to limit their consideration to equipment they and the owner are comfortable with.

Replacement

In the retrofit process, unlike new construction, the project is often specifically about the cooling system or the chiller. Figure 5-4 shows the activities in the chiller replacement process.

Chillers in this study had operated 18 to 40 years. The maintenance and engineering groups become concerned about a chiller as its performance decreases. In a multiple chiller plant, this degradation may not have any effect on occupants, just on energy efficiency. In a single chiller plant, the impact on occupants may still be limited to just the hottest days. The time span from initial concern to operation of the retrofit chiller is generally three to five years.

Figure 5-4
Replacement Buy Process



Segment Differences

The following diagram shows that although each segment progresses through the same steps, their objectives, thoughts, and actions differ.

Table 5-1
Objectives, Thoughts, & Actions of Each Segment

	Green	Professional	Real Estate	Too Lean
How an aging chiller is evaluated	How does performance compare to new chillers?	How long before it affects occupant comfort?	How long before it affects occupant comfort?	How long can we get it to last?
Replacement Timing	Funded in next budget cycle	Funded before it is expected to effect comfort	Funded before it significantly effects comfort	Funded when the budget permits it
Preliminary Needs Assessment Stage	Acceptable technologies will limit options	Space constraints will limit options	"Same model" would save piping costs	"Same model" would save space, and training costs
Construction Schematics	"Acceptable" chillers	"Maintainable" chillers	Low first cost chillers	Low first cost chillers
Design Development	Chiller type finalized	Chiller type finalized	Chiller type finalized	Chiller type finalized
Specification and Construction Documents	Possibly a gas chiller	Electric chiller or possibly a hybrid plant	Electric	Electric
Bidding	Expected technology wins	Expected technology and brand wins	Low cost wins	Low cost wins

Source: QDI Strategies, Inc.

Mechanical engineers do not conduct a detailed chiller comparison. In most cases, they have prior experience they see as applying to the situation. Generally, they can assume the relative electric and gas rates have not changed significantly, the relative electric and gas energy efficiency has not changed significantly, and the space, maintenance, and noise characteristics are about the same. Therefore, when they are designing a building that is similar in size and usage, they expect that comparing alternatives such as gas versus electric or standard versus high efficiency will produce the same outcome as before.

For example, one respondent said:

> "The last multi-story office building used a standard efficiency electric chiller so this one will also."

Another said:

> "A large hospital we worked with wanted a hybrid plant so they could shave their peak. Our calculations showed they could save money and their maintenance staff was convinced they had the experience to maintain the absorption chiller. It took the maintenance staff time to get to know the chiller, but the hospital is now pleased with the results. Absorption chillers are too different for most clients, but we now look into hybrid plants when doing work for other hospitals served by the same gas utility."

For many mechanical design firms, this is still a simple issue. Electric chillers fit all or almost all of their clients. An electric chiller is always a safe recommendation: the engineer has experience with electric chillers, it uses a proven technology, and it is the simplest to install and operate. Mechanical design firms with gas chiller experience are guided by their rules of thumb – "in select geography's (low relative gas rates) and certain customer segments (technical maintenance staffs), customers may fit alternative types of chillers. "

When the mechanical engineer does a comparison, the analysis is limited by how accurately they can model the building's load profile. Using the chiller OEM tools (HAP, Trace, York Calc, etc.) or other simple commercial programs (Market Manager, etc.), they can compare chillers. These tools are viewed as adequate to compare alternatives. But without actual building experience (does the building shell achieve the estimated R value?) and actual occupant use (is the first floor really used evenings and Saturdays?), their estimate is not predictive of actual energy use or energy costs.

Consequently mechanical engineers do not want to provide an estimate of actual energy usage to the construction oversight team or the facilities manager. The risk of angering an owner who places too much weight on the estimate is far greater than any value the estimate would provide.

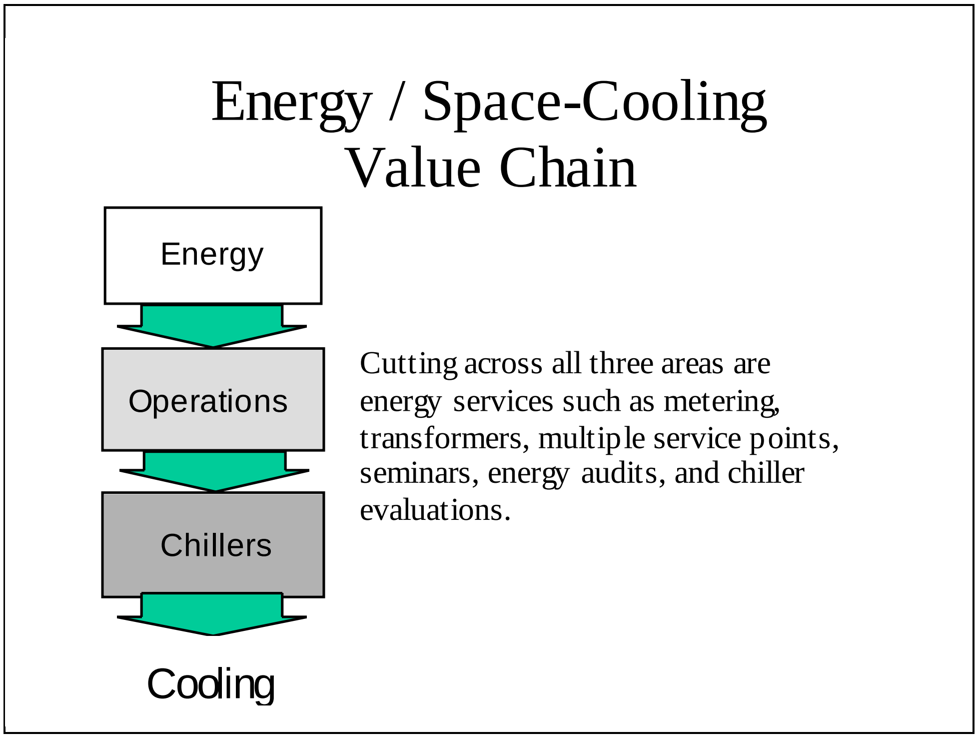
Those mechanical engineers who have considered more complex models like DOE-2, do not see how they can improve their estimate of energy use given the uncertainty in assumptions discussed above. Analysis is required in California (Title 24) and may be mandated in other states in the future. This requirement is only to comply with code and does not appear to be a better predictor of actual use than earlier types of analysis.

The chiller is part of the mechanical systems of the building. Another way to view the chiller is as part of the process of converting energy into improved occupant comfort.

Energy / Space Cooling Value Chain and Energy Services

Energy, through operations and chillers, is converted into the desired cooling. Utilities can provide services which improve the effectiveness of this value chain.

Figure 5-5
Energy/Space-Cooling Value Chain



The services utilities can provide cut across these three sets of decisions. For example, utilities can provide a wide range of assistance including:

- Assistance in comparing rate schedules
- Metering to track usage
- Information on efficient operation of equipment

- Assistance in evaluating chillers

There are a host of other services described in the brainstorming section utilities could provide which affect one or more of these decisions and are of value to some segment of the market.

Thermal Storage

In many areas, the cooling options include thermal storage.

Thermal storage is the concept of using the chiller at night or off peak to cool water, make ice, or cool other compounds, then reversing the process and using the cool water or ice to cool during the peak. Thermal storage is typically used when electric rates are significantly less expensive at night.

By "storing" the chillers output, thermal storage gives customers additional options for chiller size and load profile. How an organization views thermal storage is indicative of how they make space cooling decisions and their approach to energy use overall. Green and professional organizations have explored this technology as a way to meet their goals.

Thermal storage also raises new issues. One concern is the risk of not having the cooling capability when needed. If the system should fail to operate during the night, the customer must still be able to cool the building. So, rather than size the system for optimum performance with thermal storage, the chillers and the thermal storage decisions are made somewhat independently. The chiller is sized to cool the building, so that the system could operate without the thermal storage system. The thermal storage system is then evaluated to see if the electric savings justify its use. Engineering's willingness to use thermal storage depends on two associated risks:

- How well can the building be cooled it the thermal storage system does not work one night?

- How big is the financial penalty if the chiller must be used during the day?

Programs where the annual financial benefit of using thermal storage would be eliminated with one or two errors are considered too risky. Programs that permit the firm to operate a chiller when necessary, even with a steep penalty, are significantly more attractive than programs that do not allow the chiller to be operated during the day. Should the system fail to make ice one night, or should the storage system fail to completely cover the cooling needs on a particular day, the customer must be able to use the chiller.

Similar risks apply to interruptible rate schedules where a customer plans to use backup generation to bridge the interruption. Customers are concerned about:

- What are the options if the backup generator does not work or does not switch over smoothly?
- How big is the financial penalty if the contract terms are not meet during one of the utility requested interruptions?

Again, if the financial incentive for interruptible rates is eliminated by failing to comply during a single interruption, the program is too risky for the customer.

6

DEREGULATION'S IMPACT

Deregulation will change how some of these customers behave. For example, some organizations are preparing to aggregate their purchasing. They plan to shift their purchases from a local to a national decision.

To win customers, the energy retailer will have to provide services that are perceived to be of greater value than competitors (or offer energy at a perceived lower cost). Energy management system vendors and the performance contracting vendors are already offering services that have value to some segments.

To compete, utility retailers will need to use their knowledge of the customers and their existing technical support groups to create combined services and electricity "products." Chiller support tools can be bundled into these retail utility products. These range from simple information on how to select a chiller, to commissioning, to operating the chiller for the customer.

Retail Model of Energy Company Economics

This document uses QDI's Retail Model of Energy Company Economics to determine the implications for energy retailers after deregulation. Even if the deregulated roles for specific utilities or geographies do not match this model, the model will provide a rough framework for applying the findings of this study to energy retailer strategy and organization decisions.

QDI's Retail Model of Energy Company Economics positions power marketers as "retailers" of energy and energy services. As such, they will have to behave and make money the same way other retailers, integrators, or distribution channels do which is by:

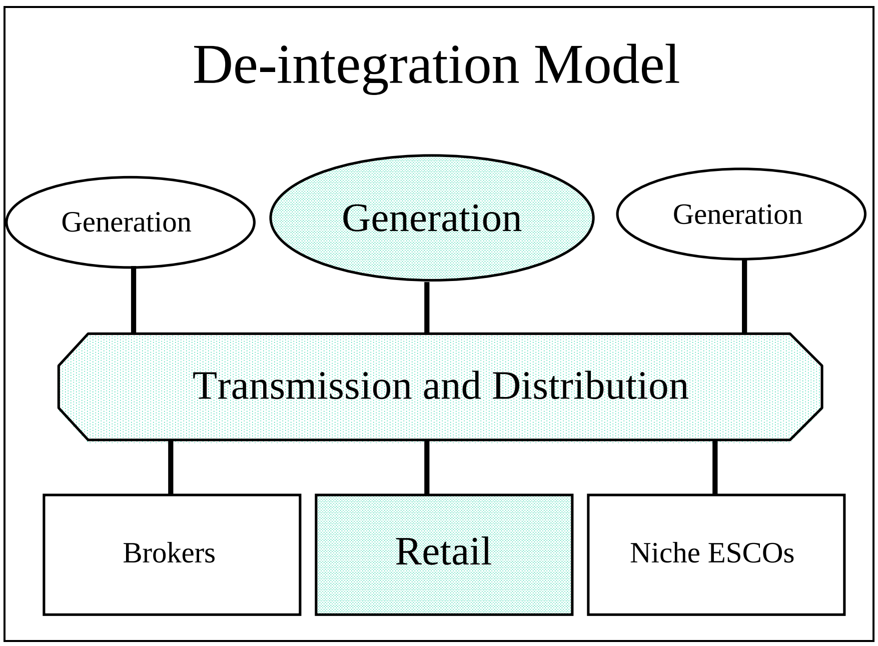
- Targeting the right customers
- Buying right (buying or generating power that matches when customers want to use it)
- Controlling costs and investments

De-integration

The three components of today's utility must be examined separately since they will compete on different levels after deregulation. For the rest of this report, we will focus on the retail business.

Generation, transmission and distribution, and retail will compete on different levels.

Figure 6-1
De-integration Model



This model is based on the principal that at least part of the price/availability risk will be borne at the retailing level. Retailing companies will purchase blocks of "take or pay" electricity, which they in turn price to their customers based on time of day and day of the year.

[The cellular telephone industry is another capital intensive, peak capacity industry with retail competition. Retailers with excess off-peak capacity will even give off-peak capacity away to secure profitable contracts ("six months of free weekend calls with a two year contract").]

Competitors

In this model, there are three basic types of retailing organizations:

Brokers: Pure brokers will make money on their ability to match buyers and sellers. Their sales proposition will be low cost power. They will provide little or no services.

Retailers: Organizations who aggregate customers. They make money on the spread between the revenue and cost of electricity. The closer their contracted purchases match their sales the more profitable they will be.

ESCO's: Non-utility ESCO's and niche ESCO's will provide on site specialty services: for example, providing and maintaining multiple back-up power sources for data centers.

This model is a simple way to work with two key principles after deregulation, 1) pure price competitors will emerge, and 2) retailers who can shift or control demand will have market power. (See Edison Electric Institute study #73 "The Impact of Deregulation: An Overview across Five Industries" for examples of the emergence of low price competitors and demand shifting after deregulation.)

How a Retail Utility Profits from Providing Services with Electricity

Each of the decisions retailers make - customers, products, and cost structure - must be right for utilities to insure success as retailers. Like other retailers, the utility has a well-known set of economic forces that dictate its profitability.

An example of a profit and loss statement for an energy company appears in the following table. The purpose of reviewing this P and L (profit and loss statement) is to reinforce some key operating issues:

- Revenue is driven by the product mix the utility sells and the sheer size of the utility (how many customers buy the utility's products).

- Profit margins could be different for electricity, gas, and other energy products.

- Cost of goods sold is driven by "how well you buy" and the incentives that your suppliers give you to sell their products. These incentives usually relate to moving low demand product or supporting specialty product sales.

- Operating costs include inventory shrinkage, a category that is new to the electric utility. It is anticipated that some retailers will get better prices by committing to volumes of product on take or pay contracts. Thus, if the product is not sold or stored, it is lost. While gas can be stored, there are very few economical ways to store electricity.

- Interest expense is an important cost to retailers. The more money tied up in capital investments (i.e., trucks, customer-site generating equipment, etc.), the lower the retailer's overall profit.

What the P and L fails to show also provides some important lessons to the energy retailer.

- Retailers have/build a customer base that buys from them because they like the products and services the retailer provides.

- The more attractive the product is to the customer, the higher margin the retailer will be able to get (or the greater volume at a lower margin).

- Retailers often decide to serve selected customers because those customers provide purchasing leverage to the retailer.

    - This paradigm may be especially true in the energy retailing arena. As long as supply and demand are out of synch at any time during the day or year, there are economic incentives for both generators and distributors to make sure their product is the one sold, not the competitor's. Smart, aggressive retailers learn how to take advantage of these incentives. Some go as far as to build customer bases that enable them to take advantage of the higher profits that accrue from this effort.

- Retailers carefully watch their operating costs and investments (which drive interest cost) because they typically work on very low profit margins.

- The decisions the retailer makes about customers and product mix will drive his cost structure. The more diverse the customer base is, the more diverse the product offering is, typically the higher the operating cost is. Moreover, a more diverse service typically generates higher operating costs. Retailers such as Wal-Mart mastered the diverse products and customer base model, but they have done so because they only provide one service level. When all three variables increase, the retailer fails.

Table 6-1
Profit and Loss Example for an Energy Retailer

P and L Category	Definition	Explanation
REVENUE		
Energy Sales	Sales of energy & services: Each "product" & service will have its own price	Energy will include many types of offerings including flat pricing, commodity pricing, premium services pricing and every other variation conceivable to marketers. Energy services will include activities such as performance contracting, consulting and equipment servicing and again, any service imagined by marketers.
Service Sales		
COSTS		
Energy Costs	Total wholesale cost of energy purchases	These could include different costs for different purchases of energy— everything from volume related and time related contracts to spot purchases by the day and hour
Service Resource Cost	The people cost to provide services	This could include service technicians, engineers, sub-contractors, etc.
Delivery Expenses	The distribution cost to get the product to the customer	These costs may also be variable and directly related to the "products" sold
Inventory Shrinkage	The cost of products not sold and not sellable	Energy bought and not stored or sold is lost. This would be a form of inventory shrinkage.
(LESS: Supplier Allowances)	(Rebates, special allowances, etc.)	Energy producers may give special incentives to sell products in the form of promotions, allowances, etc. These reduce the cost of goods sold.
TOTAL COSTS OF GOODS SOLD	Sum of purchase, delivery and shrinkage cost	
GROSS PROFIT	**Revenue Less Cost**	
OPERATING COST		
Cost of Sales	All the people involved in direct face to face contact	
Promotional Cost	Non-face to face communications with customers	Advertising, direct mail, etc.
Order Handling Cost	Activities required to establish and process customers business	Order entry, billing, etc.
G & A	General and administrative expenses	Administrative costs - rent, equipment, etc.
TOTAL COST	Sum of the operating costs	
TOTAL GROSS PROFIT	Revenue less costs	
Financing Costs	Bad debt, interest costs	The interest expense to carry inventory, fixtures and equipment
OPERATING PROFIT	Total costs less financing costs	

Source: QDI Strategies, Inc.

This report is primarily written for retailers who plan to sell energy bundled with value added and/or fee based services. At the same time, these retail utilities must compete against pure price and specialty service retailers. Additionally, distribution companies and generators will also find value in understanding the customers behavior and needs.

There is some evidence that customers expect all brokers and utilities to compete on price. If this evidence is true, retail utilities who choose to compete in other ways will need to educate their markets as to the value they provide.

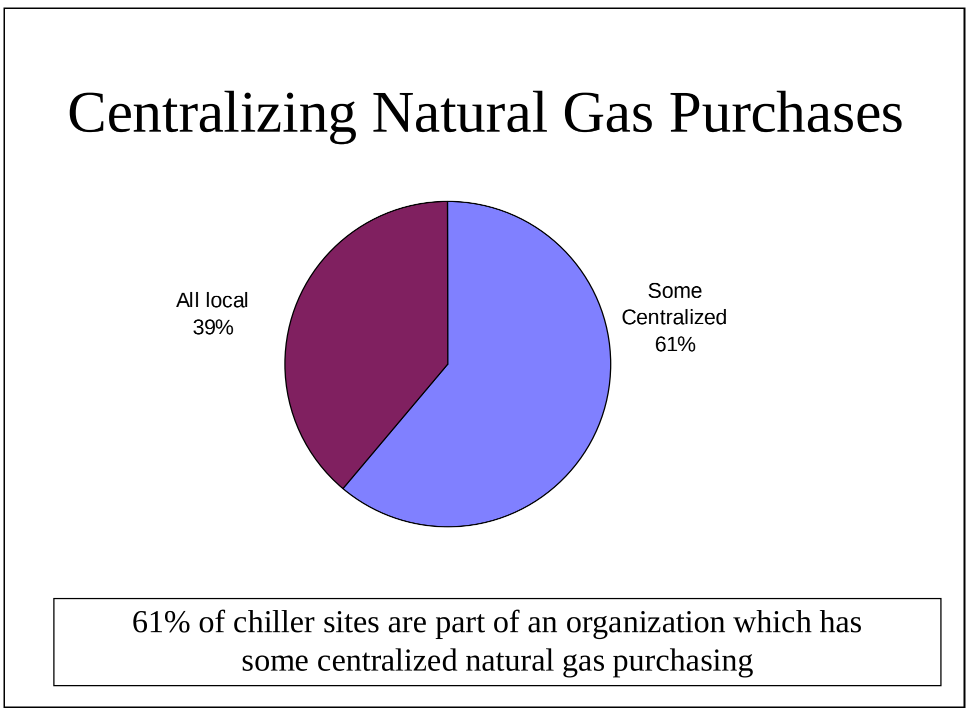
Changing Roles

As organizations anticipate deregulation, they expect to change their policies and practices to take advantage of the new options they will have with competition.

Natural Gas' Example

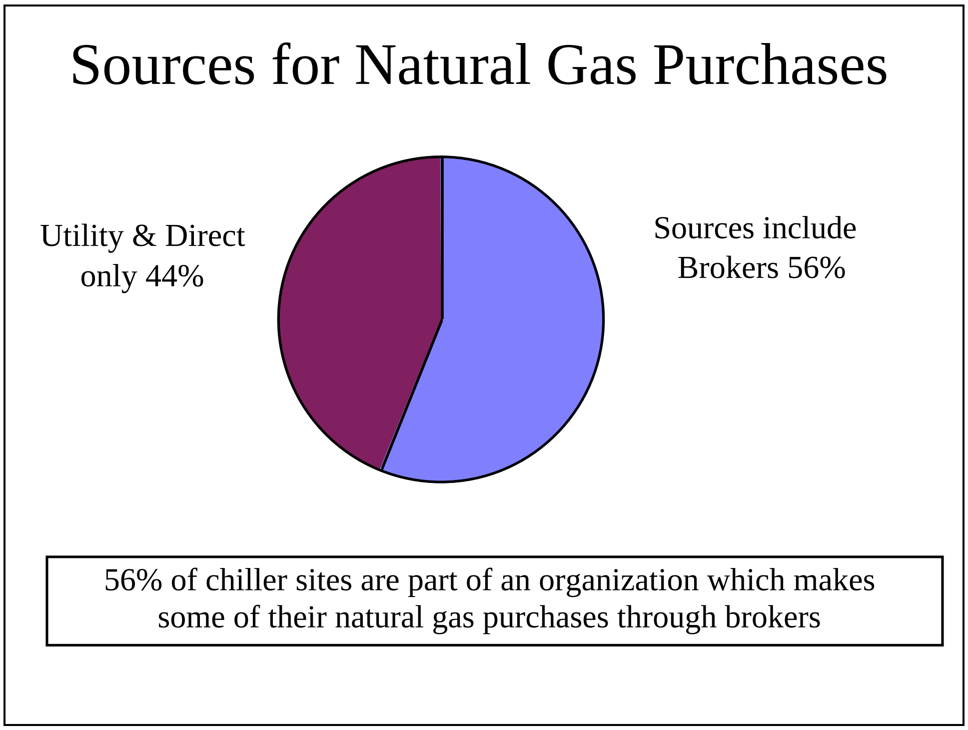
Natural gas was deregulated in 1986-87 and serves as an example for many companies. It is useful to understand how these organizations currently purchase natural gas.

Figure 6-2
Centralizing Natural Gas Purchases



As noted earlier, chillers are in large buildings, often in large organizations. Over half of these organizations have centralized their purchasing of natural gas - purchasing either all of their natural gas centrally or purchasing the forecasted demand centrally and supplementing those purchases locally based on actually usage.

Figure 6-3
Sources for Natural Gas Purchases



One of the implications is that: over half of the chiller sites are part of organizations that have experience purchasing energy from a broker.

The price fluctuations of natural gas have caused most organizations to be cautious of committing to any long term agreements. The corporate natural gas manager does not want to be caught with a contract price significantly above the market price. Only 21% of the organizations are using natural gas contracts longer than one year.

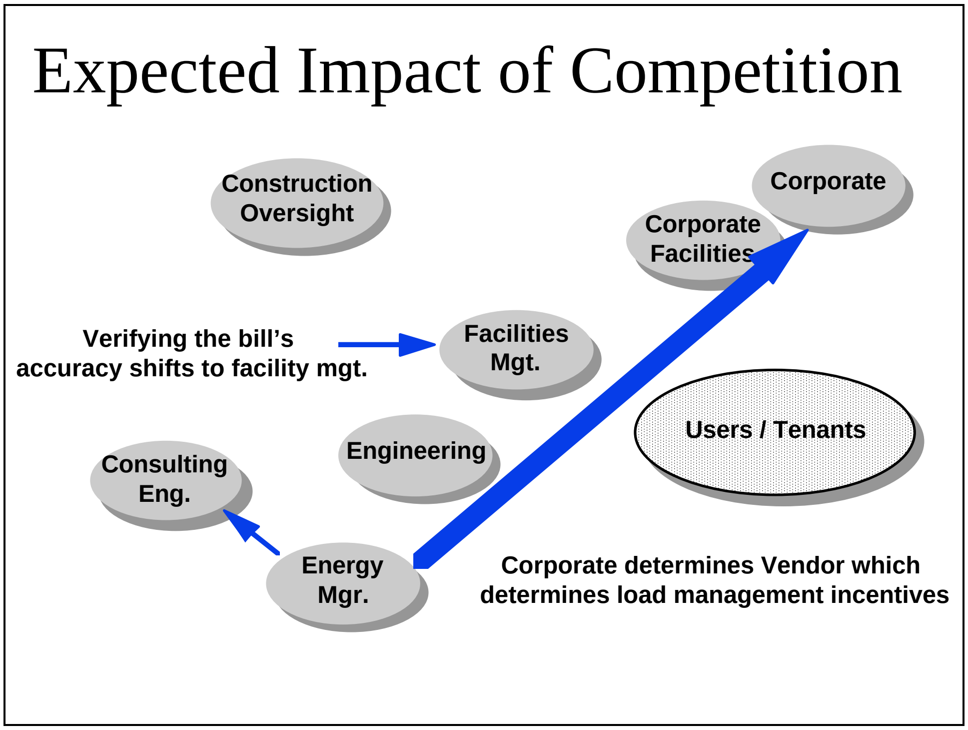
> "We expect gas prices to fluctuate, if I locked in prices, the sites would complain to my boss whenever the spot price was below my contract, but they don't call [and compliment me] when the contract is below the spot price."

Electric Deregulation Roles

Organizations expect to change the roles of various end user entities as a result of electric deregulation, as they did with natural gas deregulation.

These organizations expect deregulation will change how they purchase electric power.

Figure 6-4
Expected Impact of Competition



The biggest change is that some customers plan to aggregate their purchase to obtain the best deal.

> "We are waiting for the electric brokers to emerge who will resell lower cost electricity. My plan is to purchase from multiple sources as the prices fall with deregulation."

Companies compare their plans for electricity with what they did for natural gas:

- 58% expect the corporate natural gas manager or a similar person dedicated to electric purchases will be the centralized buyer for electricity.

- 42% see shared or split purchasing with local individuals.

In 24% of the sites, they expect the corporate organization to work towards a single contract for electricity. The rest either do not know if they will, or currently only plan to do regional or local contracting.

Corporate facilities management or corporate energy management (or operations/ procurement in a manufacturing organization) will negotiate on behalf of the entire organization. This shift in decision makers also changes the criteria. Local energy managers expect the corporate criteria to be: "who can provide the biggest discount." Both the local facilities manager and the corporate natural gas manager believe that if they negotiate on behalf of all their facilities, they can achieve quantity discounts. Some of the professional organizations are already collecting information about each site's kWh, electric cost, and peak kW.

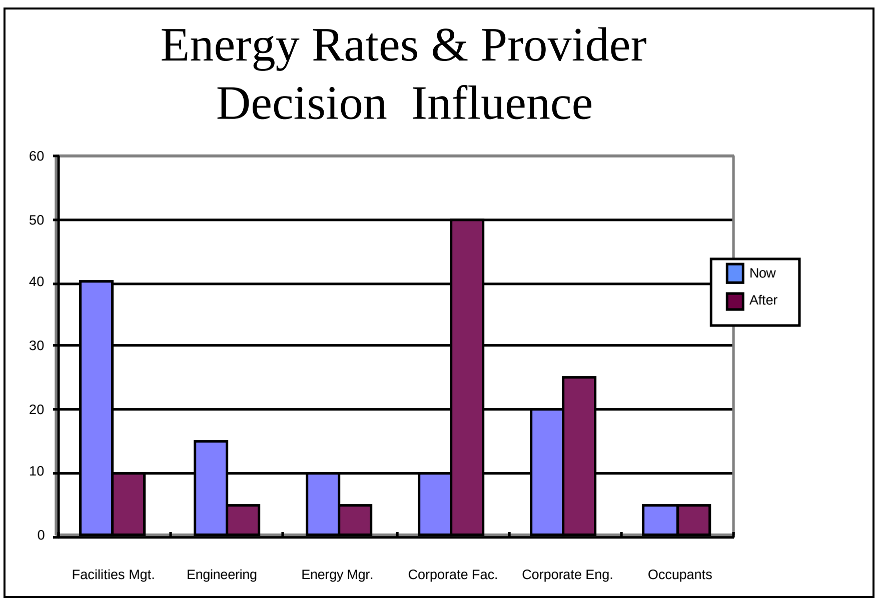
Customers see two other changes taking place. When the consulting engineer is comparing alternatives, they will need the appropriate rate schedule. Energy management or engineering must provide the consulting engineer with information about their unique energy rates.

With consolidated purchasing, the on site facility's management group loses the responsibility for primary contact with the utility. Consequently, they become less comfortable with the billing process. They expressed a greater need to verify their utility bills in these situations.

Each of the seven end user groups has a different role in the three key decisions discussed in this report: energy provider and rates, operating procedures, equipment selection. The following figures show the influence each group has in the three decisions.

Energy Rate and Provider

Figure 6-5
Energy Rates & Provider Decision Influence



After deregulation, the decision influence shifts toward the corporate entities.

Most companies are just starting to plan for some type of centralized purchasing or oversight:

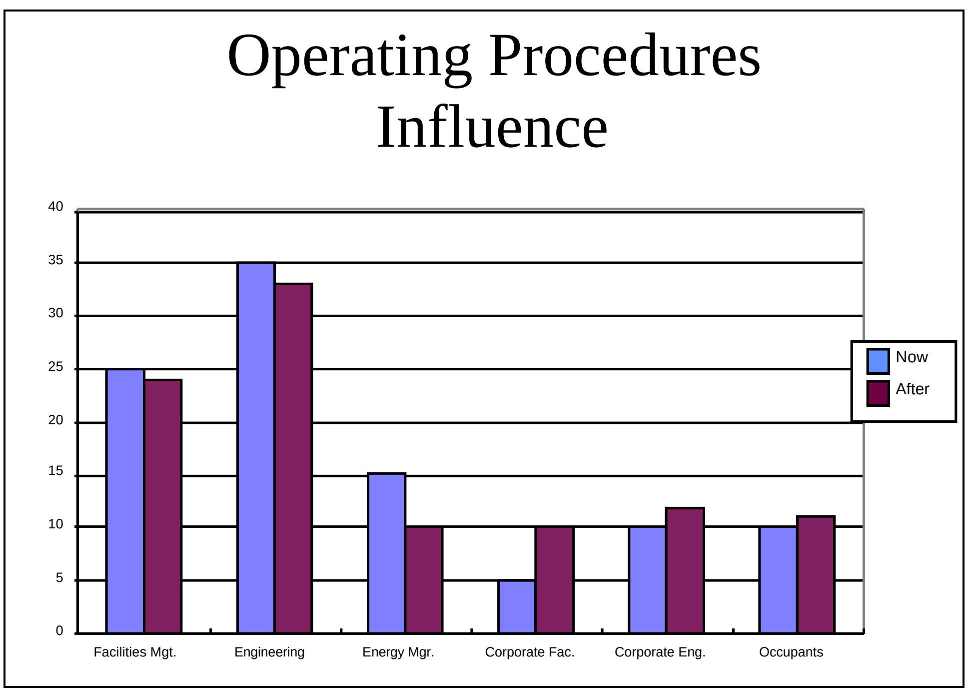
> "I expect it to be as @#%^and as Hogan's goat. I will be asked to purchase electricity, but we don't know what we want, and the utilities haven't a clue what they can provide nationally."
>
> "Ultimately, we will do the same with electricity as we did with gas. We will competitively bid our needs annually and use the best option each year. We want to stir up the market place." (When asked if electricity can really be bid like gas …"why not?")

Operating Procedures

The operating procedures are set by engineering and funded by the facility management budget. Particular activities are influenced by corporate efforts to standardize or by occupant complaints.

Deregulation will have minimal impact on the operating decisions. Corporate will use standards to influence engineering and energy management decisions.

Figure 6-6
Operating Procedures Influence

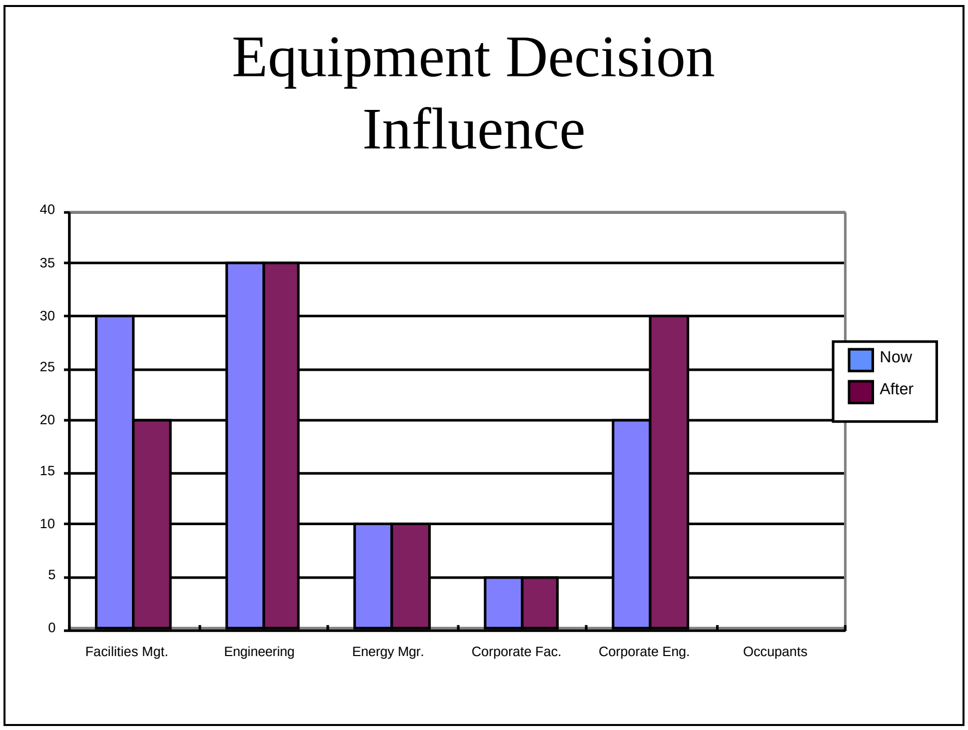


Equipment Decision

Chapter 5 shows that engineering and facilities management determine the technical specifications and budgets respectively for chiller equipment decisions.

After deregulation, corporate engineering will use equipment standards to influence local chiller decisions.

Figure 6-7
Equipment Decision Influence



End users are still exploring what impact deregulation will have on their chiller decision making. The increased corporate influence in the energy decisions will spill over into some directives on equipment, but the budgets and constraints are still local issues.

Impacting the End User's Decision

To change a decision means influencing one or more of these individuals to change their desired outcome. The role changes caused by deregulation will create a window of opportunity to influence decisions.

Gaps Created by Deregulation

At the corporate level, companies have not established criteria for vendor selection. The entity that will assume responsibility for purchasing electric power has not yet developed processes for assessing the value of services they need, such as:

- Load management
- Energy efficiency education
- Energy audits
- Usage history
- Equipment comparisons

Even the issue of aggregating electric purchases is undefined. These customers do not have a model about how to aggregate their purchase. Large professional customers have a mix of facilities. At some facilities, the customer owns the step down transformers, at others, the utility provides all the step down service. Some sites are on interruptible power, some are on firm power. Some sites are on real time pricing, others are not. End users know they do not want the same service at every site, but they do not know what services they do want at some sites.

The corporate organization has not established a mechanism or model for aggregating sites. They will need to create procedures for evaluating:

- Electric load profiles
- On site options
- Voltage differences
- Transformers
- Metering
- Interruptible vs. firm
- Volume per site
- Schedule options
- Time of day, peak demand, or total usage

This creates an opportunity for EPRI or someone to introduce a model for these new buyers about how to shop for electricity and related services in a competitive market.

Each customer segment will be interested in different products and services. As in other industries that introduced customer choice, customers will move to the vendors that fit their particular needs best.

The move to centralized purchasing creates an opportunity to educate the new decision maker about the importance of the various products and services energy companies provide. Whoever shows the end user how to aggregate sites, the value of these products and services, and the criteria for evaluating the competitive alternatives will influence the end user's decision. In practice, this will require showing different audiences of end users how to make sense out of these new opportunities in light of the end users' goals. Each of the behavioral segments will look for different types of assistance.

The end users will adopt criteria consistent with their behavior. The information or educational source that speaks to their needs as a green, professional, real estate, or too lean organization will have the advantage.

Note: Many customers regard electric reliability more important than any of the other criteria. If one vendor were viewed as more reliable than another, the local site could ignore corporate contract and change vendors to obtain the higher reliability.

7

CUSTOMER NEEDS

This chapter examines needs that chiller customers expressed. The needs relate to helping in one or more of the following ways:

- reduce their total energy bill
- reduce their total costs (e.g., life cycle costs of a chiller used for space cooling)
- improve the occupants comfort or reduce the risk of interrupting their comfort

The customers express needs in four areas: measurement, information, investments, and corporate goals.

Measurement

Customers do not know how much electricity the chiller or cooling system is actually using. While the chiller clearly contributes to the peak demand, most accounts do not really know how much of the peak is due to the chiller. Facilities managers are making budgeting decisions without the data to differentiate between different energy uses. Facilities managers generally do not have enough usage information to fully understand what caused the changes in their bill from month to month and year to year. Costs are often allocated among tenants and departments based on their relative space since they do not measure their actual usage.

Engineering and maintenance are making operating decisions without any direct feedback on what impact the change actually had on energy use.

The professional segment is interested in measuring the actual performance of their equipment with the expectation that this information will help deliver one of their goals. They are looking for improved operating efficiency, better estimates of how much longer the equipment will last, or improved occupant comfort.

The green segment is looking for measurement of the criteria related to meeting the environmental objectives. They are exploring measurement of: energy use/ conservation, emissions, global warming impact, etc.

The customers who have reduced their peak demand the most are those that have created measurement and feedback systems that track chiller electric use. The shorter the time period between changes in procedures or equipment and electric use feedback, the easier it is to manage. One customer compared forecasted to actual electric use every day.

Information

Measuring the effectiveness of improved efficiency is complicated by the fact that the two main determinants of most building (and chiller) energy consumption are the weather and building use. Because of the complexity in separating these two factors from controllable actions, most organizations do not attempt to do so. Consequently, they have no feedback on smaller equipment and operating decisions.

Information that helps the organization evaluate their energy management performance helps them improve that performance. End users need information on equipment options, actual performance of equipment, and analysis of how changes in use of the building will effect energy consumption. The chiller decisions are obviously part of cooling system equipment decisions. There are two other systems that are related to the chiller/cooling system decisions and significantly impact energy cost: thermal storage and interruptible rates (and backup generation).

End users are interested in how they make three related decisions; the chiller, thermal storage, and rate schedule; to collectively meet their needs. The issues with CFC and HCFC have shown the engineering and facility management groups that they can face significant environmental and economic challenges. Today, these groups need information on a wide range of issues, such as the EPA rules on refrigerant issues.

End users are looking for information about the changes occurring:

> "What new technologies, like thermal storage, should we know about?"
>
> "What do the experts really think will happen to energy rates? Should I consider long term contracts, or wait for the drop? Should we put all our sites on the real time pricing or just the large ones? We need more of the seminars the utility used to offer."

End users need comparative statistics that help them evaluate their performance relative to similar organizations. The end users then need an analysis to adjust for random variables such as weather.

The professional organizations are interested in information and data that compares the performance of their buildings with the performance of similar buildings used for similar functions. The ideal scenario would be comparisons to their peers, both other sites in their organizations and in competitors'.

Professional and too lean organizations also asked for more information about how changes in building usage would effect their electric bill. For example:

> "When we decided to go to 16 hour operation in our customer service department, I had no idea how it would effect our electric bill. Even after the change, it was difficult to separate the impact and convince my boss our lighting program had the savings we expected."

Information about the performance of their existing chillers and information about the performance of new chillers they are evaluating is of value. The operating data is available from the manufacturer. What the customer wants is performance evaluations that can be tied to actions (when to replace the chiller) that can meet their objectives.

> "If we knew how rapidly the performance of our current chiller will deteriorate, we would know when we have to replace it. If we knew how efficient the number two unit really is, we would know whether we should stay with two chillers of the same size, or split the total 60/40."

Investment

Financing energy improvements is a drain on capital resources that could be put to use in other ways. Thus, each type of buyer has a logic and financial requirements that relate to the use of capital. The real estate and too lean segments are trying to minimize their capital investment in mechanical systems. They are interested in programs that substitute annual payments for capital outlays or defer expenditures.

The real estate segment is looking to shift the capital expenses to operating expenses. The too lean segment is looking to avoid committing any of their limited capital.

These segments are choosing the performance contractor or retailer that can provide the capital, or reduce the capital requirements, for energy efficiency projects. By shifting the capital cost to an operating cost, the customer can meet his primary need to conserve immediate capital for core business investments. The capital can be provided as a loan, built into a contract for energy, or paid as rebates the company is required to spend for specific projects. Customers have demonstrated their need to delay capital outlays by signing long term contracts for heating, cooling, or energy management that shift the investment to the vendor.

Corporate Goals

These organizations have corporate and division goals that influence the behavior of chiller decision makers. These customers have needs to:

- Demonstrate their decisions support the corporate goals
- Track their movement toward corporate goals
    - Generation sources
    - Energy efficiency
    - Use of CFC's and HCFC's
    - Reduction in capital tied up in non-core activities
- Cope with constraints imposed by changes in corporate policy
    - Hiring freezes
    - Budgeting delays

End users have a wide range of needs, many of these needs are consistent within each behavioral group. This commonality creates distinct marketing opportunities with each segment. By targeting products and services that meet a segment's needs, a retailer can win and retain customers in that segment. The next chapter discusses the products and services that can distinguish a retail utility.

8

TOOLS UTILITIES CAN USE

Integrated Solutions

Utility's can use the chiller opportunity in one of two ways;

- To influence the chiller decision attempting to insure an electric chiller – insuring a significant electric load
- To secure or maintain the total electric load as part of a complete relationship with the account

Brainstorming Process

As part of this project several utilities participated in a brainstorming session to create product and service concepts to meet the end users needs articulated in the customer research portion of the study. The participants used groupware software so that they could all generate or refine ideas anonymously and simultaneously.

The team reviewed the customer research, discussing the needs, attitudes, and perspectives of each of the seven end user audiences. The team then reviewed the study findings on the behavior of each of the four segments.

The study research categorized four groups of end user needs:

- Measurement – measuring electric usage in different areas, over time, or in relation to other activities.
- Information – data that helps the end user make decisions about rates, providers, operating decisions, equipment, or performance relative to a benchmark.
- Investment – while end users desire the output (e.g. cool space, efficient lighting) some are looking for ways to get the benefit without making the capital investments.

- Corporate Goals – assistance in meeting corporate goals such as energy efficiency or switching to "green" processes.

The brainstorming team identified a fifth group of needs:

- Services – activities ranging from basic support for energy use to activities which help deliver multiple needs.

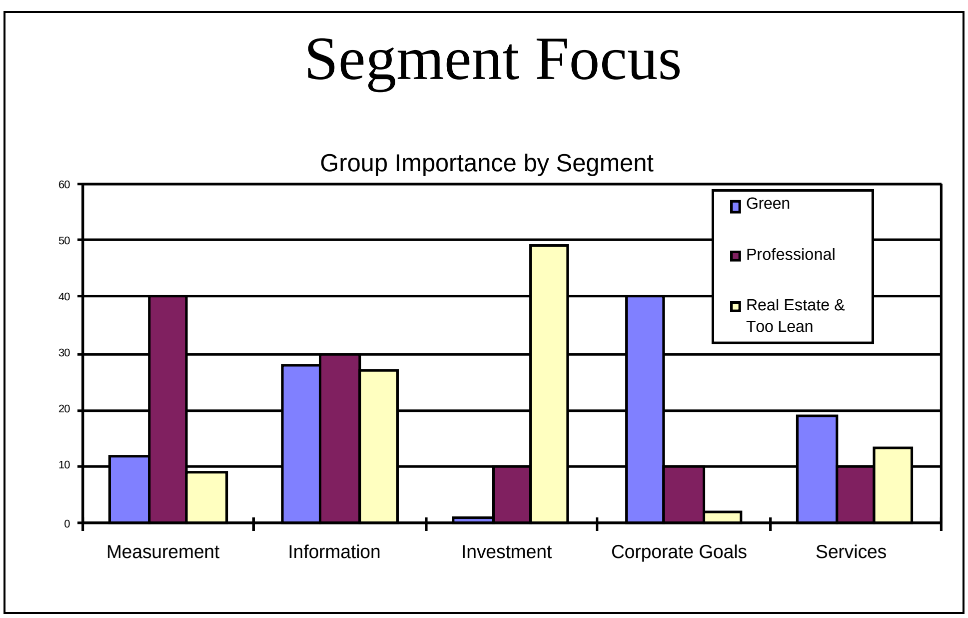
The products and services for two of the segments are very similar so they were grouped together. The team conducted separate sessions to generated products and services that could be of value to three segments:

- Green
- Professional
- Too Lean and Real Estate

The research objective for these sessions was to identify solutions that could be offered by the retail portion of a utility, but no product or service concepts were rejected. While many of the services fit all three customer segments, most have variants that specifically address the needs of each specific segment.

While the segments express interest in all five areas, further research shows each segment places different value on each of the groups of products and services.

Figure 8-1
Segment Focus



This chapter covers all of the concepts identified by the brainstorming team. It should be used by utilities to help identify all the products and services that could be offered to their customers. (The chapter should be skimmed the first time through the report then used as a resource to develop a chiller strategy to win and retain customers.)

For each segment, the chart shows the importance customers give each of the five groups (100 points were divided between these five product and service groups). Additional work should be done to identify the relative importance of specific products or services and their fit within a utility's overall strategy.

The following tables contain the chiller related products and services that utilities could offer the various customer segments identified in the behavior research. These products and services will affect multiple audiences within each end user. Utilities should consider all of the audiences (see Chapter 3), their view of new products and services, and how to communicate with the audience before introducing a new offering. The comments about how different audiences will view a product or service have been omitted.

Table 8-1
Products and Services - Green Customers

Measurement
Monitoring/remote monitoring • Assess the pollution abatement impact of end user facilities "green" strategies   • Implement monitoring of energy use, converted into pollutants for end source (absorber gas consumption) or source energy (electric power plant emissions) • The owner may also want to know how much of his energy usage is devoted to greening efforts • Chiller refrigerant purge pump run time • Track savings from the annual energy or chiller tune up • Track how much more efficient customers are, less electric use, less fossil fuel use
Real time pricing - continuous operating cost analysis • Send the user real time electricity pricing information, and integrate this into his chilled water plant decisions • Tell users the real-time premium in energy costs they pay to be green because they may want to make operating trade offs between green and other goals, such as cost or comfort • Show the fuel mix real time, so the operator can avoid poor mix in terms of environmental impact and cost • Provide bill analysis/load analysis   • Knowledge = opportunity to increase efficiency, thus reduce emissions

Measurement (con't)
Help the owner measure occupant comfort • Provide an instant feedback and monitoring system (on line system via computer at occupant's desk) which would enable occupant to vote on comfort plus provide real-time measurements that the occupant could see to determine if his/her discomfort was based on system problems or personal problems • Provide data that correlates temperature control and use of green building materials to occupant comfort to help the owner make better occupant comfort decisions • Have EPRI fund studies about green building materials Break down building operating costs on the utility bill, i.e., cost for HVAC/ lighting/general service • Itemize the bill in such a way that the owner can track energy used in "green" activities versus non-green   • i.e., if the owner put in special air handling to improve indoor air quality, the owner wants to track the energy usage and to promote this effort to his employees Compare electric usage to others/best of class in the industry • Show customer's energy use compared to similar facilities in his climate area • Show annual movement to "green" fuels for the industry as a whole so individual companies can compare where they are versus the industry • Provide an award for having better CFC management than the average company • Establish recognition process for users in the top tiers for efficiency in class • Give an award for being state of the art Help owners determine what they should charge the tenants in their building cooling • Owners would like to prorate cooling cost by usage for each tenant • Provide tenants with "control strategies" to help them reduce their energy bills, improve their environment/air quality and increase employee productivity Measure the actual chiller efficiency kWh/ton • Measure efficiency and provide upgrades that are guaranteed by the supplier • Evaluate the overall performance of building operations • Perform on-site efficiency tests, i.e., measure the efficiency of the customer's chiller • Show the owner the efficiency of his machine over time and tie this into generation mix emissions • Display the emissions' savings on a monitor in the building's reception area Meter chiller electric usage • Does it make sense to monitor the amount of energy used for the chiller this year vs. last year to show customers they are using less energy? • Would it make sense to monitor the absorption chiller separate from the electric chiller? Forecast customer energy usage, tell the customer when he deviates and why • Show energy savings from forecast (last year's rate)

Information

Analyze how a building's chiller operates, and help the facility to operate it more economically
• Conduct chiller operations analysis
  • Measure the cost to run a chiller
  • Conduct a contribution to peak demand analysis (energy cost analysis)
  • Help operators evaluate interruptible rates for systems
  • Determine what the operator can do to improve its performance
  • Evaluate the most efficient operation for a multiple chiller plant, i.e., lead/lag and provide controls to do this
  • Show operator what he can do with auxiliary chiller equipment, i.e., pumps/cooling tower, to optimize the chilled water system
    • Purchase variable speed equipment to improve efficiency
    • Chillers are only part of customer load, help them manage the rest
  • Show the water savings of an electric chiller over absorption
  • Identify who are the best sources for chiller systems engineering evaluations
  • Show operators what they can do to optimize their current operation without major capital expenditures
• Conduct a retrofit or replacement analysis
  • Conduct an analysis of the fossil fuel savings of switching to gas absorption, or the fossil fuel saving of switching from absorption to utilities fuel mix
  • Tell customers when they should plan to replace their chillers
  • Provide them with the environmental cost of delaying the replacement by one, two, or more years
• Develop a means to capture reject heat from condenser
  • Show environmental impact of reducing energy use because of this measure
  • Have an award for environmental impact of CO_2 emissions saved by using rejected heat
• Provide environmental data on the benefits of using ozone
  • Show if magnets/ozone water treatments work
  • And, if they work, are they cost effective when compared with chemicals?
Customer education
• Educate customers on real costs
• Teach customers about real efficiencies vs. run time
• Educate customers on environmental costs of energy inefficiency and poor comfort
  • i.e., how pollutants increase health cost, how lost worker productivity because of bad comfort costs money

Information (con't)

Help customers understand their rate structure
• Provide special rate structure for "green" power and peak load shaving which is still below "list" price, so it looks attractive
• Educate customers. Provide them with factors relevent to their particular service territory, i.e., what the local utilities generating mix is, and what average pollutants/kWh is.
• Tell customers what the incremental cost of your service is in your rate structures
• Help customers know if they can use interruptible power with their chillers and show them how to do so
Help customers with systems evaluation
• Provide operators with an analysis to determine whether or not they need to address the CFC issue. (Is this really an issue?)
• Tell operators whether they need to be concerned with an EPA refrigerant audit
• Publicize that the utility or company has a refrigerant management plan, and share what the utility has done to reduce CFC chillers.
• Track CFC usage per employee. Show the downward trend.
• Provide information on the true life cycle costs of chillers; electric centrifugal, absorption, engine driven
• Provide analysis of chiller options before selection of the system
• Provide comparisons of electric vs. gas vs. district cooling vs. thermal storage
    • Tell customers whether thermal storage is feasible in the deregulated utility market place. What is the best way to operate thermal storage systems, i.e., partial, full, or real time?
    • Tell customers whether a gas hybrid chiller plant is economically feasible
• Show the reliability and maintenance costs for alternative cooling technologies
• Provide cool storage performance and financial analysis
• Help the operator determine what minimal amount of maintenance should be budgeted before he will see a decrease in performance
Maintenance issues
• Help the operator maximize operations of the maintenance department
• Show the operator how to reduce his O & M cost
• Educate operator's in-house maintenance staff on proper and efficient chiller operation
• Keep operator informed of new technologies and information
• What are preventive maintenance items that customers should do to maximize reliability?
• Educate operators on how to reduce refrigerant leaks. What extra maintenance is required?
• Tell operators how they compare with their competitors in energy, maintenance, and operation costs
Keep customers informed of new technologies and information
• Provide alternative dehumidification evaluations
    • Provide them with information showing how reduced humidity reduces IAQ problems

Information (con't)

Green (emissions/ozone) comparisons between different cooling technologies
• Greenhouse gas emission comparison between facilities that practice "green energy management strategies" and non-green facilities
• Show customers the environmental impact of purchasing a new chiller --energy savings, CO_2 emissions reductions, etc.
• Provide the customer with a comparison of the "green" impact of CFC-based electric chillers versus gas absorption chillers. What are all the variables that need to be considered? What are the dimensions of greenness that should be measured?
• Provide end users with information as to the cost premium that they pay to be green so that they can promote this to their shareholders
• Provide them with EPRI literature that has this information
• Provide a seminar on benefits and operation of thermal storage
Show how control strategies affect operating costs
• When is electricity the "dirtiest," i.e., how does the generating mix vary between nuclear/coal/gas/hydro? When is the "greenest" electricity available?
Additional information
• Provide flyer's that show "green" tenants that this green building uses less energy
• Provide a list of "green" builders, consultants, and manufacturers
• Provide information on manufacturers of cooling equipment
    • Market shares of new chillers by chiller type
    • Create a list of what manufacturers build chillers using which refrigerants

Investment
Financial analysis of replacement of existing equipment • Help answer the questions, "What would be the payback for putting in a new high efficiency (CFC free)chiller? What are the refrigerant options?" • Show what the environmental impact is (ozone and power plant emissions) • Provide cost models for green vs. non-green equipment strategies. This would be of primary benefit to those on the margin who would like to be green, but do not have a corporate mandate. Promote special financing for "green" technologies • Financing/installation for thermal storage   • Show that the fuel mix at night is greener Offer chiller financing options for retrofits and new installations to help reduce the customers' capital requirements • Buy the chiller for the customer and put the cost into the rate the customer pays, thereby saving the customer capital • Offer financing or leasing on high efficiency purge device, or retrofit of entire chiller

Investment (con't)
Help make green strategies have financial benefits in addition to environmental benefits • Work with the environmental groups like the South Coast Air Quality District to get them to create markets in green credits for things like the reduction of CO_2, NO_X, SO_X, VOC, and PM_{10} emissions. Do this in conjunction with lobbying for funds or tax credits that would be paid for these types of reductions. Then offer the customer the programs and technologies to be greener. • Help develop other sources of capital to pay for the cost of green equipment and power Form district cooling system • Indicate the efficiency of district cooling and environmental benefit • Let the building promote that it has eliminated CFC's
Corporate Goals
Help customers create a plan to become "greener" • Provide a set of measurements that show the "environmental impact" of various green strategies -- i.e., how much savings in energy use and CO_2 would result from a high efficiency chiller. Give these to management as a guidebook to implementing a green strategy. It would provide them with targets for "greenness" for benchmarking purposes. • Provide corporate energy managers, executives and PR groups the "logic and payback" for green strategies. This will help grow the market for green solutions and services. • Give them examples of other corporations green plans • Get them involved with the EPA's Energy Star Programs if not already in them
Service

Take over ownership and operations of customer's chiller plant and sell them chilled water
• Or, take over the chiller plant and HVAC engineering operations in the building and sell the customer cool space
• Install, own, and run an on-site thermal storage system for the customer
    • Use the utility's experience to run the plant more efficiently
Take over maintenance and operation of the customer's chiller
• Group all customer chillers into one package and provide all necessary services, i.e., maintenance, energy, operation strategies, take over the mess!!, etc.
• Provide maintenance for the chillers
• Provide services and energy to customer's international operations
Commissioning
• Share with the public that a building invested in the concept of commissioning to ensure the building is operating as efficiently as possible. In sharing this, emphasize emissions reductions.
Provide equipment that helps reduce the cost of cutting edge technology
• Provide the customer with the equipment and service to flatten his peak
• Install control systems that allow customers greater control over cost
    • Automatically control the customer's system to provide a constant load profile

Service (con't)
Provide customers with "green power" • Contract purchases with utility that sells "green power," and publicize • Determine what the utilities environmental generating mix is • Define what the market considers as "green power" Provide special rates for chiller • Guaranteed electric bill. Eliminate the weather risk. • Provide a reliability guarantee, with penalty for outages • Create a rate that is specific to customer's needs • Provide rates, services, etc. to customer's national facility base • Provide a "green rate" Offer EPA certification to customer's maintenance technicians • Conduct training to ensure all staff is certified in all environmental requirements/training • Develop a "green technician" certification Help customer increase occupant comfort with his system • Help customer balance and optimize air side system • Greater occupant comfort = higher productivity Provide backup power supply to carry through outages and lower voltage conditions • Provide on-site premium power generation and use waste heat from chiller • Backup power will allow use of interruptible rate, and interruptible reduces power plant construction requirements Help customers sell excess cooling capacity to their neighbors • Optimize the operation = improved efficiency = maximize resources Other service • Provide customers with less expensive CFC refrigerant for their chillers Testing and optimization • Provide service to optimize the rest of the cooling system to fit customer's new chiller

Table 8-2
Products and Services - Professional Customers

Measurement
Monitoring/remote monitoring • Provide real time data on customer's chiller operations • Measure the actual chiller efficiency kWh/ton • Continuously monitor the kW/ton efficiency of the chiller and relate it to outdoor temperature • Remotely monitor customer chiller, and notify customer's service company when the monitoring equipment indicates problems • Monitor usage across all customer's US buildings and applications - lighting, cooling, elevators • Monitor the performance of customer's key systems so he can see when they experience problems • Provide centralized monitoring so customer can reduce staff at each facility to the bare minimum to meet customer needs • Link equipment monitoring to rate projections so customer can automatically change equipment utilization to reduce peaks • Meter chiller electric usage
Real time pricing - continuous operating cost analysis • Send customer real time electricity pricing information and integrate this into his chilled water plant decisions • Estimate their utility bill for each site on a continuous basis
Provide software that tracks: • kW, kWh usage • Flags significant changes (with or without adjustments for weather) • Cross checks with customer's bill • Handles all customer sites • Computes cost per square foot • Activates alarms when customer should interrupt operations to save peaking charges
Help owners measure occupant comfort • Administer surveys to the employees that let's the owner know whether employees are working in a comfortable environment, i.e., an environment that maximizes productivity. Analyze surveys and determine what customer needs to do to improve comfort. • Put an environmental scorecard on each person's PC so that they can score comfort -- maybe some simple measurement instruments can be packaged into a little cube that sits on top of the monitor to provide the user real time measurements on temperature, humidity, air quality - CO_2, pollen, dust, formaldehyde, etc.
Break down building's operating costs on the utility bill, i.e., cost for HVAC/lighting/general service • Show graphical display (pie chart, etc.) showing energy use split • Customer's usage compared to similar type of facilities and equipment • Provide customer with a bill that shows graphically how he compares with his peers

Measurement (con't)

Compare electric usage to others/best of class in industry

- Show customer's energy use compared to similar facilities in his climate area

Help owner determine what he should charge the tenants in his building for cooling

- Owners would like to prorate cooling cost by usage for each tenant
- Sell owners a cost-allocation or billing service (which may include metering)

Forecast customer energy usage, tell customer when it deviates and why

- This may be a service that expands the definition of commissioning -- the commissioner first checks to be sure that everything is working as designed. Then, provides monthly updates of the projected usage and performance based on the building load changes and climatic changes. The purpose of this is to provide the manager with a forecasting model.
- Provide trend analysis

Meter chiller electric usage

- Provide a temporary metering and reporting service

Information

Analyze how a building's chiller operates and help the facility to operate it more economically

- Conduct a chiller analysis
    - Measure the cost to run a chiller
    - Help operators evaluate interruptible rates for systems
    - Evaluate the most efficient operation for a multiple chiller plant, i.e., lead/lag and provide controls to do this
    - Conduct a contribution to peak demand analysis (energy cost analysis)
    - Show operator what he can do with auxiliary chiller equipment, i.e., pumps/cooling tower, to optimize the chilled water system
    - Show how control strategies affect operating costs
    - Provide bill analysis/load analysis
- Conduct a retrofit or replacement analysis
    - Tell customers when they should plan to replace their chillers
        - Provide them with the operating cost of delaying the replacement by one, two, or more years
        - Provide them with a measure of the risk of unacceptable occupant comfort that is associated with delaying the decision
    - Provide customer a package of information that explains what environmental risks/liabilities he/she has in each facility
- Develop a means to capture reject heat from condenser
- Show operating cost savings that result
- Provide economic data on the cost benefits of using ozone
    - Show if magnets/ozone water treatments work
    - And, if they work, are they cost-effective when compared with chemicals?
- Provide data on diskette so customers can calculate cost per square foot cost per employee
    - Make data available from internet, requiring certain password, and approval to access the information on the web

Information (con't)

Help customer with systems evaluations
• Provide an engineering analysis service to help customer decide what system design is best for them
• Provide operators with an analysis to determine whether or not they need to address the CFC issue
• Tell operators whether they need to be concerned with an EPA refrigerant audit
    • Quantify the costs and risks associated with each CFC management strategy
• Provide information on the true life cycle costs of chillers; electric centrifugal, absorption, engine driven
    • For example, hospital engineers must have continuous power for their chillers. However, utilities want them to use an electric chiller and not install a gas chiller. It's cheaper for the hospital to use a gas engine driven chiller and not buy backup power. What can utilities provide this engineer to justify staying with the electric chiller?
• Provide analysis of chiller options before selection of the system
• Provide financial and performance comparisons of electric vs. gas vs. district cooling vs. thermal storage
    • Tell customers whether thermal storage is feasible in the deregulated utility market place. What is best way to operate thermal storage systems, i.e., partial, full, or real time?
    • Analyze the economics of thermal storage with real time rates
    • Tell customers whether a gas hybrid chiller plant is economically feasible
• Provide a list of who are the best sources for chiller systems engineering evaluation
• Help customers evaluate use of interruptible rates for their HVAC systems
• Help the operator determine what minimal amount of maintenance should be budgeted before he will see a decrease in performance
Help customers understand their rate options
• Identify the incremental cost of the service in the rate structure
• Provide information on energy price trends and forecasts
Customer education
• Educate customers on real costs
• Teach customers about real efficiencies vs. run time
• Train customer's in-house maintenance staff on proper and efficient chiller operation
    • Educate facility users on ways to reduce chiller load
• Provide training seminars for a fee
• Provide seminar on thermal storage - benefits, cost, operational issues
• Offer customer a technician EPA certification for his maintenance staff
    • Coordinate and offer a training class
Keep customers informed of new technologies and information
• Provide customers with a report or presentation on state-of-the-art HVAC technologies that are economically feasible
    • Provide alternative dehumidification evaluations
• Provide life cycle analysis of alternative technologies

Information (con't)
Maintenance issues • Help the operator maximize operations of his maintenance department • Show the operator how to reduce his O & M cost • Educate operator's in-house maintenance staff on proper and efficient chiller operation • What are preventive maintenance items that customers should do to maximize reliability? • Teach operators how to reduce refrigerant leaks. Teach them what extra maintenance is required. • Tell operators how they compare with their competitors in energy, maintenance, and operation costs • Offer a service to set up and monitor PM for chillers
Investment
Financial analysis of replacement of existing equipment • Help answer the questions, "What would be the payback for putting in a new high efficiency (CFC free) chiller? What are the refrigerant options?" • Provide customers an economic analysis of their chiller plants, and if justified, provide them with a financing package to replace/retrofit equipment Promote special financing for technologies that improve occupant comfort and delay or eliminate larger capital expenditures • Financing/installation for thermal storage Offer chiller financing options for retrofits and new installations to help reduce the customer's capital requirements • Buy the chiller for the operator and put the cost into the rate the operator pays, thereby saving the operator capital • Offer financing or leasing on high efficiency purge device, or retrofit of entire chiller Form district cooling system • Promote the capital costs savings impact this can have for utility customers • Indicate the efficiency of district cooling
Corporate Goals
Help customers meet business goals • Become the leader in establishing standards around occupant comfort   • Establish sub-segments of BOMA (Building Owners and Managers Association) to measure energy usage and occupant comfort in different environments such as labs, hospitals, schools, foodservice establishments, etc. • Audit company energy usage and create a business plan outlining the equipment which should be replaced, how much will be saved, and the cash flow requirements

Service
Take over ownership and operations of customer's chiller plant and sell them chilled water • Purchase their system and contract to sell them chilled water at a fixed price per BTU for the next 20 years • Or, take over the chiller plant and HVAC engineering operations in the building and sell the customer cool space • Install, own, and run an on-site thermal storage system for the customer   • Use the utility's experience to run the plant more efficiently
Take over maintenance and operation of the customer's chiller • Eliminate operations issues for facilities manager. Better maintenance will save energy for the energy manager. Better maintenance will mean more reliable cooling for occupants. • Take over multiple buildings systems, and interconnect, sell cooling to other buildings • Group all customer chillers into one package and provide all necessary services, i.e., maintenance, energy, operation strategies, etc. • Provide maintenance for the chillers • Take over and become customer's in house maintenance staff • Provide services and energy to customer's international operations
Commissioning • Share with the public that a building has invested in the concept of commissioning to ensure the building is operating as efficiently as possible. In sharing this, emphasize emissions reductions. • Create a benchmark for the existing system, then tune it and track it • Serve as a clearing house for commissioning information; supplying names of companies that do commissioning. Educate the facilities manager to want commissioning done in the first year of their management. Help them get credit for all the energy savings that result. • Bundle commissioning in with long term contracts. If they sign a 10-year deal, utility will do an audit or chiller commissioning. • Offer pre-commissioning with guarantee that you will return every two years to insure the system is still working as designed
Provide equipment that helps reduce the cost of cutting edge technology • Provide the customer with the equipment and service to flatten his peak • Install control systems that allow customers greater control over cost   • Automatically control customer system to provide a constant load profile • Provide customer with an equipment upgrade plan that will pay off in greater occupant comfort and greater occupant productivity. While the energy savings will not justify the cost of the new equipment based on traditional 3-5 year payback, the productivity improvements will show paybacks of less than one year with the use of the new technology. • Offer equipment for use. If it does not save energy, the utility will pay to have it removed. If it saves, the operator can pay for it on utility bill. • Create energy efficient concept sites, prove savings, and provide tours

Service (con't)

Provide special rates for chiller
• Guaranteed electric bill. Eliminate the weather risk.
• Offer a reliability guarantee, with penalty for outages
• Create a rate that is specific to customer's needs
• Provide rates, services, etc. to customer's national facility base
• Special rate with price caps for multi-year contract
• Provide an interruptible rate for chillers -- they must cycle the chiller on utility's signal
• Interrupt (or night) rate for thermal storage users with two exceptions allowed per year to eliminate their fear that the thermal storage may not work one or two days a year
• Real time pricing rate for chiller use only
• Create rate structures or cost guarantees for people who follow your recommendations for new equipment or systems changes. Provide customers with a rate structure that rewards them for doing what you want them to do. All this might be part of a long term contract.
• Provide customers with a rate that includes energy, maintenance, and operations
Help customer increase occupant comfort with his system
• Help them balance and optimize air side system
• Create comfort target levels and track, i.e., CO_2, photometrics, temperature, and humidity
Provide backup power supply to carry through outages and lower voltage conditions
• Provide on-site premium power generation
• Install and remotely control distributed power generation that is interconnected into your own service grid, but is located on customer site
• Premium service with on-site equipment to manage low voltage conditions
• Provide a self generation standby bundle
    • Connect to the grid with 500 kW capacity
    • Up to 2000 kWh per month for emergencies and when equipment is being maintained
    • Guaranteed rate of $.50 per kWh if they need more than 2000 kWh
    • Benefits for each group who is impacted or impacts system decisions
        • Facilities manager = budgetable #'s
        • Engineer = backup
        • Occupants = dual power system, backup
        • Construction oversight = easy to ask for
Help customers sell excess cooling capacity to their neighbors
• Provide analysis to other customers showing what they might save by buying neighbors cooling
• Organize a type of district cooling contract for neighbors to buy chilled water

Service (con’t)
Testing and optimization • Perform on-site efficiency tests, i.e., what is the efficiency of customer’s chiller? • Rate the effectiveness of customer’s staff • Help customer optimize the rest of the cooling system to fit customer’s new chiller • Measure efficiency and provide upgrades that are guaranteed by the supplier • Help customers reduce their buildings’ cooling load Other service • Provide customers with less expensive CFC refrigerant for their chillers   • Order bulk quantities of refrigerant so can get lower price, and pass savings on to customers, thereby persuading them to retain electric cooling

Table 8-3
Products and Services - Real Estate and Too Lean Customers

Measurement

Monitoring/remote measurement
• Allow customer to monitor several buildings remotely from one location, thereby allowing a reduction in on-site personnel
• Measure the actual chiller efficiency kWh/ton
    • Measure efficiency and provide upgrades that are guaranteed by the supplier
• Evaluate the overall performance of customer operation
• Meter chiller electric usage
    • Simple task, can automate and present on bill
Real time pricing - continuous operating cost analysis
• Send customer real time electricity pricing information, and integrate this into his chilled water plant
• Estimate customer's utility bill for each site on a continuous basis
Break down building's operating costs on the utility bill, i.e., cost for HVAC/lighting/general service
• Itemize and use benchmarking to help customer focus efforts to reduce operating costs and identify wasteful areas
• This can be done somewhat automatically and presented as an option on the bill
Help the owner determine what he should charge the tenants in his building for cooling
• Owners would like to prorate cooling cost by usage for each tenant
• Provide the owner with a way to measure and bill tenants separately for cooling, lighting, etc. By doing this, the owner will get tenants to use less energy, keep his rates more competitive - all without spending capital on improving the efficiency of his plant.
Forecast customer energy usage, tell the customer when it deviates and why
• Provide trend analysis
• Can be automated on degree-day basis and presented on bill

Information

Analyze how a building's chiller operates and help the facility to operate it more economically
• Conduct a chiller operations analysis
    • Measure the cost to run a chiller
    • Help operators evaluate interruptible rates for systems
    • Evaluate the most efficient operation for multiple chiller plant, i.e., lead/lag and provide controls to do this
    • Conduct a contribution to peak demand analysis (energy cost analysis)
    • Show operator what he can do with auxiliary chiller equipment, i.e., pumps/cooling tower, to optimize the chilled water system
    • Show how control strategies affect operating costs

Information (con't)

• Conduct a retrofit or replacement analysis
  • Tell customers when they should plan to replace their chillers
    • Provide them with the operating cost of delaying the replacement by one, two, or more years
    • Provide them with a measure of the risk of unacceptable occupant comfort that is associated with delaying the decision
  • Provide customer a package of information that explains what environmental risks/liabilities he/she has in each facility
• Develop a means to capture reject heat from condenser
• Show operating cost savings that result
• Provide a workshop offering seminars about how to buy the latest technology to save money. Create a program of seminars on saving money just for this group of undercapitalized customers.
Help customers understand their rate options
• Identify the incremental cost of your service in your rate structure
• Provide information on energy price trends and forecasts
Customer education
• Educate customers on real costs
• Teach customers on real efficiencies vs. run time
• Train customer's in-house maintenance staff on proper and efficient chiller operation
  • Educate facility users on ways to reduce chiller load
• Provide seminar on thermal storage - benefits, cost, operational issues, etc.
• Educate customers that reducing maintenance ends up costing them more money in the long run
• Build some training courses into the basic rate since customers do not have money to send their staffs to training
• Education program for the occupants that explains why it is good to turn the lights and HVAC off when they leave
Help customers with systems evaluation
• Provide the selling information building owners need to make good buying decisions on existing buildings - provide the seller with information as to what system and equipment fixes could be made to increase the value of their buildings at a cost less than the cost of the fixes
• Provide operators with an analysis to determine whether or not they need to address the CFC issue
• Tell operators whether they need to be concerned with an EPA refrigerant audit
  • Quantify the costs and risks associated with each CFC management strategy
• Provide information on the true life cycle costs of chillers; electric centrifugal, absorption, engine driven
• Provide analysis of chiller options before selection of the system

Information (con't)

• Provide financial and performance comparisons of electric vs. gas vs. district cooling vs. cool storage
    • Tell customers whether thermal storage is feasible in the deregulated utility market place. What is best way to operate thermal storage systems, i.e, partial, full, or real time?
    • Tell customers whether a gas hybrid chiller plant is economically feasible
• Provide a list of who are the best sources for chiller systems engineering evaluation
• Help customers evaluate the use of interruptible rates for their HVAC systems
• Help the operator maximize operations of his maintenance department
• Show the operator how to reduce his O&M cost
Maintenance issues
• Help the operator determine what minimal amount of maintenance should be budgeted before he will see a decrease in performance
• Educate operator's in-house maintenance staff on proper and efficient chiller operation
• What are preventive maintenance items that customers should do to maximize reliability?
• Teach operators how to reduce refrigerant leaks. Teach them the extra maintenance that is required.

Investment
Financial analysis of replacement of existing equipment • Provide customers an economic analysis of their chiller plants, and, if justified, provide them with a financing package to replace/retrofit equipment • Provide customers with a comprehensive package of measures that they can apply that will lower their maintenance and energy bills, but will pay back quickly (within one year) Promote special financing for technologies that improve occupant comfort and delay or eliminate larger capital expenditures • Financing/installation for thermal storage   • When thermal storage is good for the utility (this will probably only happen when the utility is pitching greening efforts), the utility could offer some thermal storage financing to help businesses save energy cost • Replace their aging systems and create performance contracts that create positive cash flow • Find quick no-cost savings. Use those savings to pay for capital improvements. Offer chiller financing options for retrofits and new installations to help reduce the customers' capital requirements • Buy the chiller for the customer and put the cost into the rate the customer pays, thereby saving the customer capital • Offer financing or leasing on high efficiency purge device, or retrofit of entire chiller

Investment (con't)

Form district cooling system

- Promote the capital costs savings impact this can have for utility customers
- Indicate the cost efficiency of district cooling
- Find a business in an area that could support a small district cooling system (i.e., an office park) and work with one of the businesses to use their facility as the district plant and sell district cooling to the rest of the park. Bottom line is everyone benefits and the company with the district plant benefits the most.

Help customers who are trying to keep their old chiller alive

- Measure the value of capital saved for each year that chiller is kept alive
- PM (preventive maintenance) contract with insurance. If the chiller fails, pay for portable chillers to fill in for 30 days. Options to sell the customer a replacement chiller.

Corporate Goals

Help customers meet business goals

- If comfort increases employee productivity, this becomes a great segment to take over the ownership of delivering comfort. This probably means performance contracting.
- This is also a segment that could benefit greatly from all the manufacturing process electrotechnology support and knowledge that EPRI provides. The energy vendor that can bring information to help the company increase productivity and profits will be a valued supplier.

Service

Take over ownership and operations of customer's chiller plant and sell them chilled water

- Purchase their system and contract to sell them chilled water at a fixed price per BTU for the next 20 years
- Or, take over the chiller plant and HVAC engineering operations in the building and sell the customer cool space
- Install, own, and run an on-site thermal storage system for the customer
  - Use the utility's experience to run the plant more efficiently

Take over maintenance and operation of the customer's chiller

- Eliminate operations issues for facilities manager. Better maintenance will save energy for the energy manager. Better maintenance will mean more reliable cooling for occupants.
- Take over multiple buildings systems and interconnect, sell cooling to other buildings
- Group all customer chillers into one package and provide all necessary services, i.e., maintenance, energy, operation strategies, etc.
- Provide maintenance for the chillers
- Take over and become customer's in house maintenance staff
- Provide services and energy to customer's international operations

Service (con't)

Commissioning
• Provide commissioning service for customer before they choose to buy or sell a building
• Bundle commissioning in with long term contracts. If they sign a 10-year deal, you will do an audit or chiller commissioning.
• Provide a commissioning service that is free of charge when the owner's building comes in over budget
Provide equipment that helps reduce the cost of cutting edge technology
• Provide the customer with the equipment and service to flatten his peak
• Install control systems that allow customers greater control over cost
    • Automatically control customer's system to provide a constant load profile
• Offer performance contract agreement, with shared savings
Provide special rates for chiller
• Guaranteed electric bill. Eliminate the weather risk.
• Offer a reliability guarantee, with penalty for outages
• Create a rate that is specific to customer's needs
• Provide rates, services, etc. to customer's national facility base
• Give a rebate at the end of the year based on compliance with, interruptions, attractive load profile
• Create a rate for chiller customers that favors shutting the chiller off just at the very peak. Customers can shut down the system for 30 minutes, but not 4 hours.
• 1000 kWh free, night and weekends, with a five year contract. (Use it to light up the building/signs at night, to promote building or company.)
• Establish a benchmark. Sign a 10-year deal to supply the electricity at a given rate + escalator. Then purchase and install a thermal storage system.
    • The building operates the system and shares in the savings
    • Or, the utility operates the system and keeps the savings.
• Poor guy rate options -- design rates that encourage investment in technology that makes these customers more competitive. The goal is to move them from the constrained segment into the well-managed segment.
• Program for "gold card" customers, will do free building audits for buildings they are considering buying, as long as they continue as a customer
Provide backup power supply to carry through outages and lower voltage conditions
• Provide on-site premium power generation
• Create an agreement to install distributed generator sets on customer site (tied into electric grid), with agreement that could also be used as backup power for their site in case of a local power outage. Customer would benefit by not paying for equipment, utility would benefit by not having to pay for property/building location.
• Help solve low voltage problems that are not from the utility grid. Provide the operator a no cost/low cost to remedy this problem.

Service (con't)

Help customers sell excess cooling capacity to neighboring businesses
• Act as a third party to purchase cooling from one customer, and sell to the other. All money exchange would occur on their respective utility bill.
Testing and optimization
• Perform on-site efficiency tests, i.e., what is the efficiency of customer's chiller?
• Rate the effectiveness of customer's staff
• Provide service to optimize the rest of the cooling system to fit customer's new chiller
• Help customers reduce their buildings' cooling load
    • If done for a fee, wrap into the utility bill
• For customers who cannot afford a chiller performance test offered by the OEM, provide something similar
Other service
• Provide with less expensive CFC refrigerants
    • Purchase refrigerant from the customer, then lease it back to them. They would have to pay for any refrigerant lost or made unusable. Utility to retake ownership when chiller abandoned.

9

FITTING THE CHILLER STRATEGY AND TACTICS INTO A UTILITY'S OVERALL MARKETING PLAN

The purpose of this chapter is to highlight how the market insight, customer research, and brainstorming data can be used to create a chiller strategy that fits in an overall marketing plan.

The first task is to decide which segments could be profitable. Does the utility want to attract more customers in this segment? What chiller services fit the segment's needs? If the services increase the cost of serving these customers, are they still a profitable segment? This analysis can be done by computing the profitability of a representative sample of the customers and comparing a representative sample of load profiles with the margins for each hour of the profile.

Once target segments are selected, how will potential chiller users be identified and categorized? Since chillers are only used in large accounts, this effort can be restricted to the key account salesforce. If the salesforce is organized by industry, it will be possible to target the commercial property management, education, government, and healthcare industries that make up over half of all chillers. The percentage of customers in each of these key account segments that have chillers is over 40%, so chillers will be an important energy user for any key account sales person in those segments.

Segmenting Customers

Most utilities are moving to a segmentation system of some type. Utilities generally have classifications that are similar to the behavior segments in Chapter 4. If the key account rep needs to determine what areas interest a customer, he/she can use the questionnaire in Appendix A.

In other segments, including retail (where 9% of all chillers are installed), only a small portion of all the buildings have chillers. Here salespeople may need a simple process to sort chiller customers when they find them; the same questionnaire (Appendix A) can be used to categorize customers with chillers.

Chiller Strategy Development

For each targeted chiller segment, a chiller strategy must be created. Starting with the description of each of the customer segment's behavior develop:

- What approach you will take to helping the segment meet its goals
- How you will communicate that approach to the segment. (See the customer research on how the segment gets information.)
- What areas you have a competitive advantage in, for example:
    - Customer relationships
    - Certain product or service areas
    - Lower cost energy (overall or at certain times of the day)
- The products and services (including electricity) that you will offer this segment

The following example shows how the value of a service may depend on the competitive offerings, its fit with the overall marketing strategy, and where it is offered.

Metering Example

For this example, consider the professional segment. The professional segment is interested in reducing overall costs while maintaining or improving occupant comfort. They view their current utility as a reliable source for new ideas about how to reduce cost and increase occupant comfort. Assuming the overall marketing strategy to the professional segment is to retain and strengthen the relationship with existing customers and increase sales of additional products and services to these customers.

The overall chiller strategy could be to offer measurement and information services that provide value and encourage customers to stay with the utility. One example is metering the chiller and cooling system electric usage.

This professional segment will use measurement of its electric usage to better manage the cooling system use, potentially lowering their total costs. The service can easily be presented by the key account rep as part of the overall services offered.

If the competitive firms do not offer metering, it could be part of a competitive advantage, differentiating the utility from the alternatives. As the utility gains experience in helping customers use this data to reduce their electric bill, the metering and analysis could become a chargeable service.

On the other hand, if competitors offer cooling system metering free of charge, the utility may need to do the same just to remain on par with them.

Finally, the tactics should be consistent with the overall corporate strategy. If the utility's overall marketing strategy promotes energy audits as the way to understand electric use, it may appear inconsistent to suggest long term metering for chillers. (But metering during the audit may be consistent.)

Delivering the Products and Services

After selecting the services to offer, the retail utility must determine how to build the delivery organization:

- When will the account rep present these capabilities to the customer? What method fits this segment's behavior and expectations best?
- Who will do the technical presentations? What areas of expertise must be included in the technical presentation: environmental data, impact on occupant comfort, others?
- Who approves spending, financing, and/or contractual terms? (See the different audiences identified in Chapter 4.)

Strategy Feedback

The final step is building the marketing measurement system. The utility should consider systematically tracking indicators such as:

- Projected number of chillers to be installed
- Number of prospective chillers being tracked
- Number of chiller customers the utility is working with
- Number of times the customer implemented the utility's recommendation
- Customer's rating of the value of the services performed
- Value to the utility of the services

- Retained customers
- New customers
- Knowledge of the load profile
- Shifting of the load profile to an attractive shape

Possible EPRI Role

There are a number of resources that could be created and shared among utilities. Services such as the subscription to comparative data showing a customer how their costs compare to similar types of organizations is valuable only if the database covers a large number of organizations. The more companies included in the database for comparative statistics, the more valuable the service is. The service could be run by EPRI for participating utilities; making it easy for them to provide a higher value service than the utility could provide on its own. Earlier EPRI work, such as the healthcare benchmarking study, could form the basis of this service.

Shared Activities

The most efficient solution may be for EPRI to create these tools for some or all of the target group members. Services that could be leveraged by EPRI include development of:

- A service providing end users a comparative "average" profile for similar sites and an analysis of the customer's load relative to the average
    - Requires a database of load profiles and associated demographics
    - Requires maintaining the right search/sort criteria
- Educational material and courses on how to aggregate purchases
- Educational material and courses on how to evaluate suppliers
- Chiller performance under actual operating conditions.

The Gas Absorption Chiller Challenge

Green organizations select chillers that are consistent with the corporate policy to make good environmental decisions. They choose absorption chillers since their refrigerants are not based on CFC's or HCFC's. The difference in life cycle costs of absorption and electric chillers does not impact the decision.

To influence this market segment we must find:

- the technological innovation that eliminates the HCFC's

  or

- an alternative paradigm that shows the electric chiller to be the most environmentally friendly.

Both of these approaches are ideally industry-wide programs. The cost is prohibitive for individual chiller support groups or utilities to drive the technology change or a change in perception of relative environmental impacts.

The electric utility industry could support technical and attitude research. As an industry, it may be possible to identify and publicize the environmental advantages of electric chillers over gas absorption chillers.

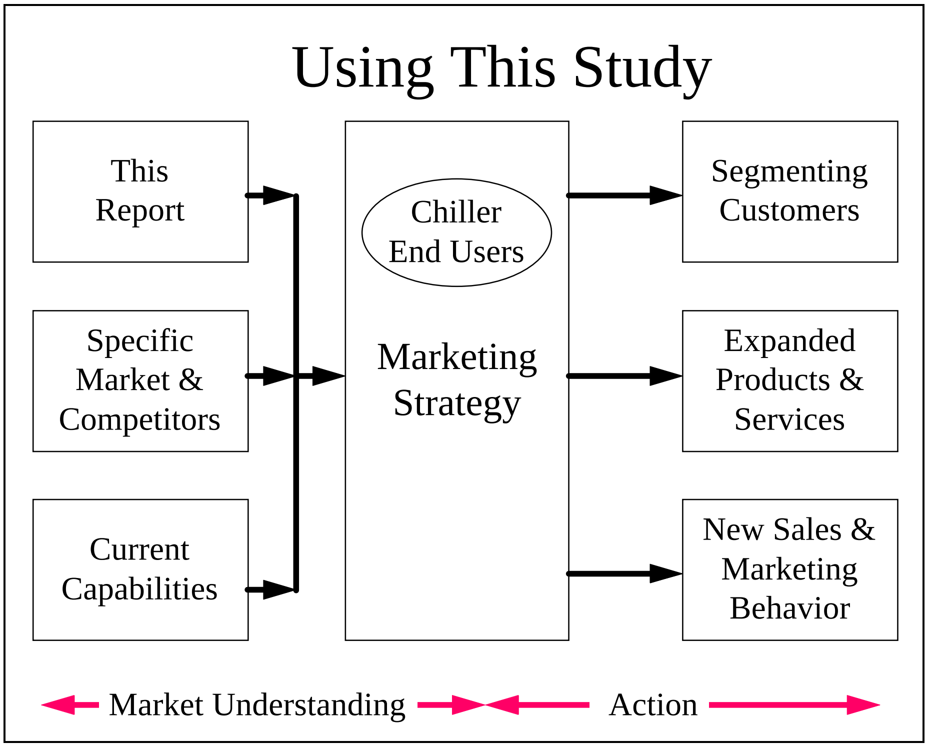
Results

This report has explored end user behavior and built an understanding of how utilities can use this insight to better meet their customers' needs. As shown in Figure 9-1, for a utility to take advantage of this research, it needs to combine the study's findings with an investigation of the utility's specific market and competitors and its own capabilities. The output of this effort will be a chiller marketing plan that fits within the utility's overall marketing plan.

This market understanding can be turned into specific strategies, tactics, and actions to achieve different strategic results (increased profitability, employee and customer satisfaction, and community service).

Sales people, technical service, marketing, and operations will execute components of this strategy. As such, they can use this market understanding to help individuals make the day-to-day decisions that deliver the strategy to customers.

Figure 9-1
Using this Study



This plan will address specific customer segments, define new products and services to offer, and define new marketing and sales behaviors required to implement the strategy.

10

SUMMARY

The retailing portion of electric utilities will soon face competition from brokers and niche ESCO's who will build lean, efficient organizations focused on specific customer groups. Retail utilities can compete by using their expertise to help customers make better energy use decisions. The type of help a particular customer will value depends on the customer's situation (which are classified as market segments). As retail utilities help their customers, they can gain a detailed understanding of the customer's energy use. This knowledge can form the basis of profitable retail management decisions and can be used to continue to provide value to that customer in the future.

The fundamental message in this study may be that utilities should not unilaterally eliminate their chiller support groups as they rush to prepare for deregulation. Chiller support does not change many customers' selection of electric versus gas chillers. The value of chiller support is in building a relationship with customers via helping them meet their needs. This study has some significant implications for how utilities should work with key customers:

- Chiller related activities can be part of their strategy to certain customer segments
    - Chiller support can be used to retain and win customers
    - Chiller support can be used to influence the demand profile
- Chiller support can be an important component of a utility's relationship with customers
    - Specific products and services can be created for each of the four segments
        - Superior offerings by competitive utilities or resellers in the territory are a threat to the existing customer base
        - Superior offerings by the organization can win new customers outside the territory
    - Chillers, thermal storage, and rate schedules are the three areas where a chiller site can have a significant impact on its energy bill

- The changes brought by deregulation bring risk and opportunity to the relationship with customers
    - In some accounts, the shift to corporate purchasing means the utility will have to demonstrate the value of its support to corporate organizations
    - In real estate and too lean customers, performance contractors who provide chiller capital investments are a serious threat
    - Utilities who show customers how to meet their needs when making corporate purchases will have a competitive advantage in working with these customers
    - Utilities who offer products and services that match the needs of a market segment will have a competitive advantage in servicing that segment
- Green chiller customers choose absorption chillers to avoid CFC and HCFC refrigerants. Switching to electric chillers requires their adopting a different paradigm, which EPRI or the industry may undertake, but can not be done by an individual utility's chiller support efforts.
    - The chiller support group generally can not convince green customers to consider electric chillers. As part of a utility's effort to win or retain green customers, the chiller support group should focus on helping the customer meet their objectives.
    - Non-green customers, when shown how gas and electric chillers compare on their criteria, are unlikely to select an absorption chiller except in hybrid plants

How retail utilities react to these implications will determine how well they can use chiller support to win and retain customers.

A

SEGMENTATION QUESTIONNAIRE

The following questionnaire can be used to identify which behavioral segment a customer belongs to:

End User
Discussion Guide

Contact Name:	________________	Type of Organization	________________
Title:	________________		
Phone:	________________		

Hello, my name is ________________ with ________________. I would like to get a better understanding of your organization and your needs. I am trying to understand what other assistance we should be providing you. Could we take a few minutes to talk about what you do and what services you would like to see?

As background, can you tell me about what type of organization ___________ is?

> Is it a non-profit organization? If yes, did you run a deficit last year?
> (If it is a for profit organization, did you make money last year?)

Based on your prior knowledge and their answers circle the best fit:

Non-profit corporation (including non-profit hospitals)	A
Non-profit corporation – running a deficit	D
Profitable corporation	B
Unprofitable or cash starved corporation	D
Giant international, non-US based, corporation (e.g. Toyota)	A
Builder, developer, or property management company	C
Government body (local, state, or federal)	A
Government agency – running a deficit or out of cash	D

Can you tell me what all you are responsible for?

Is that for electric, gas, steam, chilled water, water, sewage?
For how many facilities _______
Sq. ft. _______
Manufacturing, office space, Both

How does your organization measure internal investments such as buying energy saving equipment?

Total dollar savings
Savings per sq. ft. (meet a cost per sq. ft. target)
Savings per person
All the projects had good paybacks
Reduction in kWh

How do you measure the value of individual energy efficiency projects?

A and D	**B and C**
Total $ ROI Payback	$ per sq. ft. impact $ per (any measure)

What type of (payback, total savings, savings per person, per sq. ft, per revenue) do you look for? __________ Get a range or the longest they have done.

A and A (counts double)	**B and B** (counts double)	**C and D**
up to 10 years	up to 4 or 5 years	about 1 year

Do you have a corporate policy regarding energy?

A	B	C and D
Minimize the environmental impact	Improve efficiency and comfort	None

<u>Chiller Selection</u>

What size chillers do you have?

Chiller 1	____ tons,	Electric, Gas Absorption, Gas Engine
Chiller 2	____ tons,	Electric, Gas Absorption, Gas Engine
Chiller 3	____ tons,	Electric, Gas Absorption, Gas Engine

What type of chillers are they? (Circle answers above)

For the last chiller you installed or retrofitted, what where the top two criteria?

		Scoring
____	Energy efficiency	B
____	Minimize the equipment costs	C and D
____	Minimize installation costs	C and D
____	Minimize life cycle costs	B
____	Payback or ROI	No Letters
____	Eliminate CFC's	A
____	Fit within the space available	D
____	Minimize maintenance cost	C and D

<u>Control System</u>

What type of control systems do you have?

What is the primary objective of the control system?

A	B	C	**D and D** (counts double)
To control energy use	To control energy use and improve occupant comfort	To control tenant comfort	Don't have one or it's turned off

Does the system control the chillers?

Yes No

Is it a full building automation system?

Yes No

Thank you for the assistance.

What types of services would you like to see offered? (Open ended question to allow the contact to express their needs.)

Classifying an Organization

An organization can be classified into one of these segments based on it answers to the above questions. Fill in the table below with the number of letters (A, B, C, D) that are indicated from the answers in the questionnaire and compare to that of the table that follows.

Answers for each question were grouped:	**A**	**B**	**C**	**D**
Indicate the # of times each letter was scored				
Categorize the customer using the column with the highest score	**Green**	**Professional**	**Real Estate**	**Too Lean**

Segment Characteristics	Green	Professional	Real Estate	Too Lean
Type of Organization	Large corp., non profits, hospitals, some gov. agencies	Well run corp. organizations, long term property owner/mgrs.	Builders, developers, image driven corporations	Corporate organizations short of capital, some gov. agencies
Corporate Energy Objective	Minimize environmental impact	Improve efficiency and comfort	None	None
How energy efficiency projects are measured	Total $ ROI or payback	$ per sq. ft. impact	$ per sq. ft impact	Total $ ROI or payback
Projects they will undertake	Payback up to 8-10 years	Payback up to 4-5 years	Payback in 1 year	Payback in 1 year
Control System	To control energy use	To improve occupant comfort	Minimum functionality, no chiller control	Turned off or does not control chillers